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EFFECTS OF THE MULTISPORT ACTIVITY PROGRAM ON YOUTH FOOTBALL PLAYERS' MOTOR SKILL DEVELOPMENT

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Abstract

Objective: Our study aimed to compare the dynamic leg strength, acceleration, running speed, agility, and ball-handling skills of young football players.

Material and method: Forty-two players members of the Szeged-Csanád Grosics Academy participated in the so-called "Multisport Activity Program" (SG) (n_{sg}=42), whereas the control group (CG) involved players from the academy's partner clubs (n_{cg}=109). Our testing procedure included: standing long jump, 10 m, and 30 m run, COD 505, and T-Test with ball dribbling.

Results: We found that the dynamic leg power of the SG players was significantly improved. The means of the T-tests demonstrated ($p<0.001$) improved ball dribbling skills in the SG group. We found no significant difference in the COD 505 test results. The results of the standing long jump, 10 m, 30 m, COD 505, and ball control tests are strongly correlated; however, none explain the minor COD difference.

Conclusion: It is beneficial for players to participate in multisport sessions involving various agility and ball control tasks. The COD 505 test results demonstrated smaller differences between dominant and non-dominant sides in SG participants. We suggest they are less likely to develop unilateral movement patterns that lead to overtraining injuries. The results indicate that implementing a "Multisport activity program" benefits youth athlete.

Keywords: *multisport activity, youth football, motor skills, field tests, Szeged-Csanád Grosics Academy*

THEORETICAL AND PRACTICAL BACKGROUND

A decrease in physical activity is a well-known phenomenon in our modern society. Our children walk, run, climb, crawl, fight, jump less and less, and spend more time doing sedentary activities. The negative trend begins in early childhood (CHRISTIAN et al., 2024). Sedentary behaviour has an adverse impact on multiple dimensions of well-being in children and adolescents (LI et al., 2024).

What is the effect of sedentary behaviour on future generations of elite athletes? What is the role of sports institutions in eliciting these adverse effects?

At Szeged-Csanád Grosics Akadémia (Szeged, Hungary), we experienced a contrast between players' football-specific skills and generic motor skills. Players with superior

ball-handling skills struggled with fundamental athletic skills such as running and executing basic gymnastic routines. This resulted in a significant drop in their performance once they reached the age of playing 11v11 football. A high number of injuries due to poor landing techniques (e.g., fracture of the forearm after falling) were also documented. Our practical experience is supported by Duncan et al. (2024), who found a significant relationship between locomotor and object control (Motor Competence) and errors in drop jump landing mechanics in boys aged 10–13 years.

The risk of acute and overtraining injuries is also higher in young athletes specializing in a single sport (JAYANTHI, 2015). According to Adlou et al. (2024), early sports specialization may increase the risk of sports injuries and does not necessarily increase the likelihood of achieving elite athlete status.

Although sports specialization is not inherently harmful, its physical and emotional effects and financial costs can harm young athletes and their families. Those families who are unaware of the benefits of gaining proficiency in multiple sports focus on just one sport to progress kids more quickly. However, participating in various sports during childhood and adolescence is extremely helpful in developing their motor skills. In addition, young athletes can avoid the physical, mental, and emotional exhaustion and burnout resulting from intense and prolonged participation in each sport (HAYES, 2024). Komínkova (2021) also emphasizes the importance of multiple training stimuli in children's sport. Some sports require early specialization (acrobatic sports, e.g., gymnastics, diving, or figure skating; sports that require a high degree of kinesthesis, e.g., swimming, synchronized swimming, equestrian sports). However, most sports require late specialization. Early specialization, or unilateral preparation, leads to a lack of fundamental movement skills, deprived motor coordination, early burnout, and dropout. In contrast, early implementation of multiple training stimuli may enhance movement experience, transferable skills, motivation, and self-confidence (MOB, 2016).

Wiersma (2000) found that athletes who reached the world-class level specialized in football at a later age started training and competing later. According to a systematic review by Kliethermes et al. (2020), early sports specialization is unnecessary to achieve elite-level sporting success (LAPRADE et al., 2016). However, intense unilateral training stimuli should be delayed until late adolescence to optimize success while minimizing injury, psychological stress, and burnout (JAYANTHI et al., 2013). Creating a balance between versatile and specific activities may provide the foundations for high-level sports results (NÁDORI, 2011).

Since psychomotor skills interact with each other during various sports activities Kovács et al., (2022), a multisport approach is recommended for the balanced development of young athletes. Taylor et al. (2024) examined the practice of coaches in English professional football academies (n=60). About half of the respondents participated in multisport training at least once a week (on average 30 minutes). They all agreed that multiple training stimuli improve physical skills, reduce the risk of injury, help avoid early professionalism, and develop communication and problem-solving skills.

THE MULTISPORT ACTIVITY PROGRAM

In 2021, we designed and implemented the "Multisport Activity Program" project to expose players to a wide range of motor activities. After two and a half years, we examined the program's effects and explored new ways of further development.

For this purpose, we administered motor fitness tests to a group of U10-U13 players who registered with our academy and participated in our multisport program. The control group consisted of certified players identified as potential candidates for these age groups.

Before the project started, we designed a program developing generic motor skills. In the summer of 2021, we implemented the "Multisport Activity Program"

- once every week.
- U8 – two football sessions and one "Multisport" session (75 minutes) per week,
- U9 – three football sessions and one "Multisport" session (75 minutes per week,
- U10 – three football sessions and one "Multisport" session (90 minutes) per week,
- U11 – three football sessions and one "Multisport" session (90 minutes) per week,
- U12 – four football sessions and one motor fitness development session (60 minutes, including 30 minutes of futsal training),
- U13 - four football sessions and one 60-minute motor skills development session, including 30 minutes of futsal training,

U8 and U9 players were trained in a circular pattern, and each session was dedicated to a specific motor skill. U10 and U11 train similarly to the U8 and U9 age groups. U12 and U13 train in separate groups, focusing more on preparatory movement patterns related to strength training.

CONTENT OF THE MULTISPORT ACTIVITY PROGRAM

Athletic session: The goal is to improve the running technique's acceleration, deceleration, and agility. We included tag games, relays, and agility ladder exercises using the IAAF Kids' Athletics Manual, World Chase Tag, and activities from the television series Exatlon.

Hand-eye-feet coordination session: The goal was to develop coordination through a wide range of ball-handling exercises. The participants executed the tasks in a constantly changing environment, which provided an overload of cognitive stimuli. We used exercises adapted from the "Life Kinetik Training Method" by Lutz (2017) and the "Chaos Methodology" of Sisa (2018) combined with ball games other than football (such as basketball, handball, volleyball, floorball, and rugby).

Gymnastics session: We implemented this session to develop players' spatial and body awareness and landing techniques, explicitly focusing on movement timing. We involved fundamental gymnastic movements (e.g., cartwheel, handstand, headstand, springboard

jumps) to contribute to football techniques involving diving and falling (e.g., overhead kick, dive-in header, goalkeeper techniques). We also introduced contact games to improve the balance and proprioception of the participants.

Each age group executed a three-week mesocycle with different exercises for each station every week (A, B, and C). In the fall of 2023, we extended the mesocycle to four weeks, adding 60 minutes of specific trampoline training on week D.

MATERIAL AND METHODS

PARTICIPANTS

Our study was conducted on December 5-8, 2023, at the Szeged-Csanád Grosics Academy Football Club. One hundred and fifty-three (151 male and two female) football players born between 2014-2011 (U10-U13) participated in our examination. Sixty-two players were registered players of Szeged-Csanád Grosics Academy, while 91 players were registered players of our partner clubs. Our statistical analysis was based on the male sample (n=151). Our Study Group (SG) (n_{sg}=42) consisted of Szeged-Csanád Grosics Academy registered players who have been involved in our "Multisport Activity Program" for a minimum of 1.5 years. All other players were treated as our Control Group (CG) (n_{cg}=109) (Figure 1). SG players have participated in the non-sport-specific development program for an average of 2 years (M_{sg}=1.93±0.42; Max.=2.5, Min=0.5).

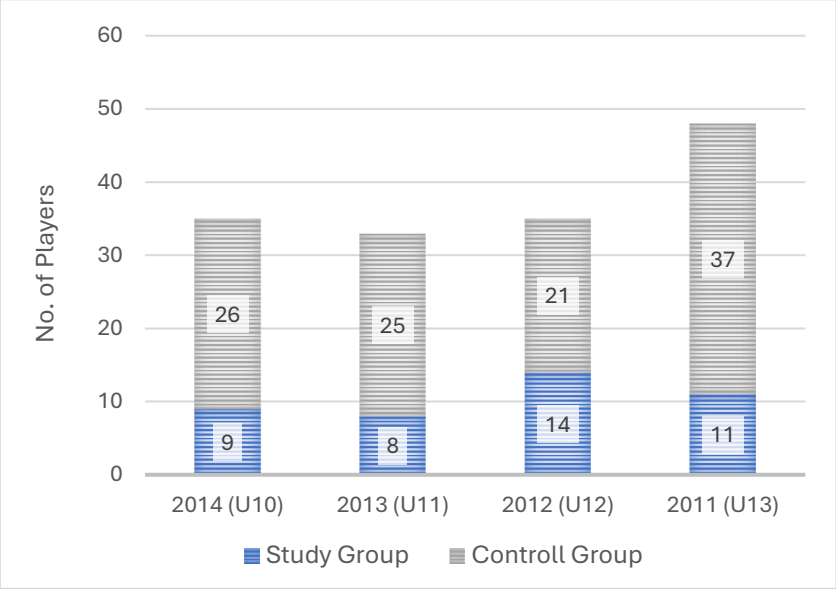

Figure 1: Composition of the male players' test sample by age group (n=151) own source

MOTOR SKILLS TESTING PROTOCOL

The performance of young football players is multidimensional, influenced by maturation, different training strategies, and the development of movement skills (Bakalár et al., 2020). Our testing procedure included seven assessments focusing on four key areas:

1. The standing long jump test measured the dynamic power of the legs.
2. *Acceleration ability and locomotor speed* were measured using a 30 m linear run. We assessed the initial speed at the 10 m mark and the acceleration at the 30 m mark.
3. *The ability to change direction (deceleration-acceleration ability and reactive-explosive-ballistic strength)* was measured by the COD 505 test in both directions (turning to the left and right) (DRAPER – LANCASTER, 1985). We calculated the difference between the best results for both sides for each participant to detect any signs of asymmetric development.
4. *We measured ball control ability* with the T-shaped dribbling test (SEMENICK, 1990).
5. The participants performed

the motor skill tests twice with a 4–5-minute recovery. We used the fastest time from each test for the final analysis.

We compared the results of the two groups using two methods:

We used age-specific standards for the elite academy's players. The Hungarian Football Federation TalentX database provided these values. This database included results for the 10 m and 30 m sprints and the standing long jump tests. Since standardized results were unavailable for the COD 505 and the T-shaped dribbling tests, we focused solely on the average values of the different age groups.

STATISTICAL ANALYSIS

Independent sample T-test and Mann-Whitney U-test were used to determine any significant differences, and Pearson's and Spearman's correlation analyses were used to determine any significant relationships. We performed all statistical analysis using the Jamovi software.

RESULTS

First, we analysed the standing long jump (SLJ) results. We found that significantly ($p<0.05$) more Study Group (SG) players performed above average than their Control Group (CG) counterparts ($M_{sg}=1.75\pm0.16$; $M_{cg}=1.68\pm0.16$). The difference is highly significant ($p<0.01$) for the U12 age group (Figure 2).

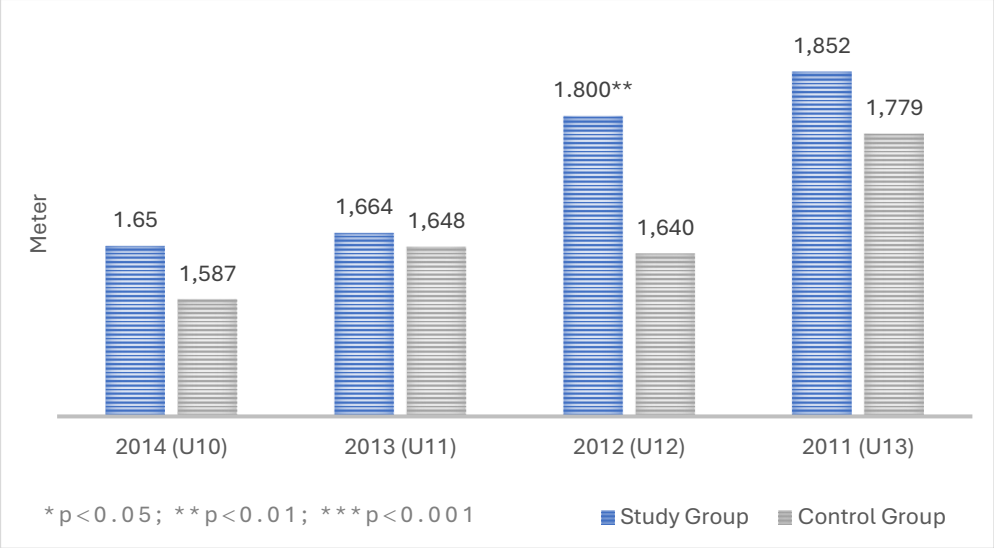

Figure 2: Average values of the standing long jump test by age group (n=151)
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We found no significant difference performing the 10 m sprint test ($p<0.05$) between SG and CG players ($M_{sg}=2.00\pm0.11$; $M_{cg}=2.00\pm0.10$). SG players born in 2014 and 2012 performed better in this test than their CG counterparts. SG players born in 2013 and 2011 completed this distance slower on average than their CG counterparts (Figure 3).

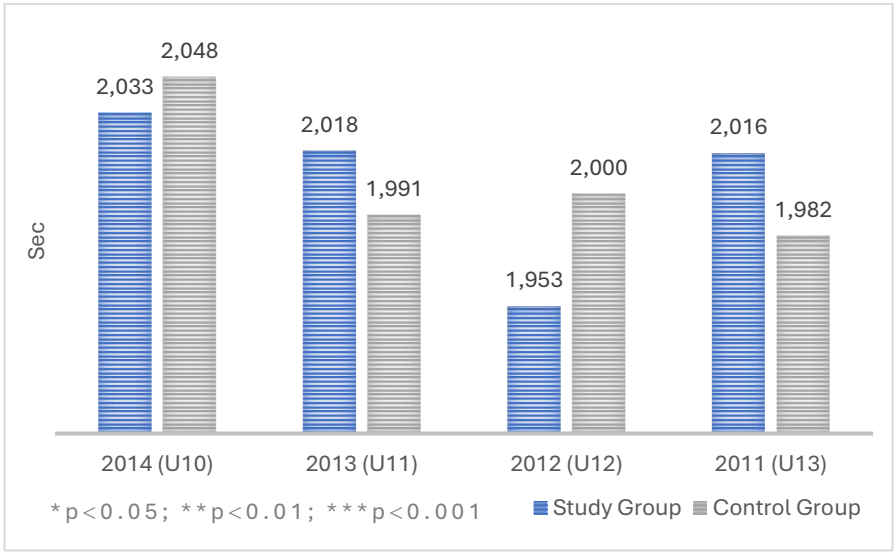

Figure 3: Average values for the 10 m sprint test by age group
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We found no significant difference ($p<0.05$) between SG and CG players completing the 30 m sprint test ($M_{sg}=5.13\pm0.27$; $M_{cg}=5.09\pm0.26$). Only U12 players performed better than their CG peers. However, the difference was not significant (Figure 4).

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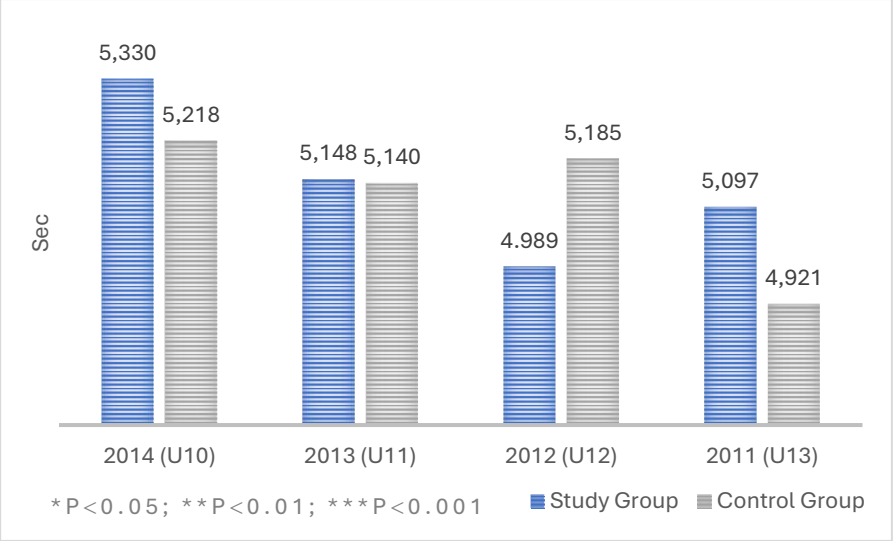

Figure 4: Average values for the 30 m sprint test by age group

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The average results of the change-of-direction ability test (COD 505) indicated a very slight difference in favor of CG participants on both sides (turning to the left and right). However, the difference was insignificant ($p<0.05$); (left: $M_{sg}=2.86\pm0.13$; $M_{cg}=2.80\pm0.17$; right: $M_{sg}=2.85\pm0.12$; $M_{cg}=2.81\pm0.18$). In the U11 age group, the SG players' time results were slightly better than those of the CG members; in the U13 age group, the CG players turned significantly faster to both sides (Left $p<0.05$; Right $p<0.01$) (Figure 5).

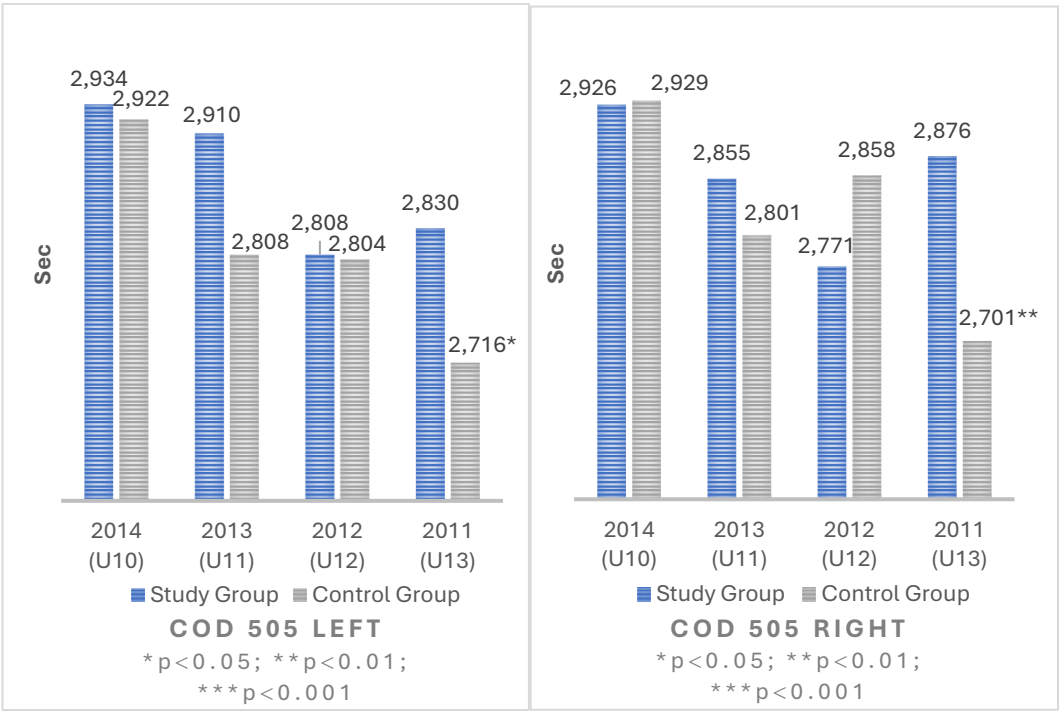

Figure 5: Average values for the COD 505 test by age group

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We observed a more negligible, insignificant difference between the right and the left sides of execution (M_{sg}=0.09±0.06; M_{cg}=0.11±0.08) among the SG players in all age groups. This difference was lower, what we measured in the CG group. This suggests that they are less likely to develop unilateral movement patterns, possibly resulting in overtraining injuries. In the comparison by age group, low-level differences (p=0.09) mainly appeared in the U10 age group (Figure 6).

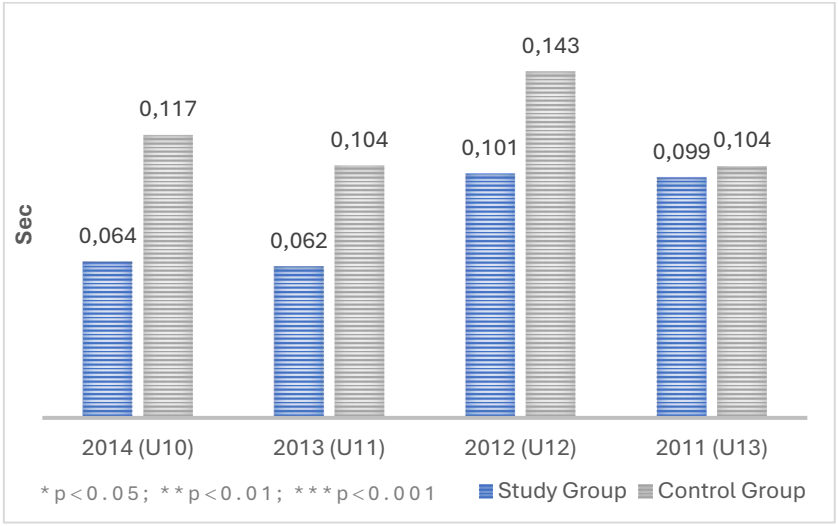

Figure 6: Average differences in both sides for the COD 505 test by age group

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Average values demonstrated a highly significant (p< 0.001) difference in dribbling skills, when performing the T-shaped dribbling test (M_{sg}=14.8±1.23; M_{cg}=16.1±1.58). We found a highly significant (p≤0.001) difference in U10 and U12 age group members, while participants of the U11 and U13 age groups demonstrated only insignificant differences (Figure 7).

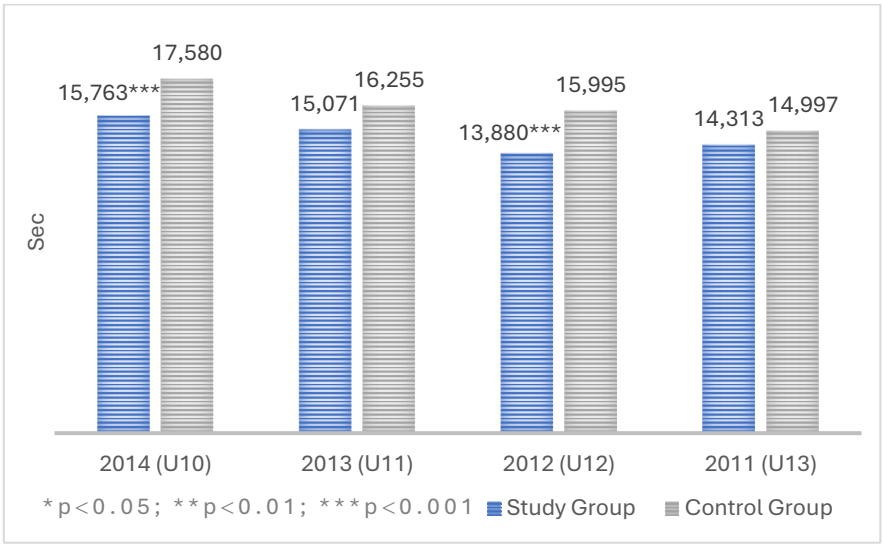

Figure 7: Results of the T-shaped dribbling test

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We observed a very high, significant correlation between dynamic leg strength (SLJ), acceleration ability (10 m), running speed (30 m), changes of direction ability (COD 505), and dribbling speed (Table 1). We also found no significant correlation between the difference in COD test executions on both sides (COD DIFF).

Table 1: Correlation analysis

Test	**Correlation coef.**	**SLJ**	**10 m.**	**30 m.**	**COD 505 R**	**COD 505 L**	**COD DIFF.**	**T-TEST**
SLJ	Pearson's r	—						
	p-value	—						
10 m	Pearson's r	-0.39	—					
	p-value	*<.001*	—					
30 m.	Pearson's r	-0.58	0.75	—				
	p-value	*<.001*	*<.001*	—				
COD505 R	Spearman's rho	-0.42	0.37	0.53	—			
	p-value	*<.001*	*<.001*	*<.001*	—			
COD505 L	Spearman's rho	-0.35	0.51	0.62	0.64	—		
	p-value	*<.001*	*<.001*	*<.001*	*<.001*	—		
COD DIFF.	Spearman's rho	-0.05	0.04	0.03	0.05	0.06	—	
	p-value	*0.57*	*0.65*	*0.69*	*0.52*	*0.47*	—	
T-TEST	Spearman's rho	-0.47	0.30	0.44	0.30	0.44	0.02	—
	p-value	*<.001*	*<.001*	*<.001*	*<.001*	*<.001*	*0.84*	—

own source

DISCUSSION

Overall, the results do not demonstrate a clear benefit of the Multisport Activity Program; however, we observed notable results in some respects.

The dynamic leg strength of young players participating in Multisport Activity Program was significantly higher compared to the members of the CG.

We found no significant differences in the players' acceleration ability (10 m) or running speed (30 m). Our results support the hypothesis that speed is majorly determined by hereditary factors such as the quality and mobility of the neuromuscular system and the ratio of slow-twitch and fast-twitch muscle fibers (DUBECZ, 2009; PETRIDIS, 2015; RADÁK, 2016). However, a longitudinal study could examine potential differences in the rate of development.

We found no significant difference in the ability to change direction when performing the COD505 test. In the U13 age group, players in the Control Group performed significantly better than those who participated in the multisport session. We experienced minor

differences between the left and right sides of execution among the participants of the SG. Players participating in the Multisport Activity Program are less likely to develop unilateral movement patterns leading to overtraining injuries.

The significant difference in the results of the T-shaped dribbling test suggests that various agility and ball control tasks (multiple training stimuli) positively affect the development of this skill. However, contact time, the quality of training, and competition stimuli are highly likely to play a key role in improving ball-handling skills.

The positive relationship between dynamic leg strength (SLJ), acceleration ability (10 m), running speed (30 m), the ability to change direction (COD 505), and ball-handling skill is a natural consequence of the results of growth and development.

Multisport activities may prevent the development of unilateral movement patterns and movement asymmetry. Those players facing various training stimuli are less at risk of overtraining injuries.

Performance differences between limbs are common among athletes, but excessive differences are associated with decreased physical performance and increased risk of injury for athletes (VIRGILE – BISHOP, 2021).

The COD 505 test can be an important tool in assessing injury risk by detecting force and movement asymmetry. Sport professionals may use the COD 505 test to assess the functional capabilities of the lower limbs and monitor recovery from ankle injuries (LOCKIE et al., 2015).

The generalization of our results is limited because we conducted a cross-sectional study. Thus, we were unable to consider the heterogeneity of the player population. Another limitation is the difference in the size of the study and control groups (42 and 109).

The outcome of this analysis suggests that a "Multisport Activity Program" is beneficial for youth academies. Multiple training stimuli not only create a rather enjoyable environment but may enhance the development of various skills that are highly relevant to football. It is critical to avoid training overload; the number of football-specific training sessions should be reduced proportionally, and to pay attention to the age-specific load recommendations (NAKAICHI et al., 2024). This way, we can identify the movement patterns that cause injury to reduce the incidence of injuries in the selected sport (PUCSOK et al., 2023). Providing multiple training stimuli for young athletes may be beneficial for injury prevention. However, this hypothesis needs to be confirmed by further longitudinal studies. Another potential area of further investigation is the mental effect of introducing non-sport-specific sessions into players' training routines. Practicing various sports and performing multiple movements may increase overall well-being and decrease the risk of burnout.

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REFERENCES

Adlou, B., Wilson, A., Wilburn, C., & Weimar, W. (2024). Early sport specialization impact on rates of injury in collegiate and professional sport participation: A systematic review and meta-analysis. *International Journal of Sports Science & Coaching, 19*(4), 1833-1843. https://doi.org/10.1177/17479541241248565

Bakalár, I., Šimonek, J., Kanásová, J., Krčmárová, B., & Krčmár, M. (2020). Multiple athletic performances, maturation, and Functional Movement Screen total and individual scores across different age categories in young soccer players. *Journal of Exercise Rehabilitation*,*16*(5), 432–441. https://doi.org/10.12965/jer.2040546.273

Biese, K. M., Post, E. G., Schaefer, D. A., 2nd, Hernandez, M. I., Brooks, M. A., McGuine, T. A., & Bell, D. R. (2020). Evaluation of adolescent sport specialization and injury mechanism by sex: A secondary analysis. *Journal of Science and Medicine in Sport*, *23*(8), 721–725. https://doi.org/10.1016/j.jsams.2020.01.012.

Christian, H. E., Adams, E. K., Moore, H. L., Nathan, A., Murray, K., Schipperijn, J., & Trost, S. G. (2024). Developmental trends in young children's device-measured physical activity and sedentary behavior. *The International Journal of Behavioral Nutrition and Physical Activity*, *21*(1), 97. https://doi.org/10.1186/s12966-024-01645-z

Draper, J. A., & Lancaster, M. G. (1985). The 505 test: A test for agility in the horizontal plane. *Australian Journal of Science and Medicine in Sport, 17*(1), 15–18.

Dubecz, J. (2009). *Általános edzéselmélet és módszertan*. Budapest: Rectus Kft Kiadó,

Duncan, M. J., Heering, T., Tallis, J., Guimaraes-Ferreira, L., Martins, R., Crotti, M., Barnett, L., Lander, N., & Lyons, M. (2024). The Relationship Between Motor Competence and Landing Error Scoring System Performance in Youth Soccer Players. *Journal of Strength and Conditioning Research*, *38*(9), e496–e502. https://doi.org/10.1519/jsc.0000000000004843

Hayes, J. (2024). Navigating Youth Sports: The Dangers of Early Specialization. *Gleanings: A Journal of First-Year Student Writing,* 14. 26–32.

Jayanthi, N., Pinkham, C., Dugas, L., Patrick, B., & LaBella, C. (2013). Sports Specialization in Young Athletes: Evidence-Based Recommendations. *Sports Health, 5*(3) 251-257. https://doi.org/10.1177/1941738112464626

Jayanthi, N. A., LaBella, C. R., Fischer, D., Pasulka, J., & Dugas, L. R. (2015). Sports-specialized intensive training and the risk of injury in young athletes: a clinical case-control study. *The American Journal of Sports Medicine*, *43*(4), 794–801. https://doi.org/10.1177/0363546514567298

Kliethermes, S. A., Nagle, K., Côté, J., Malina, R. M., Faigenbaum, A., Watson, A., Feeley, B., Marshall, S. W., LaBella, C. R., Herman, D. C., Tenforde, A., Beutler, A. I., & Jayanthi, N. (2020). Impact of youth sports specialization on career and task-specific athletic performance: a systematic review following the American Medical Society for Sports Medicine (AMSSM) Collaborative Research Network's 2019 Youth Early Sport Specialisation Summit. *British Journal of Sports Medicine*, *54*(4), 221–230. https://doi.org/10.1136/bjsports-2019-101365

Komínková, L. (2021). *The relationship between multilateral development and specific sport skill acquisition in middle childhood.* PhD-thesis. Charles University, Faculty of Physical Education and Sport.

Kovács, M., Balogh, L., Pöszmet, T., & Pucsok, J. M. (2022). Complex performance analysis in ball sports. *Stadium – Hungarian Journal of Sport Sciences,* 5(1). https://doi.org/10.36439/shjs/2022/1/11321

LaPrade, R. F., Agel, J., Baker, J., Brenner, J. S., Cordasco, F. A., Côté, J., Engebretsen, L., Feeley, B. T., Gould, D., Hainline, B., Hewett, T., Jayanthi, N., Kocher, M. S., Myer, G. D., Nissen, C. W., Philippon, M. J., & Provencher, M. T. (2016). AOSSM Early Sport Specialization Consensus Statement. *Orthopedic Journal of Sports Medicine, 4*(4), 2325967116644241. https://doi.org/10.1177/2325967116644241

Li, B., Valerino-Perea, S., Zhou, W., Xie, Y., Syrett, K., Peters, R., He, Z., Zou, Y., de Vocht, F., & Foster, C. (2024). The impact of the world's first regulatory, multi-setting intervention on sedentary behavior among children and adolescents (ENERGISE): a natural experiment evaluation. *The International Journal of Behavioral Nutrition and Physical Activity*, *21*(1), 53. https://doi.org/10.1186/s12966-024-01591-w

Lockie, R. G., Callaghan, S. J., & Jeffries, M. D. (2015). Can the 505 change-of-direction speed test be used to monitor leg function following ankle sprains in team sport athletes? *Journal of Australian Strength and Conditioning. 23*(1), 10–16.

Lutz, H. (2017). *Life Kinetik - Bewegung macht Hirn*. Meyer & Meyer Fachverlag und Buchhandel GmbH.

MOB, (2016). *Hosszú távú sportolófejlesztési program*. Budapest: Magyar Olimpiai Bizottság.

Nádori, L. (2011). Edzéselmélet (Gyermek- és ifjúsági sportolók edzéselmélete és módszertana) In. Rétsági, E., H. Ekler J., Nádori L., Woth P., Gáspár M., Gáldi G., Szegnerné Dancs H. *Sportelméleti ismeretek*. Pécs: Dialóg Campus Kiadó. 39–70.

Nakaichi, N., Sugimoto, D., Numa, D., Kotani, R., Nakamura, H., Akiyama, K., & Hirose, N. (2024). Associations of Sport Participation and Training Volume With Overuse Injuries in Japanese Male Youth Soccer Players: Implications for Early Sport Specialization. *Sports Health*, 19417381241275658. https://doi.org/10.1177/19417381241275658

Petridis, L. (2015). *A sportteljesítmény fizikai összetevőinek diagnosztikája*. Debrecen: Campus Kiadó.

Pucsok, J. M., Szentes-Szendrey, A., Balogh, L., & Tarnóczy, Z. (2023). Examination of functional movement status, injury history, and specific motor performance among young elite football players. *Stadium – Hungarian Journal of Sport Sciences, 6*(1). https://doi.org/10.36439/shjs/2023/1/12556

Radák, Zs. (2016). *Edzésélettan*. Budapest: Author's edition

Semenick, D. (1990). Tests and measurements: the T-test. *National Strength and Conditioning Association Journal,* 12, 36–37.

Sisa, T. (2018). *Döntésképesség és kreativitás fejlesztése a labdarúgásban I.* Budapest: Author's edition.

Taylor, J. M., Quigley, C., Madden, J., & Wright, M. D. (2024). Multisports training in English soccer academies: A survey exploring practices, practitioner perspectives, and barriers to use. *International Journal of Sports Science & Coaching, 19*(4), 1671–1679. https://doi.org/10.1177/17479541231210746

Virgile, A., & Bishop, C. (2021). A Narrative Review of Limb Dominance: Task Specificity and the Importance of Fitness Testing. *Journal of Strength and Conditioning Research, 35*(3), 846–858. https://doi.org/10.1519/JSC.0000000000003851

Wiersma, L.D. (2000). Risks and Benefits of Youth Sport Specialization: Perspectives and Recommendations. *Pediatric Exercise Science, 12*, 13–22.