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ORIGINAL PAPER

COMPARATIVE ANALYSIS OF SELECTED MOTOR SKILLS OF FEMALE SOCCER AND FUTSAL PLAYERS

ANALIZA PORÓWNAWCZA WYBRANYCH ASPEKTÓW MOTORYCZNOŚCI ZAWODNICZEK FUTBOLU I FUTSALU

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ABSTRACT

Introduction

A high degree of motor skills is an essential factor determining effective competition in many sports disciplines. A player showing a high level of motor preparation is able to properly use technical and tactical skills during the game. There are a lot of differences in training process and in the very nature of the activities between classic soccer and its five-person variant.

Design

Single-point assessment, no blinding.

Aim

The aim of this work was to compare motor profiles of soccer and futsal players.

Material and methods

The analysis involved 36 females: 18 indoor female players (23.89 ± 5.09 years, 1.66 ± 0.06 m, 58.89 ± 7.31 kg) and 18 outdoor female players (22.94 ± 4.67 years, 1.66 ± 0.05 m, –60.83 ± 6.78 kg). The following motor skills were assessed: speed, agility, power, flexibility, strength, coordination, endurance; using tests: 30 m run, agility (envelope-shaped) run, standing long jump, forward bend, medical ball throw, lateral step test and Cooper test.

Results

The results indicated statistically significant differences: indoor players achieved better results in speed, agility, power, flexibility and coordination; players on the turf fared much better in the endurance run.

Conclusions

Better motor preparation of futsal players is probably related to the faster speed of action, faster decision making, more situations with the opponent, simultaneous participation in offensive and defensive action by players in this sport. The aerobic effort dominates on the turf, which requires proper general endurance, hence the results of the Cooper test for classic soccer players are better.

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STRESZCZENIE

Wstęp

Wysoki poziom wyszkolenia motorycznego jest kluczowym czynnikiem warunkującym skuteczne współzawodnictwo w wielu dyscyplinach sportu. Zawodnik wykazujący się wysokim poziomem wyszkolenia jest w stanie skutecznie używać technicznych i taktycznych umiejętności podczas gry. W procesie treningowym i podczas gry w futbol i futsal ujawnia się wiele różnic dotyczących motoryczności.

Cel

Porównanie umiejętności motorycznych zawodniczek futbolu i futsalu.

Materiał i metody

Badaniem objęto 36 zawodniczek, po 18 futbolu (wiek 22.94 ± 4.67 lat, wzrost 1.66 ± 0.05 m, masa 60.83 ± 6.78 kg) i futsalu (wiek 23.89 ± 5.09 lat, wzrost 1.66 ± 0.06 m, masa 58.89 ± 7.31 kg). Oceniono: prędkość, zwinność, siłę mięśni, gibkość, koordynację i wytrzymałość, za pomocą następujących testów: bieg 30 m, bieg po kopercie, skok w dal z miejsca, skłon, rzut piłką lekarską, boczny step-test i test Coopera.

Wyniki

Badania wykazały że zawodniczki futsalu osiągnęły znamienne statystycznie lepsze wyniki szybkości, zwinności, siły, gibkości i koordynacji, podczas gdy zawodniczki futbolu wypadły lepiej w teście oceniającym wytrzymałość.

Wnioski

Lepsze wyniki zawodniczek futsalu w testach oceniających część zdolności motorycznych wynika z właściwości samej gry: jej szybszej akcji, szybszego podejmowania decyzji, większej liczby sytuacji kontaktowych, jednoczesnego udziału w akcjach ofensywnych i defensywnych. Z kolei w futbolu dominuje tlenowy wysiłek biegowy, co prawdopodobnie spowodowało lepsze wyniki tych zawodniczek w teście Coopera.

Słowa kluczowe: zdolności motoryczne, futbol, futsal, ocena motoryczności

Introduction

A high degree of the development of motor skills is an essential factor determining effective competition in many sports disciplines. A player that shows a high level of motor preparation is able to properly use technical and tactical skills during the game.

As we look at the world of soccer, what we can observe, apart from changes in the rules of the game, is a continuously increasing level of training of players. This results in a very high pace of the game, which is maintained throughout the major part of the game, and the effectiveness of players' actions in the initial and final stages of the match is equally high. Selection of a player for a given team is preceded by a series of activities aimed at choosing the best player in terms of the somatic structure, psyche and motor skills. Further good results at every stage of the training are possible only through a properly organised training process. All skills that players have should be controlled and constantly improved. It should be remembered that motor skills are the key to success in

disciplines based on competition, and above all in soccer (Karimi 2015).

Soccer and Futsal – Similarities and Differences

The beginnings of soccer in Poland date back to the early years of the 20th century. The beginnings of futsal are associated with 1989, and in 1994, after the establishment of the Five-a-Side Soccer League, regular national championship games became possible. (Juszczak *et. al.* 2013). Despite the fact that indoor soccer is a young discipline, it develops very dynamically in Poland and enjoys growing popularity. Currently, there is a Futsal Major League in Poland, which consists of 12 teams, Second Level League with two groups, Third Level League with four groups and many community leagues.

Training process

It is assumed that a high-class player during a 90-minute match on a turf pitch runs an average of 10–12 km. In a 40-minute indoor game, it's impossible to cover such a distance. A futsal player enters the field of play during one half of the match 4 times for about 4 minutes. It is estimated that during the entire indoor match a player covers an average of 4–5 km, i.e., about 2–3 times less than on the turf pitch (Aftański 2005, Andrzejewski *et al.* 2008, Jastrzębski *et al.* 2012, Juszczak 2013).

When selecting training measures, attention should also be paid to the quality, running variability, number of turns and quick starts at a short distance. During the 90-minute play, uniform physical effort, i.e., aerobic effort, prevails. It requires players to have perfect general endurance. The effort of an indoor player is not uniform, interrupted by periods of rest. Short activities at the threshold of anaerobic transformations prevail here (Aftański 2005).

When training for the season, one should focus on strengthening the muscle and ligament apparatus. This is especially true for players playing on the indoor floor. Due to the even, usually blunt surface, knee and ankle joints in these players are exposed to much higher loads than on the turf. Physical preparation, stabilisation and strengthening training, regeneration after physical effort and proper diet are of great importance in this case (Aftański 2005).

Differences in the training process are also evident in the field of technology and tactics. A futsal player has more frequent contact with the ball during the game, which requires the player to control it perfectly. Ball kicks are shorter and faster in this case. The greater the number of players on the turf and the larger the dimensions of the pitch, contact with the ball is less frequent. Dribbling the ball is often longer and slower, and the play is less dynamic (Aftański 2005).

Another important element of both team games is goalkeeper training. It is required that the goalkeeper be courageous, fast and agile. A goalkeeper should play smoothly with the legs and hands, and be able to predict the opponent's moves. In addition, a futsal goalkeeper, apart from strong back defence, also performs the task of an additional outfield player. Unlike an outdoor goalkeeper, an indoor goalkeeper waits for a shot with the hands lowered along the torso, which requires the goalkeeper to respond faster to the impact. Exercises that increase hand strength are especially important for futsal goalkeepers who defend shots without gloves (Aftański 2005).

The following motor characteristics are taken into account in the training and assessment of the players' fitness: endurance, strength, power (jumping ability), speed, agility, and coordination.

Aim

The aim of the study was to examine and provide a comparative analysis of selected motor skills of female players from Poznań soccer and futsal teams.

Participants and methods

The group enrolled in the study consisted of 18 female soccer players from the Polonia

Poznań team and 18 female players from the AZS UAM Poznań club.

A questionnaire and appropriate tests assessing the level of individual motor skills of female players playing outdoors and indoors were used in the study.

An endurance test was carried out – the Cooper test (Jastrzębski *et al.* 2012, Talaga 2004). The number of completed laps was measured, multiplied by the number of meters in each lap and the result was given in meters; agility test – agility (envelope shaped) run (Jastrzębski *et al.* 2012, Talaga 1973, Talaga 2004). The task execution time was measured and given in seconds. A strength test was carried out – throwing a ball (Jastrzębski *et al.* 2012, Talaga 1973, Talaga 2004) the distance of the throw was measured, the result was given in meters and the power test (jumping ability) – standing long jump was conducted (Jastrzębski *et al.* 2012, Talaga 1973, Talaga 2004). The distance of the jump was measured, the result was given in meters. Speed, flexibility and coordination were also analysed: speed test – 30 m run (Jastrzębski *et al.* 2012, Talaga 1973, Talaga 2004). The run time was measured, the result was given in seconds; the flexibility test is the forward bend (Pilicz *et al.* 2005, Talaga 1973, Talaga 2004), the number of bends made at a given time was measured, while during the coordination test – the Lateral Step test was conducted (Pośpiech *et al.* 2008), the number of correctly performed steps was measured.

Statistics

The obtained results were subject to a statistical analysis using the Statistica.pl software. The distribution of variables with the Lillefors and Shapiro-Wilk tests was examined. Medians with quartiles were used given the distribution different from the normal one to characterise the variables, whereas for the analysis of non-parametric tests, the chi2 test for nominal variables, the Mann-Whitney U test for the comparison of the two groups in terms of interval variables, and the Spearman test to examine correlations were used respectively. The assumed statistical significance level was $p < 0.05$.

Results

As a result of the studies conducted in both groups, no statistically significant relationship regarding age, weight and body height was found (Table 1).

Table 1. Comparison of the age, weight and height of the subjects depending on the discipline

Variable	SOCCER	FUTSAL	U Mann Whitney test	
	Median (Q25-Q75)	Median (Q25-Q75)	Z=	p=
Age	24 (21–27)	23 (19–25)	ns	
Body weight (kg)	59.5 (53.0–65.0)	60.0 (57.0–65.0)	ns	
Body height (m)	1.66 (1.60–1.70)	1.67 (1.64–1.69)	ns	

According to the questionnaire, female players from the first group (training soccer) occupy the following positions on the pitch: goalkeeper – 2 persons, attacker – 3, defender – 3, midfielder – 8, center halfback – 2. In turn, in the second group, 6 futsal players play in the playmaker position, 6 players in the wing position, 4 in the pivot position and 2 in the goalkeeper position.

Respondents had different training experience. The average training period in the group of soccer players, expressed in years, was 10.5 (8.0–15.0), while in the group of futsal players this value was 6.0 (3–8). The difference between the time of practicing

a particular sports discipline in the studied groups proved to be statistically significant ($z = 2.83$, $p = 0.005$). The comparison of the time that the athletes of a given discipline devoted to practicing it did not differ in a statistically significant manner.

The number of players who had previously been subject to motor tests (soccer: 11 yes, 7 no, futsal: 7 yes, 11 no) did not differ in a statistically significantly way between the disciplines.

The next question concerned the indication of motor skills, which, according to the respondent, have the greatest impact on the player's performance in the field of play. The most frequently selected answer in both groups was "speed", whereas with regard to the question as to what determines the level of development of motor skills, players in both groups indicated that it depended on training and time devoted to physical activity. Differences in responses to the aforementioned questions in relation to the sports discipline proved be statistically insignificant (Table 2).

The next questions concerned previous injuries. 63% of all players have suffered a sports injury over the last 2 years. These included 12 soccer players and 11 indoor players. All of the players were under the care of a doctor and a physiotherapist at that time. The incidence of injuries with regard to the discipline did not differ in a statistically significant manner (soccer: 12 yes, 6 no, futsal: 11 yes, 7 no).

In case of players playing on the turf, most of the injuries concerned the lower limbs. 7 subjects – including 3 outdoor soccer players and 4 indoor players – reported tear of the anterior cruciate ligament. 4 outdoor soccer players and 3 futsal players sprained the ankle joint. As regards the question of whether the previous injuries affected their subsequent mobility in the field of play, the response from 47.82% of the respondents was affirmative. These included were 7 soccer players and 4 indoor players. The main problem indicated by the athletes was pain and limitation of mobility within the damaged joint.

Table 2. Does a given motor skill/a given factor have impact, in the opinion of the players, on the player's performance in the field of play with regard to the discipline?

Motor skill/ factor	**SOCCER**		**FUTSAL**		**chi2**
	yes	"no"	yes	"no"	
Speed	14	4	14	4	ns
Endurance	11	7	10	8	ns
Strength	5	13	4	14	ns
Flexibility	1	17	3	15	ns
Energy	1	17	1	17	ns
Agility	8	10	12	6	ns
Coordination	11	7	10	8	ns
Training	14	4	12	6	ns
Individual fitness predispositions	6	12	9	9	ns
Genetic determination	3	15	2	16	ns
Physique	5	13	5	13	ns
Time devoted to physical activity	10	8	10	8	ns
Age	6	12	4	14	ns
Sex	5	13	5	13	ns

The period during which a given player was excluded from training and games and the time to return to full mobility depended on the type of injury. This period was the longest in the case of female players who tore their anterior cruciate ligament. The time to resume training ranged from 5 to 12 months, and returning to full mobility took from 6 to 18 months.

The last questions in the questionnaire concerned the use of other forms of physical activity. The majority of respondents – 14 outdoor soccer players and 15 indoor players make use of additional forms of physical activity: swimming, running, tennis, gym, cycling, walking, squash, sports activities at the university (e.g., self-defence, dancing, shooting range), stabilising exercises, strengthening exercises, general development training. The use of additional physical activities with regard to the discipline does not differ in a statistically significant manner. The players reported that the additional physical activity took them one hour (soccer – no players, futsal 1 person), two hours (soccer – 3, futsal – 5 persons), three hours (soccer – 6, futsal – 3 persons), up to four hours (football – 5, futsal – 6 persons) a week. The time devoted to additional physical activities with regard to the discipline did not differ in a statistically significant manner.

In order to compare motor profiles of both groups, the Mann-Whitney U test was used (Table 3). According to data analysis, indoor players achieved better results in five out of seven tests. This applies to: "envelope-shaped" run (agility test), 30 m run (speed test), standing long jump (power test), forward bend (flexibility test) and lateral step test (coordination test). It should be noted that in each of the five tests, these differences were statistically significant ($p \leq 0.05$). Outdoor players proved to be better in the Cooper test (endurance test) and the medicine ball throw (strength test), however only in the first of the above tests the difference was statistically significant.

The Mann-Whitney U test was used to determine the impact of the variables (injury, additional physical activity) on the individual components of motor performance. Taking into account previous injuries in all of the subjects, statistically significant differences were observed in the following tests: agility ("envelope-shaped") run and 30 m run ($z = -3.0$, $p = 0.003$ and $z = -2.9$, $p = 0.004$, respectively). Players who have suffered injuries in the last two years achieved better results in both tests (Table 4). The result of the agility test in relation to the previous injury differs in a statistically significantly manner when a division into disciplines is also considered (soccer $z = -2.29$, $p = 0.022$, futsal $z = -2.81$, $p = 0.005$).

The next analysed variable was additional physical activity (Table 5). Classic soccer players, engaged in additional activities during the week, achieved better results in the jumping ability test ($z = 2.29$; $p = 0.022$). The results of motor tests in the group of girls playing futsal were similar, with no statistically significant differences.

In order to assess the relationship between variables (the period of additional physical activity, training experience, time devoted to training and matches) and individual components of motor performance, the Spearman's correlation coefficient was investigated. The calculations indicated three statistically significant correlations. In the group of female soccer players, the result of the speed test positively correlates with the time devoted to additional physical activity (Rho = 0.487). In contrast, in the group of indoor players, a moderate relationship was observed between the result of the coordination test and the time of additional physical activity (Rho = 0.470). Additionally, in the group playing futsal, there was a moderate correlation between the results of the 30 m run and the training experience of the female athletes (Rho = 0.589). The time devoted to practicing a given sports discipline does not correlate in a statistically significantly manner with the level of individual motor skills. The value of the Spearman's Rho coefficient was given only if the relationship was statistically significant ($p < 0.05$).

Table 3. Comparison of motor profiles of the girls depending on the discipline

Variable	**SOCCER**	**FUTSAL**	**test U Mann – Whitney test**	
	Median (Q25-Q75)	Median (Q25-Q75)	Z =	p =
Cooper test (m)	2550 (2100–2700)	1950 (1950–2250)	2.89	0.004
Agility ("envelope-shaped") run (s)	23.7 (23.2–24.9)	21.9 (21.5–23.4)	2.77	0.006
Medicine ball throw (m)	8.95 (7.80–9.70)	8.45 (7.30–9.50)	Ns	
Long jump (m)	1.81 (1.55–1.90)	1.91 (1.75–2.15)	–2.17	0.030
30 m run (s)	5.4 (5.1–5.6)	5.2 (5.0–5.3)	2.18	0.029
Forward bend	4 (2–8)	10 (6–11)	–2.57	0.010
Lateral step – test	34 (33–36)	40 (38–43)	–3.75	0.000

Table 4. The level of motor skills with regard to the injury. The median and quartiles are given. Statistical significance with regard to the previous injury, with no division into the discipline, and also after a division by discipline* was marked #

Variable	**SOCCER**		**FUTSAL**	
	"no"	yes	"no"	yes
Cooper test (m)	2475 (2250–2550)	2550 (2025–2775)	1950 (1800–2100)	1950 (1950–2250)
"Envelope-shaped" run (s)#	24.9 (24.7–25.1)	23.4* (22.2–24.1)	23.40 (22.3–24.3)	21.6* (21.0–21.8)
Medicine ball throw (m)	9.18 (7.80–9.65)	8.95 (8.03–9.93)	8.20 (7.30–9.70)	8.50 (7.30–9.50)
Long jump (m)	1.83 (1.50–1.85)	1.80 (1.63–1.90)	1.82 (1.68–1.92)	2.05 (1.85–2.30)
30 m run (s)#	5.7 (5.5–6.0)	5.2 (5.0–5.4)	5.3 (5.2–5.3)	5.0 (4.8–5.2)
Forward bend	2 (2–8)	4 (1–8)	7 (4–11)	10 (7–13)
Lateral step – test	34 (33–35)	33 (32–38)	39 (38–41)	41 (37–44)

Table 5. The level of motor skills in relation to additional physical activity. The median and quartiles are given. Results that differ in a statistically significant manner without a division by discipline, and also * with a division by discipline, were marked #

Variable	**SOCCER**		**FUTSAL**	
	"no"	yes	"no"	yes
Cooper test (m)#	1950 (1950–2100)	1950 (1800–2250)	2175 (2025–2475)	2550 (2250–2700)
"Envelope-shaped" run (s)	21.8 (20.7–2.4)	22.0 (21.5–23.4)	23.05 (22.15–25.54)	24.1 (23.3–24.9)
Medicine ball throw (m)	8.55 (6.75–9.60)	8.40 (7.30–9.50)	8.65 (7.20–9.25)	9.30 (7.80–9.70)
Long jump (m)	1.87 (1.54–2.32)	1.92* (1.75–2.15)	1.52 (1.46–1.67)	1.83 (1.78–1.90)
30 m run (s)	5.2 (4.6–5.3)	5.20 (4.95–5.33)	5.3 (5.2–5.6)	5.4 (5.1–5.6)
Forward bend	7 (2–13)	10 (6–11)	2 (0–2)	6 (2–8)
Step – test	38 (35–40)	41 (38–44)	35 (33–39)	34 (32–35)

Discussion

Soccer is characterised by quick, short, intermittent movements. Performance of a player on a turf pitch or an indoor field of play depends mainly on the ability to perform activities with high intensity (Matos *et al.* 2008). Better responsiveness to reactive visual stimuli agility field test in futsal towards soccer players, reported by Benvenuti (Benvenuti, 2010) shows the same feature – the character of the game characterising futsal requires faster visual and motor responses.

An analysis of the conducted study showed that outdoor players achieved better results in the endurance test. According to the respondents, endurance is the second ability right after speed, that has the greatest impact on the player's performance on the pitch. A high-class soccer player covers an average distance of 10–12 km during a 90-minute match on a turf pitch, which is 2–3 times more than in the case of futsal players. Thus, the aerobic effort is dominant on the turf pitch, and it requires players to have proper general endurance (Aftański 2005). Also other authors (Kassiano 2019) reported that female futsal players are well adapted to exercise load during the game, showing well trained cardiovascular system; even if soccer players perform better in endurance tests, the futsal players show adequate exercise accommodation.

Karimi and co-workers compared futsal and soccer players, taking into account anthropometric characteristics and physical fitness. The results showed significant differences in the level of development of aerobic and explosive power, speed at the distance of 10 and 30 meters and agility ($P \leq 0.05$). The aerobic power values in classic soccer players were higher than in indoor players (Karimi *et al.* 2015).

Indoor players achieved better results in five out of seven tests that determined various motor skills. This applies to the tests for: speed, agility, power, flexibility and coordination.

What dominates in an indoor field of play are short efforts at the threshold of anaerobic processes. From the point of view of futsal, speed-endurance training is of great importance. Female players are supposed to be capable of many short-term efforts during the match and have the ability for the body to rest quickly. In the group of futsal training subjects, there was a relationship between the extent of training experience and the level of speed development. It was noticed that the longer the period devoted to the training of this discipline, the much better the speed of action. Futsal players perform one sprint every 79 seconds, changing their moves every 3.3 seconds during a game (Gioldasis 2016). Similarly, the paper comparing futsal and soccer players in Spain (Barbero-Alvarez 2015) reported better endurance training in soccer players, suggesting that elite female futsal players can benefit from high-intensity endurance training to improve aerobic fitness, at least to obtain the values obtained in elite female soccer. No attention has been paid, however, to other aspects of motor abilities.

Gorostiaga and co-workers assessed outdoor and indoor players in terms of speed in three consecutive run tests at maximum speed over a distance of 15 m. After each sprint, there was a 90-second break for rest and return to the starting line. Futsal players achieved a 2% longer run time of the first 5 m compared to the other group. Similarly, the time to cover the distance of 15 m was 4% longer in the group of indoor players compared to outdoor players. The reasons for the presented results, according to the authors, may be lower financial benefits and a smaller number of players, which makes it difficult to select talented athletes (Gorostiaga *et al.* 2009).

Matos and co-workers analyzed and compared the ability to accelerate among futsal players and outdoor soccer players. Indoor players proved to be faster than outdoor players. Analysing the features of both disciplines, it can be concluded that indoor players have greater abilities to accelerate and start at high speed compared to outdoor soccer players (Matos *et al.* 2008). According to the type of physical effort in futsal, as compared to other

sport disciplines, the players should provide macro-and micronutrients to avoid oxidative stress (da Costa 2012). Authors point at higher intensity of the game, higher level of "time-in-the-game" and consecutively – higher intensity of physical effort demanded from the players.

Similar conclusions were reached by Ünveren when examining the fitness of women playing soccer and futsal in terms of speed, ability to accelerate and agility. The average values of acceleration over the distance of 10 meters, accelerations over the distance of 20 meters and during a 30 m run in indoor players were much higher than in outdoor soccer players (Ünveren 2015).

Karimi and co-workers assessed the level of speed development using the sprint test at 10 and 30 m. Indoor players achieved better results in the 10 m run, whereas outdoor players were faster in the 30 m run. Speed in soccer depends, among others, on anticipating the course of the game, the response time and the movements made. Therefore, most soccer coaches introduce various speed exercises at the end of training (Karimi *et al.* 2015).

An important indicator of a player's efficiency is agility and coordination, which affect the player's performance, results and achievements. An important parameter influencing the player's level is experience. As far as technical skills are concerned, it was found that young people who started sports with futsal achieved important positions after switching to playing on the turf pitch (Gioldasis 2016).

Agility is the ability to quickly move the whole body with a change in speed or direction in response to a specific stimulus. In the conducted tests, futsal players showed much greater abilities to quickly change the direction of movement without losing balance in comparison to outdoor players. Futsal directional drills include a run with the change of speed and the change of direction. Players move using slip steps, and they have to be very dynamic. They also start from various positions. Sometimes, it is also necessary to move with a cross-over step. A very important element about dribbling without a ball is making feints to free oneself from the opponent. According to the investigated indoor players, agility and speed of action have the greatest impact on the player's performance on the pitch, which is evident in the results of tests for both of these motor skills.

Having good agility reduces the risk of injury and improves sport performance. Players who have suffered a sports injury in the last two years achieved better results in the agility (envelope-shaped) run. This is probably due to the fact that during the period of rehabilitation and recovery, great emphasis is placed on improving motor coordination, and thus also on agility and muscular strength. An athlete must train much more intensively to develop an appropriate level of motor performance that to avoid further injuries in the future. The ability under discussion plays a very important role when dribbling. In one-on-one situations, it makes it possible to bypass the opponent, and it also contributes to effective object manipulation, such as a ball.

Benvenuti and co-workers analysed and compared the level of the development of agility in female players of Italian classic soccer and futsal teams using the *The field reactive visual stimuli agility test* RVS-T. 66 women were enrolled in the study. The first group, consisting of 30 indoor and outdoor female soccer players, participated in the study to check the reliability of the RVS-T test. The other group consisted of 18 futsal female players and 18 outdoor female players. The inclusion criterion for the study was at least a seven-year training experience with three 2-hour training sessions and a match during the week. The aim of the conducted tests was to assess the reliability of the RVS-T test and to determine the differences between the aforementioned test and the planned (PVS-T) agility performances in players of both disciplines. Indoor players proved to be much faster in the reactive agility test and decision making compared to soccer players. This is probably related to higher-speed

actions and the need to make faster decisions while playing indoors. The results of tests with a known sequence of actions (PVS-T) were similar in both groups. The dimensions of the field of play in futsal, the duration of a single effort, a higher number of situations that a player can make use of, simultaneous participation in offensive and defensive actions, make it possible to maintain a high level of the development of cognitive and coordination skills (Benvenuti *et al.* 2010).

Ünveren A. assessed the agility level of indoor and outdoor players using the Illinois Agility Test, i.e. running around the course in the direction indicated. The results achieved by the futsal players were significantly better compared to the results of soccer players (Ünveren 2015).

The results obtained by other researchers allowed us to draw similar conclusions. The agility test (Illinois test) carried out by these researchers pointed to statistically significant differences between the studied groups. Indoor players moved faster along the designated course compared to outdoor players. Agility is a very important element of both soccer and futsal. Smaller dimensions of the field of play and frequent turns during a futsal match require players to make quick decisions and have the ability to run fast under pressure during attack and defence (Karimi *et al.* 2015).

Milanović and Sporis are another group of researchers who compared futsal players and classic soccer players in terms of agility. A group of 40 indoor players and a group of 42 soccer players were subject to the study. In order to check the level of agility, the following tests were carried out: slalom run, slalom run with a ball, sprint with a 90-degree turn, sprint with a 90-degree turn with a ball, 9–3–6–3–6–9 m sprint with 180 degree turns, 9–3–6–3–9 m sprint with backward and forward running. The results of all the aforementioned tests in both groups were similar. Interestingly, the differences between the players were statistically insignificant, despite the use of balls of different sizes in both groups. Based on the studies, it was concluded that the level of the development of agility among athletes of both sports is similar. Differences between futsal and soccer relate to the intensity of effort during the game, and not the level of motor skills of the players (Milanović *et al.* 2011). These results are not consistent with the results of the present study.

Another element in futsal directional drills are jumps, particularly the vertical jumps and leaps and in order to block the ball or to take the ball from the opponent. Players perform one-legged or two-legged jumps fighting for the ball in the air.

Power (jumping ability), tested in a standing long jump, is yet another ability that is better developed in the investigated indoor players. As a multi-factor ability, it consists of strength, speed, agility as well as body structure and proportions. It expresses the ability to overcome the weight of one's own body through dynamic work of the relevant muscles and the most distant jump from a particular point of support (Jastrzębski *et al.* 2012, Stępień *et al.* 2012, Talaga 1973). Soccer and futsal feature specific movements of the lower limbs, which are used to control the ball being dribbled and passed, as well as movements of the torso and heading the ball.

Kocić and co-workers conducted a study aimed at comparing the explosive power of the lower limbs of players playing outdoors and indoors. 37 participants, divided into two subgroups, participated in the study. The first group consisted of 23 senior soccer players, and the other of 14 senior indoor players. The explosive strength of the lower limbs was assessed using the following tests: Squat Jump (SJ), Counter Movement Jump (CMJ), Counter Movement Jump with arm swing (CMJS). The Squat Jump is a vertical jump from the half-squat position with hands on hips, while the Counter Movement Jump is a vertical jump performed from a standing position. The explosive force was tested using an accelerometer and determining the height, duration, variable speed (cm/sec) and power

(W/kg) of the jump. Futsal players achieved lower values of explosive strength of the lower limbs. According to the authors of the present paper, this difference may be due to a much longer training period of the soccer players under the study, which is directly related to the degree of the development of muscular strength (Kocić *et al.* 2016).

Similar results were obtained by Gorostiaga and co-workers when investigating 25 outdoor players and 15 indoor players in terms of their jumping ability. The subjects performed a counter movement jump from the standing position on a platform. The height of the jump in case of futsal players was 15% lower than of the players in the other group (Gorostiaga *et al.* 2009).

Other researchers (Karimi *et al.*) also compared the explosive power of the lower limbs in the group of outdoor and indoor players. This ability was tested by means of the counter movement jump. The results obtained in this test proved to be in line with the results of the present work. Futsal players jumped much higher than outdoor players. It seems that jumping to receive or catch the ball in the air is an important skill for players, regardless of the position they occupy and allows for strong passing and effective reception of the ball (Karimi *et al.* 2015).

Different conclusions were reached by Silva and his co-workers, the study involved 61 soccer players and 28 futsal players. A piezoelectric platform to measure the explosive power of the lower limbs was used in the test. There were no statistically significant differences between the results of the counter movement jump in both groups. It was found that athletes playing soccer and futsal seem to have similar levels of the explosive power of the lower limbs (Silva *et al.* 2012).

Achieving better results in the power test in the indoor female players under the study may be related to the fact that futsal players declared playing "halówka" (futsal colloquially) or classic soccer in previous years. Taking this information into account, it can be stated that the training experience of indoor players is similar to or longer than the training experience of outdoor players under the study, hence the greater development of muscle strength and power of the lower limbs. Interestingly, players in the group of classic soccer, who engaged in additional activities during the week, achieved better results in the jumping ability test. In the group of indoor players, no differences in the level of the development of individual components of motor performance were noticed related to the engagement in additional forms of activity.

This study shows that indoor female players have significantly greater flexibility of muscle structures. Karimi and co-workers compared the flexibility of players of both sports disciplines under discussion by means of the forward bend in a sitting position. The results of this test did not show statistically significant differences between the two groups. Flexibility of muscles and joints decreases with age. During puberty, as a result of rapid growth, there is a significant loss of this ability. It is also known that athletes playing soccer and futsal, as a result of training developing the strength of kicking the ball, have a tendency for the shortening of rear thigh muscles, which promotes muscle damage (Karimi *et al.* 2015).

Although players from both groups believe that the level of the development of motor skills depends primarily on training, no relationship was observed between these variables. Another important factor, according to the respondents, was the time devoted to physical activity. It was 2 hours per week at a minimum. Additional forms of physical fitness were declared by over 80% of all respondents. This variable correlated positively with the speed level of soccer players and the level of coordination in futsal players.

According to Gioldasis, futsal players are usually individuals with a mesomorphic type of body structure. They are distinguished by the ease of building muscle mass and balanced weight. It was found that a high percentage of adipose tissue negatively affects the ability to dribble in women playing futsal (Gioldasis

2016). However, the results of the conducted strength tests do not confirm this information. Differences in the medical ball throw test between the two groups were statistically insignificant. Nevertheless, outdoor players achieved better results.

Taking into account the fact that futsal is played on a smaller field of play, where players are much more focused on one-one-one competition, both in terms of the attack and defence, futsal players are expected to have better abilities than outdoor players. Based on the results of the conducted study, it can be concluded that these expectations have been met.

Conclusions

1. In the investigated group of players, indoor players achieved better results in tests for the following motor skills: agility, speed, power, flexibility and coordination.
2. Players of classic soccer showed better endurance compared to indoor players.
3. The longer the training experience, the higher the level of speed development in the group of futsal players. Engagement in additional physical activity positively influenced the development of power in women playing classic soccer.
4. The longer the time devoted to additional forms of physical activity, the better the speed preparation in the group of outdoor female players, and the better the coordination preparation in the group of indoor female players.

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