MJSS

Akdeniz Spor Bilimleri Dergisi

Mediterranean Journal of Sport Science

ISSN 2667-5463

Examination of Variables Affecting Team Success in the Special Athletes Football League with the Competition Analysis Program

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DOI: https://doi.org/10.38021asbid.1480947

ORIGINAL ARTICLE

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Received:
09.05.2024

Accepted:
13.06.2024

Online Publishing:
28.06.2024

Abstract

In football, it is of great importance to observe the performance of the athlete in the match and to follow their development. For this reason, match analyzes are made all over the world without interruption. However, comprehensive studies on the match performance monitoring of private athletes were not found in the literature. The aim of the study is to emphasize the importance of the pass network analysis and network map obtained with the E-analysis and Gephi program for the national team special athletes to be selected from the Special Athletes Football League teams to show high performance. In the study, video recordings of all matches were taken, analyzed by two experts and transferred to the EAnalyze program. The findings were processed into the Gephi program, and a team pass net map of each match was created. It was determined that 47 had light intellectual disability (ID) (LID), 5 had moderate intellectual disability (MID) and 7 had restricted intellectual disability (RID) of the 59 special athletes were mild, with a mean age of 23.56±4.93(15-38). It was observed that the matches were generally between LID players, and in-game variables were observed to occur between special athletes of the same disability group. In order for special athletes to be successful, in addition to physical performance, target-oriented integration, passing and moving drills training should be carried out to strengthen the passing network and communication within the team and to continue the development. The suitability of the training should be monitored by performing rust network analysis at regular intervals and homogeneous teams should be established. While selecting players for the Special Athletes National Team, it is anticipated that the passing network analysis and network map obtained with e-Analyze Soccer and Gephi program will facilitate the selection of talented athletes.

Keywords: Competition Analysis, Passing Net, Special Athletes, Mentally Retarded.

Özel Sporcular Futbol Liginde Takım Başarısını Etkileyen Değişkenlerin Müsabaka Analizi Programı ile İncelenmesi

Öz

Futbolda sporcunun maçtaki performansını gözlemlemek ve gelişimlerini takip etmek büyük önem taşıdığından, tüm dünyada düzenli olarak maç analizleri yapılmaktadır. Ancak özel sporcuların performansını takibine yönelik kapsamlı maç analizlerine literatürde rastlanmamıştır. Çalışmanın amacı Özel Sporcular Futbol Ligi takımlarından seçilecek milli takım özel sporcularının yüksek performans sergilemesi için e-Analyze Soccer ve Gephi programı ile elde edilen pas ağı analizi ve ağ haritasının önemini vurgulamaktır. Çalışmada tüm maçların video kaydı alınmış, iki uzman tarafından incelenerek e-Analyze Soccer programına aktarılmıştır. Elde edilen bulgular Gephi programına işlenerek her maçın takım içi pas ağı haritası oluşturulmuştur. Yaş ortalaması 23,56±4,93(15-38) olan 59 özel sporcunun 47'si hafif düzey zihinsel engelli (ZE) (HDZE), 5'i orta düzey ZE (ODZE) ve 7'si ağır düzey ZE (ADZE) olduğu saptanmıştır. Maçlar genellikle HDZE sporcular arasında, oyun içi değişkenlerin aynı engel düzeyli sporcular arasında gerçekleşmiştir. Başarılı takımlarda aynı engel düzeyindeki sporcuların geniş pas ağı ve sıklığı, isabetli pas ve hücum atakları fazla olduğu tespit edilmiştir. Mevki olarak HDZE sporcular nerede konumlandıysa maç o yönden devam etmiştir. ODZE ve ADZE sporcular mevkilerine göre oynamadıkları görülmüştür. Özel sporcuların başarılı olabilmeleri için fiziksel performansın yanı sıra takım içi pas ağını ve iletişimi güçlendirme ve gelişimi sürdürebilmek için hedefe yönelik kaynaştırma, pas ve hareketli driller antrenmanları yapılmalıdır. Düzenli aralıklarla pas ağı analizleri yapılarak antrenmanların uygunluğu takip edilmelidir ve homojen takımlar kurulmalıdır. Özel Sporcular Milli Takım'ına oyuncu seçilirken e-Analyze Soccer ve Gephi programı ile elde edilen pas ağı analizi ve ağ haritası yetenekli sporcuların seçimini kolaylaştıracağı öngörülmektedir.

Anahtar kelimeler: Müsabaka Analizi, Pas Ağı, Özel Sporcular, Zihinsel Engelli.

Introduction

Intellectual disability is defined as "a disorder characterized by the presence of incomplete or halted mental development, principally characterized by impairments in concrete functions at every stage of development, contributing to general intelligence, including cognitive, language, motor, and socialization functions. In this anomaly, adaptation to the environment is always affected." (World Health Organization [WHO] 2022). This anomaly, which has substantial social impacts, affects not only those who suffer from it but also their families and society (Petterson et al., 2007). Moreover, the American Association on Intellectual and Developmental Disabilities defines it as limitations in intellectual functioning and social application and comprehension skills observed before the age of 18 years (Dematteo et al., 2007).

Individuals with intellectual disabilities (ID) are classified into mild, moderate, severe, and profound levels of intellectual impairment. Mild intellectual impairment accounts for 85% of children with ID, with an Intelligence Quotient (IQ) score of 50-69. Due to inadequacies in social application and comprehension skills, their basic/daily living motor and academic skills are slow, enabling them to live independently with minimal support. They also have short and scattered attention spans, low self-confidence, and difficulty participating in group activities and adhering to rules (Boat and Wu, 2015). Moderate intellectual impairment includes 10% of children with ID, with an IQ score of 36-49. They can live independently with moderate support. Their attention and self-confidence are lower, and they face more difficulty in group activities and adhering to rules (Boat and Wu, 2015). On the other hand, severe intellectual impairment includes 35% of children with ID, with an IQ score of 20-35. Due to significantly slower skills, they require lifelong support for everything (Boat and Wu, 2015). Despite substantial delays in development, children with severe ID generally understand spoken language, but their communication skills are limited (Sattler, 2002).

Participation in physical activity or sports has been accepted to improve psychosocial health including integration into society, the development of social skills, coping with disability, self-esteem, and confidence, as well as mood (Asztalos et al., 2009; Eime et al., 2010). It also enhances the perception of quality of life and well-being (Bize et al., 2007; Penedo and Dahn, 2005). Sports are meaningful and important in the lives of many individuals, including those with ID, who often face significant exclusion in daily life (Currie and Szabo, 2020; van de Vliet et al., 2006). Particularly for individuals with ID, problems such as anxiety, social isolation, and depression can be resolved, and motor skills can be developed through participation in sports and social activities (Eime et al., 2013).

Team sports among individuals with disabilities foster responsibility-sharing and social cohesion, contributing to group inclusion and self-acceptance, increasing feelings of trust and

motivation, and positively impacting self-perception and personality development (Klenk et al., 2019). Team sports also enhance perceived social acceptance (Eime et al., 2013). When an individual benefits psychologically and socially from physical activity and sports, they become motivated, and family, friends, and coaches serve as sources of external motivation to turn physical activity guidelines into action (Rimmer et al., 2004). In football, special athletes with mild ID (MID), moderate ID (MoID), and severe ID (SID) strive for the same goal. The network of passes and their efforts during the match vary individually. To maximize the benefits from sports activities, the events need to be appropriate to the type and level of disability. Although the type of disability distinguishes individuals, differences are also observed among individuals with the same type of disability (Mumcu, 2018). Special athletes with MID, MoID, and SID playing on the same team face challenges in adapting to technical and tactical training within the team, as well as in selecting players suitable for specific positions. The high level of action during matches is known to limit the observation of athlete performance (Maslovat and Franks, 2008). Therefore, match analyses conducted using digital programs provide crucial feedback on the physical, technical, and tactical performances of the players (Baca, 2014; Carling et al., 2005).

Game intelligence is defined as analytical, creative, and practical skills (Williams and Reilly, 2000), while neuropsychologically, it is the metacognition that executes self-regulation and executive functions. In football, game intelligence can easily distinguish talented from untalented players (Toering et al., 2009). In individuals with ID, this skill is underdeveloped, negatively affecting performance (Toering et al., 2009). The ability to pay attention to the right stimuli and then direct attention effectively is crucial in team sports such as football, while low level of these skills in individuals with ID adversely affects the performance (Rimmer, 1994). Studies stated that technical and tactical training in football can improve game intelligence and attention in individuals with ID (Burns, 2015). Additionally, since game parameters enhance performance, they are important for providing psychological benefits such as motivation, competitiveness, self-esteem, and social acceptance, along with physiological benefits including motor skill development and aerobic capacity (Eichstaedt and Lavay, 1992). Thus, assessing the technical, tactical, physical, and behavioral performance of special athletes and planning suitable training based on match analysis obtained with e-Analyze Soccer and Gephi programs might be beneficial, especially for special athletes.

The aim of this study is to emphasize the importance of pass network analysis and pass network maps obtained with the e-Analyze Soccer and Gephi programs for the high performance of the national team athletes selected from the Special Athletes Football League teams.

The main problem of the study is whether the data from the e-Analyze Soccer and Gephi programs can facilitate the easy evaluation of special athletes' performance, in-game movements, and suitability for positions by coaches and technical staff.

Can the tangible data such as pass network analysis and network maps obtained with the e-Analyze Soccer and Gephi programs guide the selection of the best special athletes for the national team?

Do these data provide feedback to coaches for evaluating the performance of special athletes with different levels of disability playing in the Special Athletes Football League?

Materials and Methods

Study Design

Video recordings of the semi-final and final matches of the Special Athletes Football League Play-Offs were analyzed in the study with cross-sectional, retrospective uncontrolled study design. The study was performed with document analysis which is a quantitative research method (Creswell 2005; Şimşek and Yıldırım 2011).

Population and Sample

Special athletes from four clubs that participated in the 2019-2020 Special Athletes Football League Play-Off semi-final and final matches were included in the study. The sample consisted of 59 special athletes (SAs) who met the criteria for playing in the licensed Special Athletes Football League, with an average age of 23.56 ± 4.93 (15-38 years). The sample included 47 special athletes with mild intellectual disabilities (MID), 5 with moderate intellectual disabilities (MoID), and 7 with severe intellectual disabilities (SID). Only special athletes with intellectual disabilities were included in the study, excluding those with visual or physical disabilities, based on clinical evaluation and clinical health reports. The parents of the special athletes were informed about the study, and signed the written consent forms volunteerly before the study.

Data Collection

Copies of clinical health reports indicating the level of disability and demographic information from athlete personal information forms were obtained from the football clubs. All data were recorded with individual codes, ensuring confidentiality and use solely for scientific purposes. Video recordings of the matches were used for the match analysis.

Match Analysis

e-Analyze Soccer Program

The e-Analysis Soccer Program provides detailed quantitative and visual outputs by analyzing on-field performance actions and all functions. Developed in Turkey, it offers comprehensive analyses from individual to team levels. Produced by Espor Digital, the program records match conversations, converts voice to text, and transforms text into data for analysis (eSpor Coachfaces 2021). Match videos were converted to VCD format for analysis, reviewed by thr researcher while parameters such as the frequency and target of passes, pass success, successful/unsuccessful shots, goals, and fouls were coded into an Excel file. The data were then uploaded to the e-Analyze Soccer program, while analyses of game dynamics based on the level of disability and in-game variables forming the intra-team pass network were conducted.

Gephi Program

Gephi (0.10 CDDL 1.0 and GNU General Public License (GPL) v3) is an open-source network exploration and visualization software suitable for analyzing all types of networks. It processes data to create a network structure, visualizing it using a specialized module. This allows for the creation of relationships, nodes, and directions within the network, presented graphically through layout algorithms. The most commonly used algorithm is the force-directed Force Atlas. Gephi also allows the simultaneous execution of multiple algorithms. A network node is formed whenever a pass, cross, or shot occurs between two players (Balasubramaniam 2017). Graphs are supported with a text module, allowing data associated with nodes to be labeled and algorithms added via label settings (Bastian et al., 2009).

Using the Gephi program, intra-team interaction and pass network analyses were conducted with variables used to evaluate performance in the e-Analyze Soccer program. Factors such as pass dynamics, player relationships, and positional pass frequency were evaluated within the social network created.

Results from the e-Analyze Soccer program were loaded into the Gephi program. Analysis included percentages of short, medium, and long passes, the accuracy of these passes, the player's betweenness centrality (shortest path relationships), pagerank (players in the network), closeness centrality (distance as a node), and the number and directions (single or bidirectional) of nodes and relationships to create network maps of the teams.

Data Analysis

Participants' demographic data were analyzed using IBM SPSS (Version 22, Inc., Chicago, IL, USA). Descriptive statistics were reported as mean ± standard deviation and minimum-maximum, while categorical variables were presented as frequency and percentage (%). Match analyses were evaluated using the e-Analyze Soccer and Gephi programs.

Ethical Consideration of the Study

This study was conducted according to the Helsinki Declaration with the ethical approval of the Hitit University Non-Invasive Clinical Research Ethics Committee (decision no. 2021/63, dated 05.04.2021). The study adhered to the "Scientific Research and Publication Ethics Directive of Higher Education Institutions" throughout the research process, while permission was obtained from the Turkish Special Athletes Sports Federation on 08.11.2021 for the match videos and athlete information.

Results

The Kocaeli Life Coaching Olympic Sports Club (KYKOSK), Malatya Turgut Ozal Special Athletes Club (MTOOSK), Malatya Silent Steps Special Athletes Club (MSAOSK), and Bursa Mehmet Torun Special Athletes Club (BMTOSK) played two semi-final and one final match. KYKOSK defeated MSAOSK 5-0, and BMTOSK defeated MTOOSK 9-1 in the semi-finals. KYKOSK won the final match against BMTOSK with a score of 1-0.

The distribution of the 59 special athletes' levels of disability according to their clubs has been shown in Table-1.

Table 1. Distribution of Special Athletes' Average Age and Mental Disability Levels by Clubs

Clubs	**Age**		**MID**		**MoID**		**SID**	
	n	**x̄ ±sd (Min-Max)**	**f**	**%**	**f**	**%**	**f**	**%**
KYKOSK	15	24.6±5.23 (15-33)	11	73,3	2	13,3	2	13,3
MTOOSK	16	26.25±5.74 (17-38)	13	81,25	2	12,5	1	6,25
MSAOSK	13	21±2.88 (18-30)	11	84,6	0	0	2	15,4
BMTOSK	15	21.87±3.5 (18-32)	11	3,3	2	13,3	2	13,3

KYKOSK: Kocaeli Life Coaching Olympic Sports Club(Kocaeli Yaşam Koçluğu Olimpiyat Spor Kulübü), MTOOSK: Malatya Turgut Özal Special Athletes Club (Malatya Turgut Özal Özel Sporcular Kulübü), MSAOSK: Malatya Silent Steps Special Athletes Club (Malatya Sessiz Adımlar Özel Sporcular Kulübü), BMTOSK: Bursa Mehmet Torun Special Athletes Club (Bursa Mehmet Torun Özel Sporcular Kulübü), x̄: Mean, sd: Standart Deviation, MID: Mild Intellectual Disability, MoID: Moderate Intellectual Disability, SID: Severe Intellectual Disability

The Table 1 reveals that all clubs had more MID special athletes, indicating that the rosters were not homogeneous by disability level. On the other hand, the player numbers, positions, and disability levels of the special athletes are presented in Table 2.

Table 2

Player Number, Position and Disability Levels of Special Athletes

Number of the Player	KYKOSK		MSAOSK		BMTOSK		MTOOSK	
	Position	Disability level	Position	Disability level	Position	Disability level	Position	Disability level
1	Substitute	SID	Forvet	MID	Left Back	MID	Forvet	MID
2	Left Back	MoID	Right Midfield	MID	Right Back	MoID	Central midfield attack	MID
3	Substitute	MID	Midfield Libero	MID	Right Stopper	MID	Right Midfield	SID
4	Right Stopper	MID	Right Back	SID	Left Stopper	MID	Goalkeeper	MID
5	Left midfield winger	MID	Goalkeeper	MID	Right midfield winger	MoID	Right Stopper	SID
6	Forvet	MID	Right midfield winger	SID	Left midfield winger	MID	Right Back	MID
7	Left Stopper	MID	Left Midfield	MID	Left Midfield	SID	Left Midfield	MID
8	Central midfield attack	MID	Central midfield attack	MID	Right Midfield	MID	Left Back	MID
9	Substitute Goalkeeper	MID	Left Back	MID	Goalkeeper	MID	Left midfield winger	MID
10	Goalkeeper	MoID	Left midfield winger	MID	Central midfield attack	MID	Right midfield winger	MID
11	Right Back	MID	Substitute	MID	Forvet	MID	Substitute	MID
12	Right Midfield	MID	Substitute	MID	Substitute	SID	Left Stopper	MID
13	Substitute	SID	Right Stopper	MID	Substitute	MID	Substitute	MID
14	Right midfield winger	MID			Substitute	MID	Substitute	MID
15	Left Midfield	MID			Substitute	MID	Substitute	MoID
16							Substitute	MID

KYKOSK: Kocaeli Life Coaching Olympic Sports Club(Kocaeli Yaşam Koçluğu Olimpiyat Spor Kulübü), MTOOSK: Malatya Turgut Özal Special Athletes Club (Malatya Turgut Özal Özel Sporcular Kulübü), MSAOSK: Malatya Silent Steps Special Athletes Club (Malatya Sessiz Adımlar Özel Sporcular Kulübü), BMTOSK: Bursa Mehmet Torun Special Athletes Club (Bursa Mehmet Torun Özel Sporcular Kulübü), MID: Mild Intellectual Disability, MoID: Moderate Intellectual Disability, SID: Severe Intellectual Disability

Table 3

Distribution of In-Game Variables of Competitions According to Club and Special Athletes' Levels of Disability

Game-in Variables	KYKOSK				BMTOSK				MSAOSK			MTOOSK			
	MID	MoID	SID	Total	MID	MoID	SID	Total	MID	SID	Total	MID	MoID	SID	Total
	f (%)	f (%)	f (%)		f (%)	f (%)	f (%)		f (%)	f (%)		f (%)	f (%)	f (%)	
Positive short pass	160 (72,7)	23 (10,5)	37 (16,8)	220	111 (70,3)	17 (10,7)	30 (19)	158	32 (80)	8 (20)	40	24 (75)	5 (15,6)	3 (9,4)	32
Negative short pass	21 (77,8)		6 (22,2)	27	16 (66,7)	2 (8,3)	6 (25)	24	8 (61,5)	5 (38,5)	13	7 (100)			7
Positive long pass	23 (85,2)	4 (14,8)		27	17 (63)	4 (14,8)	6 (22,2)	27	6 (100)		6	7 (87,5)		1 (12,5)	8
Negative long pass	28 (96,6)		1 (3,4)	29	22 (73,3)	4 (13,3)	4 (13,3)	30	8 (72,7)	3 (27,3)	11	8 (80)	1 (10)	1 (10)	10
Positive free throw	1 (50)		1 (50)	2	3 (100)			3	5 (83,3)	1 (16,7)	6			2 (100)	2
Negative free throw	1 (100)			1	8 (100)			8		2 (100)	2	2 (100)			2
Negative shoot	8 (36,4)	7 (31,8)	7 (31,8)	22	11 (55)	3 (15)	6 (30)	20	4 (100)		4	2 (100)			2
Positive shoot	11 (84,6)	1 (7,7)	1 (7,7)	13	11 (78,6)		3 (21,4)	14	1 (100)		1	1 (100)			1
Positive clearance	35 (89,7)	1 (2,6)	3 (7,7)	39	30 (63,9)	9 (19,1)	8 (17)	47	21 (87,5)	3 (12,5)	24	20 (69)	2 (6,9)	7 (24,1)	29
Negative clearance	10 (90,9)	1 (9,1)		11	3 (50)	2 (33,3)	1 (16,7)	6	8 (80)	2 (20)	10	6 (85,7)		1 (14,3)	7
Positive throw-in	28 (90,3)	1 (3,2)	2 (6,5)	31	23 (82,1)	5 (17,9)		28	7 (77,8)	2 (22,2)	9	3 (100)			3
Negative throw-in	6 (75)	1 (12,5)	1 (12,5)	8	9 (81,8)	2 (18,2)		11	5 (100)		5	11 (91,7)	1 (8,3)		12
Positive goal shot					6 (100)			6	2 (100)		2			3 (100)	3
Negative goal shot					10 (100)			10	7 (50)	7 (50)	14			11 (100)	11
Positive punt	4 (100)			4	2 (100)			2		1 (100)	1				
Negative punt	5 (100)			5	3 (100)			3		3 (100)	3	6 (100)			6
Positive hand start	1 (100)			1	1 (100)			1	1 (100)		1				
Negative hand start	1 (100)			1											
Ball recovery	58 (89,2)	1 (1,6)	6 (9,2)	65	61 (78,2)	7 (9)	10 (12,8)	78	18 (81,8)	4 (18,2)	22	28 (87,5)	1 (3,1)	3 (9,4)	32
Ball loss	41 (74,5)	6 (11)	8 (14,5)	55	46 (69,7)	7 (10,6)	13 (19,7)	66	28 (93,3)	2 (6,7)	30	28 (96,6)	1 (3,4)		29
Earned foul	5 (71,4)	2 (28,6)		7	11 (78,6)	2 (14,3)	1 (7,1)	14	6 (100)		6	1 (100)			1
Committed foul	11 (84,6)	2 (15,4)		13	7 (100)			7	2 (100)		2	5 (100)			5
Conceded goal					2 (100)			2	5 (100)		5	9 (100)			9
Scored goal	6 (100)			6	6 (66,7)	1 (11,1)	2 (22,2)	9				1 (100)			1
Successful save	10 (100)			10	8 (100)			8	9 (100)		9	12 (100)			12
Earned penalty		1 (100)		1	1 (100)			1							
Committed penalty									1 (100)		1	1 (100)			1

The distribution of in-game variables by club and disability level were presented in Table 3, where it can be seen that KYKOSK and BMTOSK, who played two matches including the final, had higher pass rates, while KYKOSK played an SID special athlete only in the semi-final. MID special athletes had higher rates of positive movements compared to MoID and SID special athletes, though some negative movements were also higher (Table 3). MoID and SID special athletes had lower positive short and long pass rates and fewer negative short and long pass rates compared to MID special athletes. The same was true for BMTOSK and MTOOSK such that in MSAOSK, MID special athletes had high positive movement rates and low negative movement rates, while the opposite was observed for SID special athletes (Table 3).

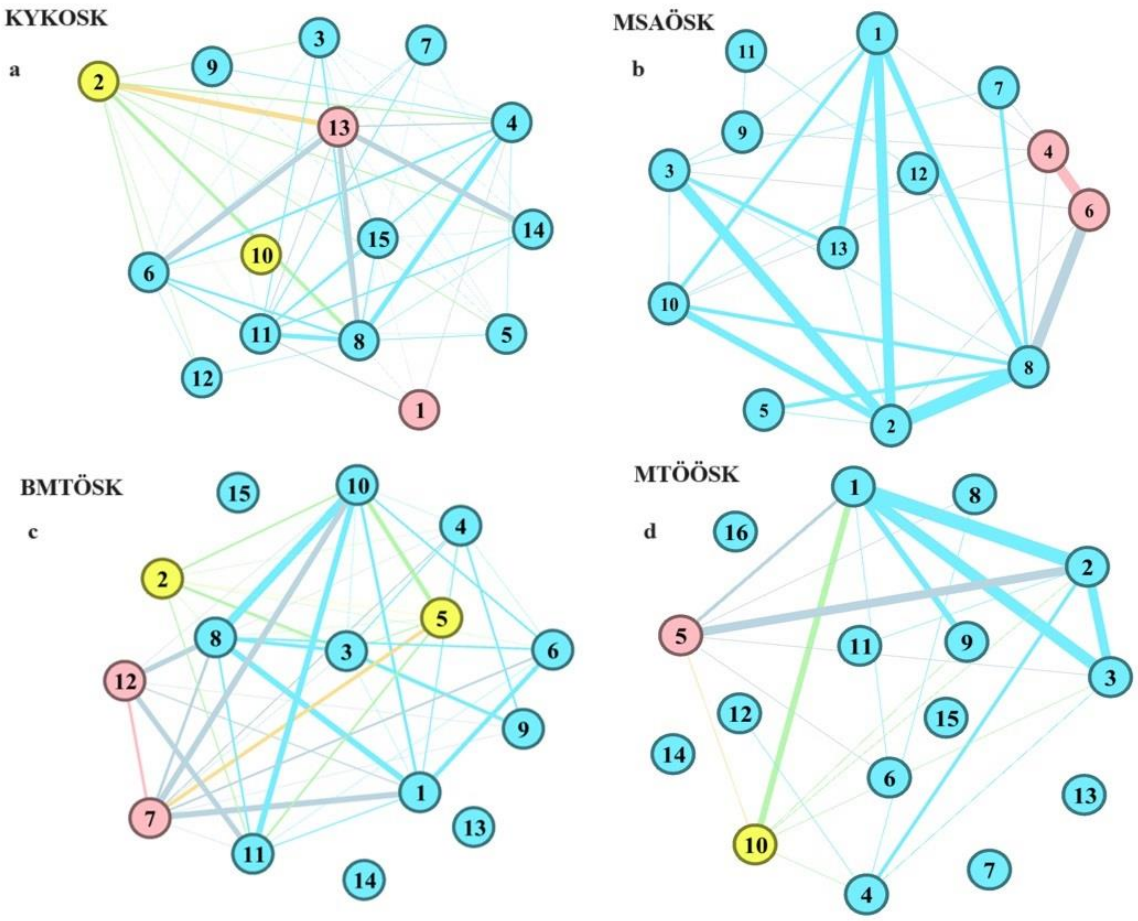
Semi-Final Match Results

Based on in-game variables, special athletes of KYKOSK had high ball possession rates against special athletes of MSAOSK. MSAOSK special athletes' disability levels were not as homogeneous as KYKOSK special athletes' disability levels (Table 2). KYKOSK special athletes had high numbers of clearances and successful saves during the match (Table 3).

The pass network map of the special athletes by club in the semi-final matches is shown in Figure 1, where the thickness of the pass distribution lines indicates pass frequency. All special athletes from KYKOSK and MSAOSK participated in the pass network (Figures 1.a, 1.b). For KYKOSK, the most frequently passing and centrally positioned special athletes in the network were MoID No. 2 left back, MID No. 6 forvet, No. 11 right back, No. 14 right midfield, No. 8 central midfield attack, and SID No. 13 substitute (Figure 1.a). For MSAOSK, the most frequently passing special athletes were MID No. 1 forvet, No. 2 right midfield, No. 3 central midfield libero, No. 8 central midfield attack, No. 10 left midfield, No. 13 right stopper, and SID No. 6 right midfield (Figure 1.b).

Direct pass networks by position in the semi-final matches are shown in Figure 2, with the thickness, direction, and shape of the lines indicating pass frequency. For KYKOSK, high direct pass rates were observed among the special athletes (Figures 2.a, 2.b). Since the opposing team did not make many attacks, the ball rarely reached MoID No. 10 goalkeeper (Figure 2.a). Before substitutes entered the match, high direct pass rates were found among MoID No. 2, MID Nos. 4, 6, 8, 11, 12, and 14 (Figure 2.a). MID No. 4 right stopper mostly passed directly to MID No. 8 central midfield attack, who then passed to MID No. 6 forvet, occasionally involving MoID No. 2 left back (Figure 2.a).

Figure 1 Passing network map of special athletes according to clubs in the semi-final matches



Mild Intellectual Disability Moderate Intellectual Disability Severe Intellectual Disability

——— The solid line indicates the passing between players; the thicker it gets, the more frequent passes are between those players

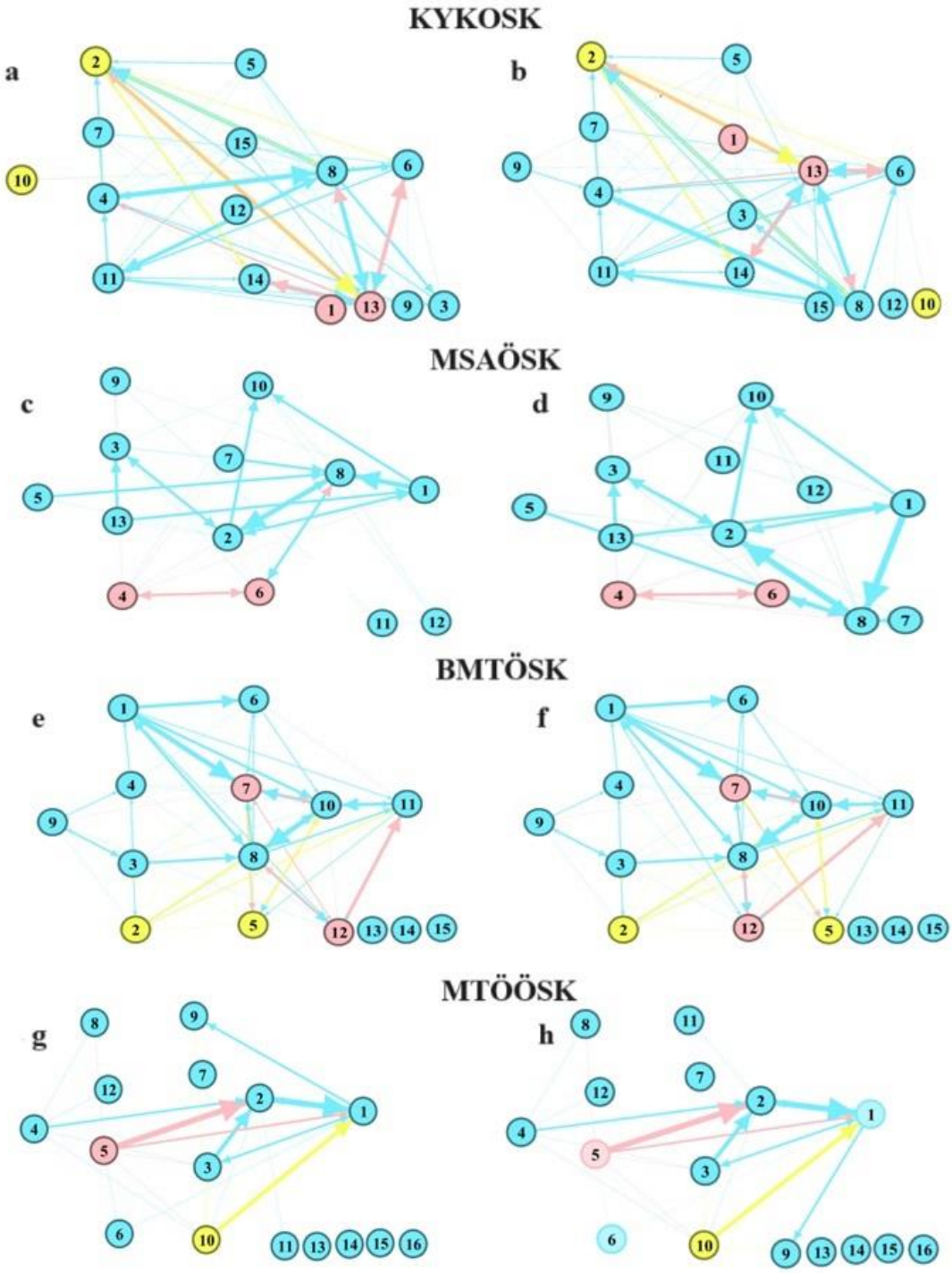
---------- Dashed lines indicate that the number of passes between players is less than expected.

The lines with different colors indicates that the mutual passing of the source and target are different. Since the analysis is carried out over the whole match, the passes when the substitute players enter the game are visible.

Similar patterns were observed for MID No. 11 right back. After substitutes entered the match, high direct pass rates were found among MoID No. 2, MID No's. 6, 11, 14, and SID No. 13 (Figure 2.b). SID No. 1 substitute replaced No. 15 as left midfield, SID No. 13 substitute replaced No. 8 as central midfield attack, MID No. 9 substitute replaced No. 10 as goalkeeper, and MID No. 3 substitute replaced No. 12 as right midfield. These changes did not alter the overall direct pass network as shown in Figure 2.b.

For MSAOSK, high direct pass rates were found among MID Nos. 1, 8, and 2 before substitutes entered (Figure 2.c). MID No. 5 goalkeeper directly passed to MID No. 8 central midfield attack (Figure 2.c). SID Nos. 4 right back and 6 right midfield passed directly to each other (Figure 2.c). Substitutes No. 12 entered for No. 8 as central midfield attack and No. 11 for No. 7 as left midfield, but no direct passes were observed (Figure 2.d).

Figure 2 Direct passing network map according to the positions of special athletes in the semi-final matches



a, c, e, g: Direct passing net before the substitutes (at the bottom right) enter the game,

b, d, f, h: Direct pass net after aces (at the bottom right) are out of the game

In the BMTOSK-MTOOSK match, BMTOSK special athletes had high ball possession and positive pass rates, while MTOOSK special athletes had high positive clearance and successful save rates (Table 3).

In BMTOSK, it has been determined that the special athletes with MID no 1, 6, 8, 10 and 11 are at the center of the rust network (Figure 1.c). SID number 12, which entered the match in the last minutes, played actively. It has been observed that MID numbers 13, 14 and 15 are not in the squad. MID number 3 and 4 right and left defenders contributed to the defense and attack by passing the ball with the surrounding positions and ensuring homogeneous passing. MID numbers 8 and 11 right midfield and midfield pass the ball frequently for attack (Figure 1.c). According to the direct passing network, it is proportional to the thickness, direction and shape of the lines where MID players passes more intensively with the number 1 left back, number 6 left midfielder, MoID number 7 left midfielder (Figure 1.e). It was observed that after SID number 12 substitute player entered the right midfield instead of number 5, he threw the ball directly to SID number 7 left midfielder, MID number 8 right midfielder and number 11 forvet (Figure 2.f).

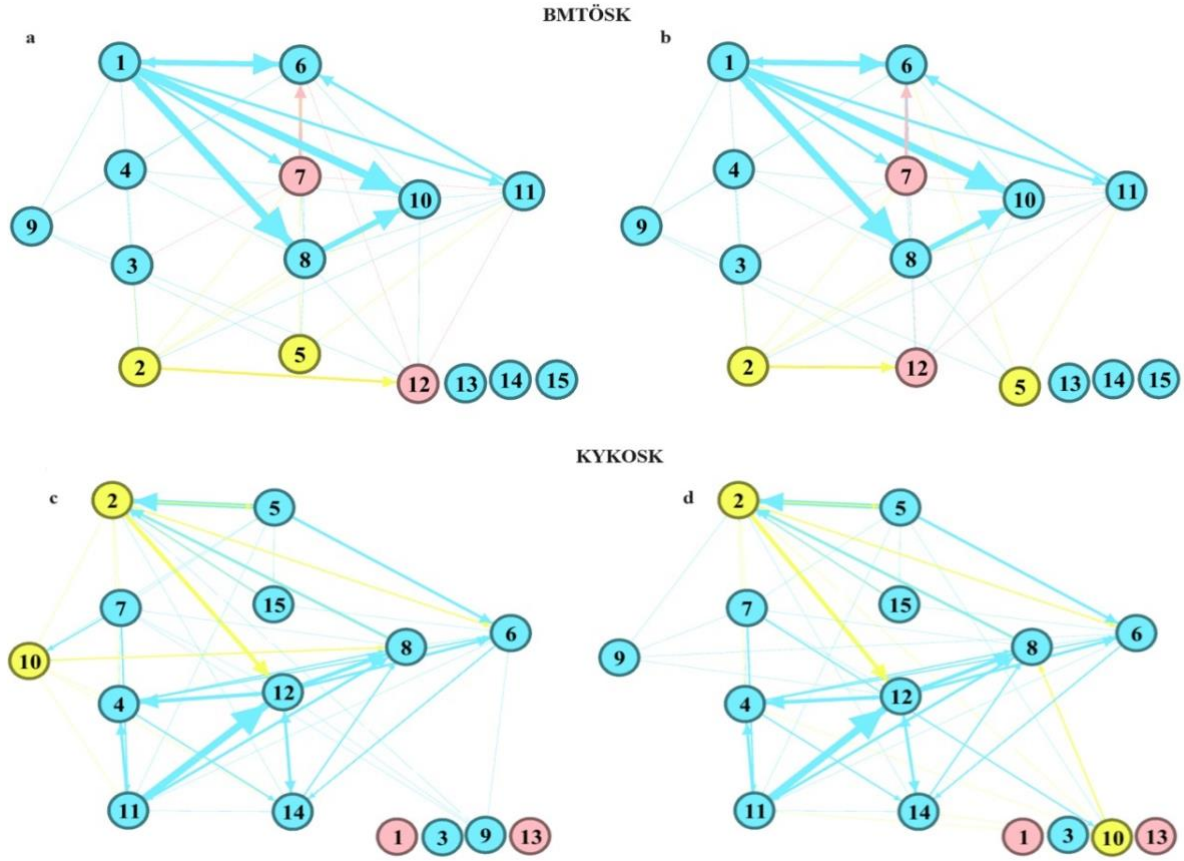
In MTOOSK, all special athletes were included in the passing network, except the MID players no 13, 14, 16, 15 substitudes, who did not participate in the match. It has been determined that the right defenders number MID no 1, 2, 3, 9 and SID no 5 are the ones who pass the most and are at the center of the passing network (Figure 1.d). SID played as the number 5 right defender until the end of the match, where the attack was low and the defense was high. According to the direct pass network, before the substitutes entered the game, MID number 1 played as forvet, MID number 9 as left midfielder, left forvet, MID is the number 2 attacking midfielder, MID is the forvet, SID is the right defender, MID is the attacking midfielder, MoID is the number 10 midfielder, right forward MID is the number 1. Rather, it is directly proportional to the thickness, direction and shape of the lines on which it rusts (Figure 2.g). It was observed that when MID number 11 substitude midfielder moved to the left wing, he did not pass the ball with the striker (Figure 2.h).

Final Match Results

According to the distribution of in-game variables in the KYKOSK and BMTOSK final match, it was determined that the number of short and positive long passes and positive throw-in movements of KYKOSK special athletes during the match were proportional to the success of the club, while (Table 3). It has been observed that negative variables vary depending on the rate and level of possession of the teams (Table 3).

The passing network map of the special athletes in the match according to the clubs is presented in Figure 3, and the direct passing network of the special athletes according to their positions is presented in Figure 4, and the high passing distribution is proportional to the line thickness, direction and shape.

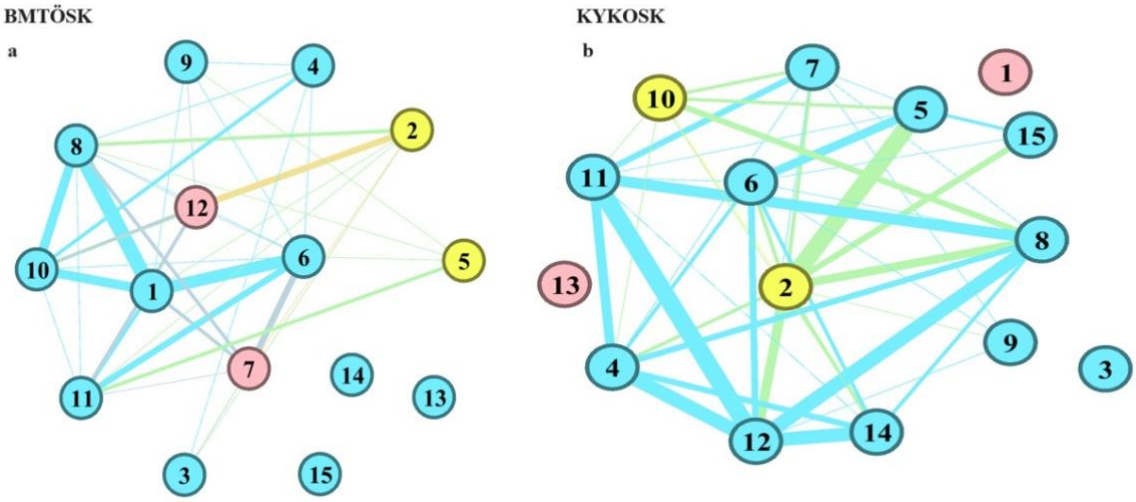
Figure 3 Passing network map of special athletes in the final match according to clubs



In BMTOSK, special athletes who were in the center of the pass network and passed the most during the match were the same as in the semi-final match (Figure 3.a). SID no 12, who entered the match in the last minutes of the semi-final and played actively, could not show the same performance in the final (Figure 3.a). As in the semi-final match, the same substitutes were not included in the final match again. It was determined that the number of passes in the match, which was mainly played with an attack focus, was less than in the semi-final. It was observed that the direct passing network was for defensive purposes and was the same as in the attack-oriented match in the semi-final (Figure 4.a). Even though SID number 12 entered the match in place of the midfielder MoID number 5, as in the semi-final, he could not be effective in defense or any possible attack (Figure 4.b).

In KYKOSK, the passing rate is lower than in the semi-finals, while the most passes were made between number 12 right midfielder and other special athletes, except for SID numbers 1 and 13 who were not included in the final match. (Figure 3.b). It has been determined that the direct passing rate of the net is higher than that of the opposing team. Before the substitutes entered the game, the direct pass net took place between the same players in the semi-final match (Figure 4.c). MID no 8 midfielder has taken more responsibility in attacking and passing within the team, while MoID no 2 left back and MID no 11 right back played an active role in the attack. Only the goalkeeper was changed towards the end of the match, and this did not disrupt the passing network (Figure 4.d).

Figure 4. Direct passing network map according to the positions of special athletes in the final match



Discussion and Conclusion

In the present study that examined the impact of different levels of intellectual disability on the performance and positions of special athletes in the Special Athletes Football League Play-Offs using e-Analyze Soccer and Gephi, we demonstrated for the first time the significance of pass network analysis and network maps obtained from these programs in selecting special athletes who will perform ideally for the Special Athletes National Football Team.

In all clubs participating in the league, special athletes with MID outnumbered the special athletes with MoID and SID. In the semi-final matches, all clubs played MoID and SID special athletes throughout the match, however, in the final matches, they were either assigned in the last minutes or not assigned at all. Consequently, MID special athletes were generally assigned in all matches due to their higher numbers and successful performance compared to MoID and SID, often forming a pass network among each other. On the other hand, MoID and SID special athletes who performed well and played according to their positions were also active in the pass network. However, MoID and SID special athletes who performed poorly, played out of position, or made incorrect passes changed the direction of defense and attack, a situation also observed among SID special athletes passing among themselves. This important factor for success in football can be attributed to three reasons: insufficient technical and tactical training, inadequate motor skills for performance, and, most importantly, decreased attention spans as the level of intellectual disability increases. Despite their good performance and positional play, the fact that the club that won the Play-Off did not include a SID special athlete in the final match squad and the other club included them for a short period suggests that attention span was a factor. As observed in all matches, it can be argued that the

difference in levels of intellectual disability affects team success. Analyzing the overall performance of special athletes confirms that their mental ages are generally under 13 years (Katz and Lazcano-Ponce, 2008). Their education focuses more on developing self-sufficient skills rather than abstract thinking or goal-oriented skills.

Examining in-game variables, MID special athletes generally displayed high levels of positive movements and low levels of negative movements. Therefore, it can be hypothized that directing MID individuals to sports can develop motor skills, extend attention spans, increase self-confidence, improve social cohesion through communication, and bring the joy of group inclusion and self-acceptance, allowing them to easily participate in group activities and adhere to rules. Consequently, team sports can contribute to the independent living of MID individuals. Moreover, according to our findings, MoID and SID special athletes can perform similarly to MID special athletes if given appropriate support. Although the positive and negative movements of well-performing and positionally appropriate special athletes seem low, their numbers and limited match time affect these findings, suggesting they actually have similar ratios to MID special athletes. Thus, when playing in positions that require short passes and less tactical complexity, they should be supported with appropriate technical and tactical training rather than being left out of the game. If passing among themselves is seen as the beginning of socialization, they can gain similar benefits to MID individuals over time through sports. For socialization, encouraging peer interaction to create group identity, approximately with peers of the same disability level, is recommended (Katz and Lazcano-Ponce, 2008). However, forming teams without considering disability levels may lead to the exclusion of these special athletes, decreased their motivation, increased vulnerability, and indirectly negatively affect their performance.

With the pass network map created by the Gephi program, it can be determined whether the passes made by the players during the match were position-appropriate and/or whether the ideal squad was formed. Direct examination of the pass network map reveals that, for instance, in the MSAOSK, the MID central midfield attacking special athlete was successful in initiating the team’s attack, whereas the replacement MID special athlete did not possess the same skills. One expectation of right and left backs in contributing to attacks is to provide assists. Although the opposing team's attack generally occurred from the central midfield and left wing, the SID right back’s passes were more directed to the SID right midfielder rather than to the left midfielder, and the right back often passed to the MID central midfield attacking player, which reduced the number of attacks. The fact that the right back and central right midfielders were SID and had weak playmaking skills was considered a disadvantage in competition. Similarly, in MTOOSK, an SID special athlete was positioned as a right stopper from the beginning of the game, but passing to the midfield and defense instead of the central

midfield attack led to incorrect passes. The MoID right midfield attack was active in the offense, providing many passes to the MID forvet, ensuring frequent ball possession, but the team was playing defensively. Therefore, the direct pass network map obtained from Gephi proves that MoID and SID special athletes should be placed in positions with fewer passes.

Analyzing the direct pass network in BMTOSK's semi-final, it was observed that the team formed a strong pass network by making attacks with MID special athletes on the left side rather than with MoID and SID special athletes on the right side, exiting the defense with deliberate passes and making good attacks. Although the SID left midfielder fulfilled their role positively, the special athletes preferred the MID special athletes in the right midfield and central midfield attack positions. The MID special athlete replacing the MoID right midfielder performed more efficiently by frequently passing with the right midfield and forward. The next day's final match's direct pass network map showed that MoID and SID special athletes were active defensively. The pass network of the MID left back, right midfield, and central midfield attack was defense-oriented, but passes from other positions turned the situation into an offensive play. The left back's role was to support both defense and offense by passing to the player in front of them, and their excessive passing to the central midfield attack indicates that this special athlete could play in the central midfield attack. While the left and right midfield should balance defense and offense, their offensive focus may have created defensive weaknesses and possibly led to the loss of the match. Passes from the SID left midfielder directly to the left midfield supported playing from the left wing. Although a substitute SID special athlete entered as the right midfielder, they were ineffective in defense or potential offense. This was not due to not playing according to their position, but because the match was played from the left wing.

According to KYKOSK's pass network map, the MoID left back and MID right back, despite their main role being defense, played well offensively in the semi-final, with the left back passing more to the central midfield attack than to the left stopper. If the left back played in the right midfield attack, they could have contributed more to the offense. The SID special athlete who entered as the central midfield attack was effective in offense and fulfilled their role. The substitutes' entrance did not change defense, offense, and passing, suggesting that the special athletes played in appropriate positions and followed a suitable tactical program. The non-participation of both SID special athletes in the final and semi-final, despite being central to the pass network, may be due to fatigue from the match being played the next day or the club aiming for victory. The opponent's positioning of the SID special athlete on the right and the inability of the special athletes to fulfill their positional roles ideally, along with the low number of passes between both teams' special athletes in the match, supports this argument. The MoID left back fulfilling their role flawlessly and passing more to the

central midfield and central midfield attack than to the left stopper indicates that the playmaking tactic was conducted through this special athlete. If this player played in the right midfield attack, they could have contributed more to the pass network and offense.

For the honorable life of individuals with intellectual disabilities, opportunities should be provided for their development, education, home and social life, professional life, health and safety, optimal behavioral development, and social integration. Necessary support should be provided for the skills they can exhibit, and social interventions to meet their social needs should be continuously implemented (Katz and Lazcano-Ponce, 2008). It is known that sports are one of these interventions. Thus, this study has revealed that individuals with intellectual disabilities can play football, a mathematically intensive sport, and that if it is necessary for MID, MoID, and SID special athletes to play as a team, they should be supported and assigned according to their level of disability, characteristics, and skills, and most importantly, to provide physical, emotional, and social benefits to all special athletes, teams should be formed according to their level of disability.

Setting appropriate goals is important while developing the skills of special athletes. Goal setting is a motivational strategy for increasing and improving performance according to the task (Estabrooks et al., 2005). Various dimensions such as performance-process-outcome, easy-hard, specific-general, realistic-unrealistic, long-short term, practical-competitive, and individual-team goals might be used in goal setting (Weinberg, 2002). Children with intellectual disabilities generally lack sufficient experience in problem-solving (Soenen et al., 2009), self-regulation, and goal setting (Wehmeyer et al., 2000). Therefore, they can perform simple targeted tasks such as visual discrimination, assembly, simulated work, writing and vocabulary, motor packing of golf balls, cleaning, and sorting (Mohammadi et al., 2022). However, because they cannot provide feedback on the task and cannot comprehend programs to achieve difficult goals, an appropriate dimension should be chosen when setting goals (Weinberg, 2002). When difficult goals beyond the athlete's potential are set, it can reduce their motivation to perform the task by not directing attention appropriately to the task and relevant cues and not activating effort as needed. Especially, decreased motivation can hinder the implementation of new learning strategies (Mohammadi et al., 2022). By directing attention to appropriate goals, activating effort, increasing persistence, and developing new learning strategies, performance can be improved (Weinberg, 2002; Dosil, 2006). Additionally, goal setting creates a competitive situation among individuals with intellectual disabilities (Mohammadi et al., 2022).

The experience of competitive situations for these individuals may increase motivation and thus enhance athletic performance by increasing their optimal arousal levels (Dosil, 2006). The individual possesses an optimal arousal level to perform a task, and this level is exceeded in difficult

tasks, which may lead to deterioration in performance and a decrease in learning (Mohadi et al., 2022). High arousal levels are required to achieve the highest performance in tasks requiring gross motor skills involving large muscle groups (e.g., volleyball and soccer), while moderate arousal levels for most motor skills and low arousal levels for tasks requiring concentration, coordination, stability with fine motor skills are necessary (Taylor & Wilson, 2002). For the simplest action in football, a free shot, both fine and gross muscle groups need to be engaged; concentration and coordination are also necessary (Taylor & Wilson, 2002). Therefore, targets should be determined according to the individual's level skill and optimal stimulation for their performance improvement in special athletes. This approach will increase motivation indirectly leading to enhanced athletic performance.

In conclusion, when selecting athletes for the Special Athletes Football National Team based on ideal performances according to position within teams, the passing network analysis maps obtained through e-Analyze Soccer program with Gephi software might have significant contribution.

Recommendations:

When forming teams from special athletes, not only physiological and physical characteristics but also observe passing network frequency among teammates as well as compatibility within team members should be taken into consideration. In order to succeed, not only physical training but also team-based communication training programs must be incorporated into practices alongside drills that strengthen group passing networks. The target goals must be set according to skill abilities. When considering similar obstacles among special athletes, homogenous teams can be formed especially at lower leagues upon analyzing frequency of passing network maps among similarly challenged groups. If special athletes of different disability levels must coexist, it is recommended that players be selected based on age-matching criteria as well as skill set ability assessment for equal proficiency. Training should focus on positional goals enabling practice teaching capabilities where continuous plays between same players should occur during defense or offense plays from designated positions strategically planned accordingly.

Ethics Committee Permission Information

Ethics evaluation board: Hitit University Non-invasive Clinical Research Ethics Committee
Date of ethical evaluation document: 05.04.2021
Issue number of the ethical evaluation document: 2021/63

Declaration of Researchers' Contribution Rates

The processes related to the method and findings part of the research were carried out by the first author, the processes related to the introduction, method, findings, discussion and conclusion were

carried out by the second author, and the processes related to the introduction, findings, discussion and conclusion were carried out by the third author.

Conflict Declaration

The authors have no declaration of conflict regarding the research.

This study was produced from the first author's Master's Thesis.

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