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Speed skills of players selected for Lower Silesian Regional Teams

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Abstract

Introduction. Team sports require comprehensive motor preparation of players. In addition to strength and endurance skills, increasing attention is being given to the development of players' speed skills. Aim of Study. The aim of the study was to evaluate reaction time and 30-metre, straight line sprint time in players selected for the Lower Silesian Regional Teams in Poland in 2013 and 2014. Material and Methods. The study involved 369 players aged 13–15 years (187 girls and 182 boys), members of football, handball, volleyball and basketball Regional Teams of Lower Silesia. Out of this group, 51 players participated in the study in 2013, and then repeated it in 2014. The study used Smart Jump and Smart Speed Systems to measure players' reaction and sprint times, which were measured at 5, 10, 15, 20, 25 and 30-metre intervals. Results. Mean reaction time to light stimuli observed in boys in 2013 and 2014 was 0.509 ± 0.141 and 0.467 ± 0.264 seconds, respectively. In girls, the mean reaction time was 0.553 ± 0.122 and 0.566 ± 0.0271 seconds in 2013 and 2014, respectively. Mean sprint time in 2013 for boys who were not selected for the Regional Teams the following year was 5.338 ± 0.285 seconds, while those who were selected reached 5.416 ± 0.321 seconds. Girls who did not qualify for the Regional Teams in 2014 achieved the time of 5.764 ± 0.305 seconds. The female players who repeated the study reached the mean time of 5.805 ± 0.28 seconds. Boys who joined the Regional Teams in 2014 had a 30-metre sprint time of 5.533 ± 0.359 s. Boys who were repeating the study achieved the time of 5.322 ± 0.295 s. Girls who were selected for the Regional Teams in 2014 reached 5.796 ± 0.348 s, while girls who were repeating the study – 5.839 ± 0.342 s. Conclusions. The players' reaction times may suggest that this ability was not a criterion for selecting male and female players for the Regional Teams of Lower Silesia. Male handball players were shown to posses the greatest speed potential.

KEYWORDS: speed, team sports, choice and selection, reaction time, 30-metre sprint time.

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What is already known on this topic?
Motor potential is one of determinants of success in sport. Reaction time and sprint speed tests are most frequently used to assess athletes' speed potential. The vast majority of the tests have been carried out on adult athletes. There have been no reports comparing selected speed skills among young team sports players.

Introduction

The dynamics of team sports requires comprehensive motor preparation of players. However, despite more favourable somatic conditions, the fitness and exercise capacity of children and youth are declining [1, 2]. There are multiple reasons for the regression of fitness levels and developmental disharmony [3]. Problems surrounding the development of motor skills have also been observed in Polish children and adolescents [4]. However, changes in the physical fitness levels

of children and adolescents do not affect their attitudes towards team sports, which continue to be very popular, and swimming, martial arts and dance, remain the most often selected physical activities in and out of schools [5, 6, 7, 8, 9]. This situation undoubtedly favours seeking children to train for team sports: particularly those physically gifted with high motor potential.

In addition to strength and endurance skills, which are generally considered essential in team sports, increasing attention is being given to speed skills in volleyball, handball, football, and basketball [10, 11, 12]. During the game, players combine efforts of short duration with maximum or close to maximum intensity (sprinting, running to a ball, jumping) with moderate and low-intensity efforts (jogging, walking) [13]. The sprinting distance and time covered during a game by team sports players vary. Mohr et al. [14] suggests that the higher the level of player's sporting performance, the longer the sprinting distance covered during a game. Chmura [13] reports that the sprinting distance covered by soccer players ranges from 11.4% to 25% of the total distance covered during a game. Bangsbo [15], in a study of Danish soccer league players, showed that 17% of match time players spend standing, 40% walking, 35% running with low intensity, and 8% running with high intensity. Sprinting accounted for 0.6% of match play, or approximately 30 seconds. Soccer players from the French league spent 35% of match play standing, 40% running with low intensity, and 20% running with medium intensity. The efforts of maximum intensity accounted for 5% of match-play. On the other hand, Pettersen et al. [16] stated that 18-year-old players covered a distance of approximately 10,000 metres during a game. Running with high intensity constitutes from 5.5% to 6.5% of the distance covered, while the sprinting distance covered amounts to about 110 metres. Abdekrim [17] in his investigation of the playing intensity and time of basketball players showed that for 16.1% of match-play, players performed very high-intensity efforts (sprints, jumps), and for 17.7% of the time, they performed efforts of moderate intensity. The low intensity efforts constituted 25.8% of the playing time. During the game, the examined basketball players were walking for 14.4% of playing time, and, were standing for 15.5% of playing time. Narazaki [18] observes that during a 20-minute game, basketball players were standing for 1 min and 42 sec. of the playing time, and were walking for 10 min and 24 sec. The players were running for 6 minutes, and jumping for 18 seconds.

During a match, 18-year-old handball players cover a distance of 1,777 ± 264 metres. During high-intensity moments, young handball players cover 170 ± 24 metres, while at maximum speeds they cover 86 ± 12 metres. Out of the 32 attacks performed, six lasted 2.3 ± 0.3 s, while the game was played at a speed of >18 km/h. Furthermore, for 16% of effective playing time, handball players were standing [19]. Karcher and Buchheit [20] attest that handball players cover a distance of 53 ± 7 to 90 ± 9 metres during one minute of game time. In volleyball, the efforts of maximum or close to maximum intensity are preceded by moderate and low intensity exercise [21, 22]. In this particular game, it is not so much the running speed that is critical, but the strength and speed of executing attacks, serves and blocks. Volleyball players, depending on their position on the court, perform from 5 to 14 jumps for a block, and they make 6–8 attacks times during one set [23].

Research on beach volleyball players shows that during one set lasting 21–23 minutes, players perform about 40 volleys, lasting 8.5 seconds on the average, while they spend 17 min resting [24, 25]. During a single match, beach volleyball players perform more than 100 jumps [26]. Considering the dynamics of motor development in school age individuals, it seems fully justified to seek new sporting talents based on results of general fitness tests, considering the assessment of motor skills during this period of intensive biological development in the young athlete.

The aim of the study was to determine players' reaction time as well as the level and dynamics of speed skills by way of a 30-metre straight line sprint test among team sports players from the Regional Teams of Lower Silesia in Poland.

Material and Methods

The study sample comprised 369 young team sport players (187 women, 182 men), members of the soccer, handball, basketball and volleyball Lower Silesian Regional Teams. Among this group, 51 young players participated in the study in 2013, and then repeated it in 2014 (Table 1).

In order to estimate the speed of a players' reaction to a light stimulus appearing in the central field of vision and the running speed, a Reactive Mat/Start test of the Smart Speed System was used. The reactive mat (Smart Jump) and six gates, which send information about the sprint times in 5, 10, 15, 20, 25 and 30-metre intervals, were used. Each participant performed the test twice, preceded by a 15 min warm-up. The test procedures were explained to the participants. The better of two test trials was selected for analysis.

Table 1. Characteristics of the study group of players selected for the Lower Silesian Regional Teams who did not repeat (N) and who repeated (R) the sprint tests in 2013 and 2014

Study year	Gender	Repeated tests	Number of respondents	Age [years]	Height [cm]	Body mass [kg]
2013	Female	N	53	14.6 ± 0.8	170.4 ± 2.2	60.8 ± 7.3
		R	23	14.3 ± 0.6	169.1 ± 5.5	61.3 ± 9
	Male	N	76	14.6 ± 1.4	178.8 ± 14.4	67.1 ± 15.9
		R	28	14.4 ± 0.8	181.5 ± 10	68.1 ± 11.4
2014	Female	N	111	13.5 ± 1.2	166.2 ± 9.8	55.8 ± 11
		R	23	15.1 ± 0.6	170 ± 5.9	63.4 ± 9.1
	Male	N	78	13.5 ± 1.4	167.1 ± 14.7	54.3 ± 14.4
		R	28	15.2 ± 0.7	184.5 ± 9.5	71.8 ± 11.4

First: cross-sectional studies were carried out on players from the Lower Silesian Regional Teams in 2013 and 2014. The speed test results of soccer, handball, basketball and volleyball players who were selected in 2013 and remained on the team for 2014 were compared with the results of players not selected for the teams in 2014, and the results of newly selected players for the teams in 2014. Second: continuous tests were performed by players who remained on the Regional Teams for two consecutive years, i.e. 2013 and 2014. Third: reaction time and 30-metre sprint times for boys and girls were compared in the 2013 and 2014 Lower Silesian Regional Teams.

The analysis of the data was performed using STATISTICA 12.0. Arithmetic means and standard deviations were calculated. In order to compare the mean values of examined characteristics, an analysis of variance (ANOVA) was used. The differences between pairs of means were verified with Fisher's least significant difference (LSD) test. The level of statistical significance was set at ($p \leq 0.05$) and ($p \leq 0.01$). The study was conducted in the facilities of the certified Ball Games Research Laboratory of the Team Sports Department of the University of Physical Education in Wroclaw (PN-EN ISO 9001: 2009). Prior approval from the University's Ethical Advisory Committee was obtained.

Results

Cross-sectional studies

The studies of soccer, handball, volleyball and basketball players from the Lower Silesian Regional Teams in 2013 and 2014 revealed no statistically significant differences ($p \leq 0.05$) between the 30-metre sprint reaction times between boys and girls who repeated and who did not repeat the test over the two year period (Table 2).

In 2013, significantly shorter 30-metre sprint times were observed ($p \leq 0.05$) among female volleyball players who remained on the Lower Silesian Regional Teams for another year (5.888 ± 0.223 s) compared with those who did not qualify for the teams in 2014 (6.219 ± 0.309 s) (Figure 1). Also, in 2013, significant differences ($p \leq 0.05$) were found in speed test results of male volleyball players of the Lower Silesian Regional Teams. Boys who repeated the tests in the following year attained longer 30-metre sprint times (5.629 ± ± 0.220 s) than those who did not qualify for the team in 2014 and, therefore, did not repeat the tests (5.342 ± ± 0.275 s) (Figure 1).

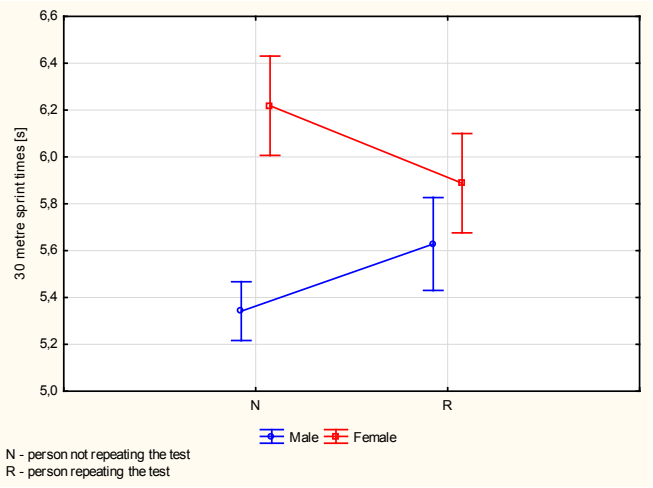

Figure 1. Thirty-metre sprint times [s] of male and female volleyball players selected for the Lower Silesian Regional Team in 2013

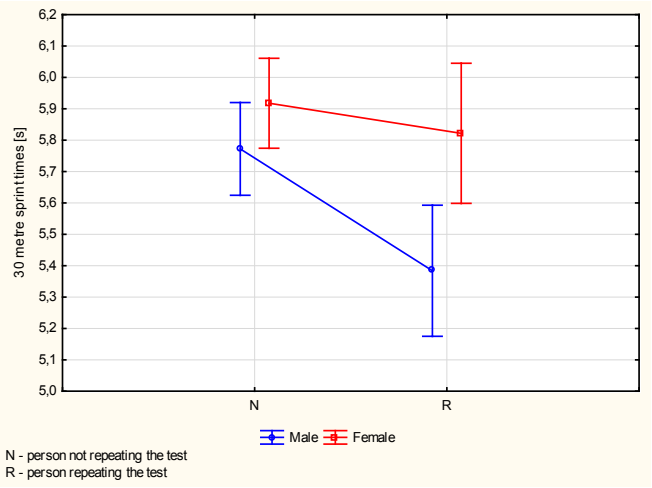

Figure 2. Thirty-metre sprint times [s] of male and female basketball players selected for the Lower Silesian Regional Team in 2014

In 2014, significantly shorter 30-metre sprint times ($p \leq 0.01$) were achieved by male basketball players who were repeating the test in 2014 (5.384 ± 0.190 s) compared to male players who joined the Lower Silesian Regional Team in 2014 (5.772 ± 0.342 s) (Figure 2).

Repeated measurements

Reaction time

In the four examined team sports there were no statistically significant differences ($p \leq 0.05$) in the reaction times in participants who performed the test in 2013 and then repeated it the following year. It was observed, however, that only male soccer and handball players had shorter reaction times in 2014 compared to the test a year earlier (–0.428 and –0.069 seconds, respectively). The remaining male and female athletes repeating the measurements in 2014 achieved lower results. The reaction times in 2014 were longer in male basketball (0.205 s), male volleyball (0.026 s), female soccer (0.015 s), female handball (0.028 s), female basketball (0.145 s) and female volleyball players (0.087 s) (Table 2).

Thirty-metre sprint

The analysis of the 30-metre sprint times of players who were repeating the tests revealed no significant differences ($p \leq 0.05$). However, there was an improvement in sprint times among young male players in 2014 as compared to 2013 in the volleyball (–0.187 s), soccer (–0.096 s), handball (–0.056 s) and basketball (–0.059 s) teams. The group of young female athletes selected for the Lower Silesian Regional Teams who were repeating the test the following year achieved slightly better (yet insignificant) results in 2014 than in 2013 in soccer (–0.013 s), volleyball (–0.02 s), and handball (–0.009 s). Female basketball players had longer sprint times in 2014 than in 2013 (0.105 s) (Table 3).

No statistically significant differences were observed in reaction time of girls selected for the Lower Silesian Regional Teams in four team sports (basketball, handball, volleyball and soccer) in 2013 and 2014. As for boys, significantly longer reaction times ($p \leq 0.05$) were observed in basketball players selected for the Lower Silesian Regional Team in 2014 compared to those achieved by the remaining players already training on the team. Male soccer players who joined the study in 2014 obtained significantly better reaction

Table 2. Reaction times [s] in cross-sectional studies of players from the Lower Silesian Regional Teams who did not repeat (N) and who repeated (R) the 30-metre sprint tests in 2013 and 2014

Year of study	Gender	Team sport							
		Soccer		Handball		Basketball		Volleyball	
2013	F	**N** (7)	**R** (5)	**N** (21)	**R** (4)	**N** (18)	**R**(7)	**N** (7)	**R** (7)
		0.502 ± 0.211	0.568 ± 0.122	0.554 ± 0.12	0.518 ± 0.045	0.567 ± 0.068	0.489 ± 0.168	0.57 ± 0.055	0.622 ± 0.07
	M	**N** (14)	**R** (2)	**N** (22)	**R** (10)	**N** (20)	**R** (8)	**N** (20)	**R** (8)
		0.482 ± 0.109	0.63 ± 0.006	0.518 ± 0.138	0.502 ± 0.131	0.536 ± 0.16	0.479 ± 0.25	0.513 ± 0.084	0.469 ± 0.089
2014	F	**N** (32)	**R** (5)	**N** (21)	**R** (4)	**N** (17)	**R** (7)	**N** (41)	**R** (7)
		0.604 ± 0.277	0.583 ± 0.23	0.505 ± 0.297	0.546 ± 0.276	0.559 ± 0.298	0.634 ± 0.282	0.534 ± 0.234	0.709 ± 0.219
	M	**N** (36)	**R** (2)	**N** (12)	**R** (10)	**N** (16)	**R** (8)	**N** (14)	**R** (8)
		0.393 ± 0.23	0.202 ± 0.003	0.493 ± 0.303	0.433 ± 0.262	0.65 ± 0.214	0.648 ± 0.281	0.37 ± 0.212	0.495 ± 0.231

Table 3. Thirty-metre sprint times [s] in the cross-sectional studies of players from the Lower Silesian Regional Teams who did not repeat (N) and who repeated (R) the sprint tests in 2013 and 2014

Year of study	Gender	Team sport							
		Soccer		Handball		Basketball		Volleyball	
2013	F	**N** (7)	**R** (5)	**N** (21)	**R** (4)	**N** (18)	**R** (7)	**N** (7)	**R** (7)
		5.649 ± 0.14	5.823 ± 0.247	5.678 ± 0.215	5.793 ± 0.391	5.734 ± 0.282	5.717 ± 0.247	6.219 ± 0.309	5.888 ± 0.223
	M	**N** (14)	**R** (2)	**N** (22)	**R** (10)	**N** (20)	**R** (8)	**N** (20)	**R** (8)
		5.629 ± 0.229	5.898 ± 0.272	5.193 ± 0.203	5.128 ± 0.135	5.291 ± 0.25	5.443 ± 0.251	5.342 ± 0.275	5.629 ± 0.22
2014	F	**N** (32)	**R** (5)	**N** (21)	**R** (4)	**N** (17)	**R** (7)	**N** (41)	**R** (7)
		5.809 ± 0.26	5.81 ± 0.229	5.748 ± 0.313	5.784 ± 0.375	5.918 ± 0.256	5.822 ± 0.268	5.762 ± 0.435	5.908 ± 0.433
	M	**N** (36)	**R** (2)	**N** (12)	**R** (10)	**N** (16)	**R** (8)	**N** (14)	**R** (8)
		5.533 ± 0.345	5.844 ± 0.382	5.239 ± 0.231	5.072 ± 0.18	5.772 ± 0.342	5.384 ± 0.19	5.512 ± 0.304	5.442 ± 0.168

times compared to the male basketball players studied in 2014, as well as handball, volleyball and basketball players selected for the Lower Silesian Regional Teams in 2013 (Figure 3).

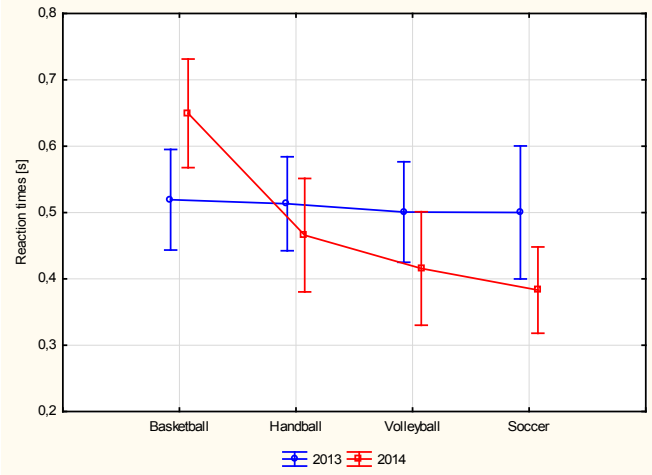

Figure 3. Speed test reaction times [s] of boys selected for the Lower Silesian Regional Teams in 2013 and 2014

In the analysis of 30-metre sprint times of girls, they were significantly ($p \leq 0.05$) longer for volleyball players examined in 2013 than for handball, soccer and basketball players examined in the same year, as well as handball, soccer and volleyball players who performed the tests in 2014 (Figure 4). Among the boys, just like in the 25-metre sprint, the handball players who participated in the study in 2013 and 2014 had significantly ($p \leq 0.05$) shorter times during the 30-metre sprint than basketball, soccer and volleyball players examined in 2013 and 2014. Basketball players

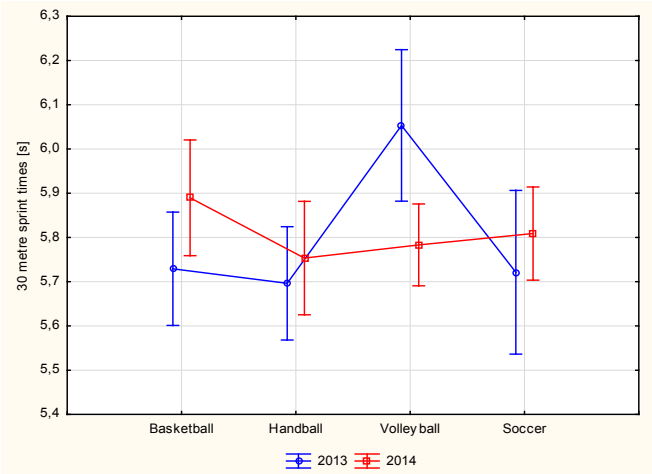

Figure 4. Thirty-metre sprint times [s] of girls selected for the Lower Silesian Regional Teams in 2013 and 2014

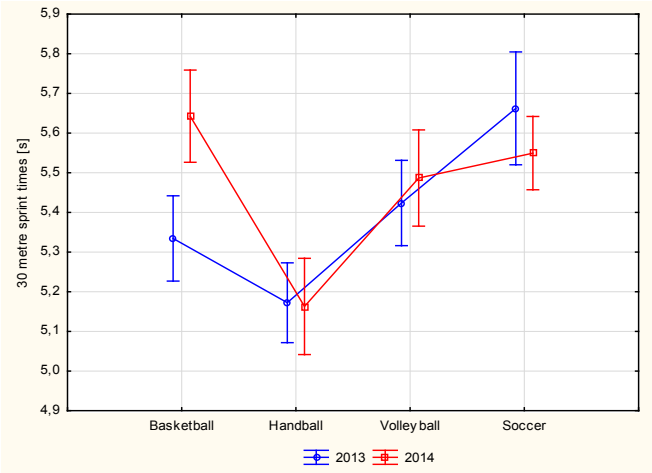

Figure 5. Thirty-metre sprint times [s] of boys selected for the Lower Silesian Regional Team in 2013 and 2014

selected for the Lower Silesian Regional Team in 2013 achieved a significantly ($p \leq 0.01$) better 30-metre sprint time than soccer players and basketball players examined in 2014, as well as soccer players examined in 2013. The group of volleyball players studied in 2013 also achieved significantly ($p \leq 0.01$) shorter 30-metre sprint times than basketball players examined in 2014, and soccer players selected for the team in 2013 (Figure 5).

Discussion

The analysis of reaction times in cross-sectional studies showed a wide variation in male and female players who qualified for the regional teams. The choice and selection as regards this particular motor ability in 2013 among male and female soccer players and female volleyball players were inaccurate. The players who were not selected for the teams the following year had shorter reaction times than people who remained on the team for another year. In the new 2014 recruitment for regional teams, female handball, basketball and volleyball players, and male volleyball players achieved shorter reaction times than those who remained on the team for a second year.

It can be assumed that the reaction time is not as important at this age as it is among professional athletes, where even the fraction of a second can determine the final outcome of a game [27, 28]. Furthermore, the development of reaction time in school-age boys and girls is not uniform. Hirtz [29] asserted that the full development of the majority of coordinational motor abilities occurs typically at the age of 16, while reaction time does not reach its highest level until 17–20 years of age [30]. Of concern, however, are the reaction times of athletes who repeated the tests. Among the eight groups under study, only male handball and soccer players improved their results from 2013 to 2014. This was important information, especially for the coaches and players who neglected to develop these players' skills throughout the year. Pyatkov et al. [31] and Zwierko [32] recommended systematic, targeted training and exercises focused on developing coordinational potential in order to improve, for example, reaction time, spatial orientation, static balance and frequency of movement.

The reaction time results may suggest that this ability was not the reason for recruitment, or part of the initial training stages in the examined athletes who were members of the Lower Silesian Regional Teams, even though in 2014, significant differences in reaction times in boys selected for the regional teams were observed.

The choice and selection of male and female players for the Lower Silesian Regional Teams based on the speed tests from 2013 seemed accurate among male handball players, and female basketball and volleyball players. In the other teams, male and female players who were selected for the following year possessed weaker speed predispositions than those not selected for the team in the following year. In 2014, accurate choices in terms of speed skills in regional teams were made in female soccer, handball and volleyball players, as well as male soccer players. In the remaining teams, individuals who were selected in 2014 were characterised by inferior speed skills compared to those who were on the team for at least a second year.

The situation in the group of male basketball players selected for the Lower Silesian Regional Team is worth mentioning. In 2013, players who exhibited inferior speed abilities than their peers who did not receive such appointments remained on the team. The following year, the basketball team welcomed players with even weaker speed skills than those who had trained there since 2013, even though they did not improve their speed performance significantly ($p \leq 0.05$) throughout the year. These results may suggest a non-objective selection of athletes for the Regional Teams, since speed skills play a key role in offensive and defensive plays in basketball [33].

Regarding speed skills, appropriate choice and selection were carried out in the group of female volleyball players selected for the Regional Team of Lower Silesia. In 2013, players who showed better speed skills remained on the team, while, in the following year, female players were selected who demonstrated even higher speed levels. Such a choice is not surprising due to the nature and specificity of volleyball. Bompa et al. [34], and Klocek and Żak [35] emphasised the significance of speed skills, which, apart from coordination and body composition, greatly affect the performance level during sporting events.

In repeated studies, the 30-metre sprint times improved among male and female soccer players, male and female handball players and male basketball and volleyball players. The results of female volleyball and basketball players are interesting: in 2014, they had worse results than in the previous year in the 30-metre sprint and in all lap times. Male volleyball players who repeated the tests also achieved worse results at the 5 and 10 metre marks. A decrease in speed in these groups can signify, on the one hand, the use of inappropriately selected training means. On the other hand, as pointed out by Zuber et al. [36] and Payne et al. [37], the decrease in speed can affect the approach, motivation and commitment of players to improve the results achieved

in test trials. Volleyball is dominated by short sprints, so the time obtained over short distances should be as short as possible bacause, Young et al. [38] indicate, this correlates with maximum jump height. As regards the times reached in the 30-metre sprint test by girls and boys, significantly higher speeds were recorded by handball players in 2013 and 2014 compared to players of the other team sports.

The male handball players achieved significantly ($p \leq 0.05$) better results in lap times during the 30-metre test than other competitors on the regional teams. Among girls, speed capabilities were at a similar level. Female volleyball players in 2013 were characterised by lower speed potential than the players of the other team sports.

Conclusions

The 30-metre straight line sprint times for male and female athletes selected for the Lower Silesian regional volleyball, handball, soccer and basketball teams, who completed the study in 2013 and 2014, allowed us to determine individual speed levels of young athletes. The sprint test, using the Fusion Smart Speed System and the Smart Jump contact mat, allowed for an objective assessment of demonstrations of speed skills and reaction times to visual stimuli by players selected for the Lower Silesian Regional Teams. The possibility of using such a test in all players selected for the Regional Teams allowed us to compare the performances of individual athletes.

The differences between individual male and female competitors selected for the regional teams may be the result of training oriented toward different motor abilities or the varying biological development of young athletes. The differences in biological development and, hence, the speed potential of young athletes born in the same year could be as high as 3–4 years [39, 40]. Therefore, it is reasonable to continue to monitor the speed potential of male and female team sport athletes selected for the Lower Silesian Regional Teams and to determine their biological ages. These activities will allow for effective training and the continuous assessment of the development of one of the most important skills in team sports without the use of laboratory equipment

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What this paper adds?

The study reveals relationships between reaction time and 30 meter sprint time in young handball, soccer, volleyball and basketball players selected for the Lower Silesian Regional Teams. Speed skills were one of the many criterions of choice and selection of girls and boys for the Lower Silesian Regional Teams. This study conforms the validity of the tests in assessing players' motor potential, with a particular emphasis on speed skills.

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