

## Adaptations to football training

Soccer training preparation has been shown to elicit specific physical locomotor activity patterns and physiological responses to improve players' performance capacity (see Table 3.). Implementation of SSGs during pre and in season stages of competition provide an effective enough stimulus to enhance player's aerobic, anaerobic, change of direction, rate of recovery, and metabolic capacity (Dellal, Varliette C Fau - Owen, et al., 2012; Hill-Haas et al., 2009; Hill-Haas et al., 2011). High-intensity interval training HIIT in conjunction with SSGs have been shown to increase aerobic, repeated sprint capacity and distance covered at high intensity compared to SSGs alone (Fransson et al., 2018; Manuel Clemente et al., 2021). Soccer players' physical activity and internal response to SSGs can vary significantly according to pitch size, game format/type, number of involved players, goalkeepers, and standard of play (Dellal, Owen A Fau - Wong, et al., 2012; Kelly & Drust, 2008; Lacombe M Fau - Simpson et al., 2018). Male and female anthropometry, motor ability, and decision-making are known to contrast making key components during SSGs like physical capacities, time-motion performance, technical-tactical behavior significantly different between male and female soccer players (De Dios-Álvarez et al., 2022). Investigations on physical responses have all shown that male footballers cover greater total distances at running, high-tempo, and sprint- intensities during SSGs than their female counterparts ("THE INTERCHANGEABILITY OF GLOBAL POSITIONING SYSTEM AND SEMIAUTOMATED VIDEO-BASED PERFORMANCE DATA DURING ELITE SOCCER MATCH PLAY," 2011; Jastrzębski & Radzimiński, 2017; Jastrzębski et al., 2016; Randers et al., 2010; Stevens et al., 2015).

Regardless of gender, the effect of number of players and pitch size during SSGs are important topics of significant practical significance from a coaches' perspective. Small quantity format SSGs ( $\leq 4$  v 4) have been shown to cause higher heart rate, blood lactate, rate of perceived exertion responses, and technical skill actions (such as tackling, dribbling and shots on goal) compared to medium to large quantity sized (5 v 5 – 11 v 11) formats (Mara Jk Fau - Thompson et al., 2016; Rampinini et al., 2007). In contrast, research consensus is that large SSGs on bigger size pitches increase the total distance covered by players and number of high-intensity and sprint actions (De Dios-Álvarez et al., 2022; Dellal, Owen A Fau - Wong, et al., 2012; Lacomme M Fau - Simpson et al., 2018; Owen et al., 2004). Per coaches' discretion, a mixture of small, medium, and large formatted SSGs are commonly performed during team-based soccer training sessions. To better optimize soccer players' physical preparation for match competition and talent development coaches might strategically consider timing and delivery of SSGs and HIIT in variation during a team's weekly training periodization (Mendez-Villanueva, 2012). More research is required to investigate how maturing players of various skill levels physiologically, physically, technically, and tactically respond to coaches' team-based training activity.

## References:

- Abarghoueinejad, M. A.-O., Baxter-Jones, A. A.-O., Gomes, T. A.-O., Barreira, D. A.-O., & Maia, J. A.-O. (2021). Motor Performance in Male Youth Soccer Players: A Systematic Review of Longitudinal Studies. LID - 10.3390/sports9040053 [doi] LID - 53. (2075-4663 (Electronic)).
- Allison, R., & Barranco, R. (2021). 'A rich white kid sport?' Hometown socioeconomic, racial, and geographic composition among U.S. women's professional soccer players. *Soccer & Society*, 22(5), 457-469. <https://doi.org/10.1080/14660970.2020.1827231>
- Andersson, H. A., Randers Mb Fau - Heiner-Møller, A., Heiner-Møller A Fau - Krstrup, P., Krstrup P Fau - Mohr, M., & Mohr, M. (2010). Elite female soccer players perform more high-intensity running when playing in international games compared with domestic league games. *Journal of Strength & Conditioning Research (Allen Press Publishing Services Inc.)*(1533-4287 (Electronic)), 912-919.
- Baker, J., & Wattie, N. (2018). Innate talent in sport: Separating myth from reality. *Current Issues in Sport Science (CISS)*, 3. <https://doi.org/10.36950/2018ciss006>
- Benounis, O., Benabderrahman, A., Chamari, K., Ajmol, A., Benbrahim, M., Hammouda, A., Hammami, M.-A., & Zouhal, H. (2013). Association of Short-Passing Ability with Athletic Performances in Youth Soccer Players. *Asian Journal of Sports Medicine*, 4(1), 41-48. <http://ezproxy.gsu.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=s3h&AN=86025488&site=ehost-live&scope=site>
- Bergkamp, T. L. G., Frencken, W. G. P., Niessen, A. S. M., Meijer, R. R., & den Hartigh, R. J. R. (2022). How soccer scouts identify talented players. *European Journal of Sport Science*, 22(7), 994-1004. <https://doi.org/10.1080/17461391.2021.1916081>
- Buchheit, M. (2014). Monitoring training status with HR measures: do all roads lead to Rome? *Frontiers in Physiology*, 5. <https://doi.org/10.3389/fphys.2014.00073>
- Buchheit M Fau - Simpson, B. M., & Simpson, B. M. (2017). Player-Tracking Technology: Half-Full or Half-Empty Glass? (1555-0273 (Electronic)).
- Buchheit, M., & Mendez-Villanueva, A. (2014). Effects of age, maturity and body dimensions on match running performance in highly trained under-15 soccer players. *Journal of Sports Sciences*(ahead-of-print), 1-8.
- Buchheit M, S. M., Hader K, Tarascon A, McHugh D & Verheijen R. (2023). Know-your-own-league context: insights for player preparation and recruitment – Part 1: Team formations. *Sport Perf & Science Reports*, 1(181).
- Castagna, C., D'Ottavio, S., & ABT, G. (2003). Activity profile of young soccer players during actual match play. *The Journal of Strength & Conditioning Research*, 17(4), 775-780.
- Christensen, M. K. (2009). "An eye for talent": Talent identification and the "practical sense" of top-level soccer coaches. *Sociology of sport journal*, 26(3), 365-382.
- Cormack, S. J., Newton, R. U., McGuigan, M. R., & Doyle, T. L. (2008). Reliability of measures obtained during single and repeated countermovement jumps. *Int J Sports Physiol Perform*, 3(2), 131-144. <https://doi.org/10.1123/ijsp.3.2.131>
- De Dios-Álvarez, V., Lorenzo-Martínez, M., Padrón-Cabo, A., & Rey, E. (2022). Small-sided games in female soccer players: a systematic review. *Journal of sports medicine and physical fitness*, 62(11), 1474-1480. <https://doi.org/10.23736/S0022-4707.21.12888-9>
- Dellal, A., Hill-Haas, S., Lago-Penas, C., & Chamari, K. (2011). Small-Sided Games in Soccer: Amateur vs. Professional Players' Physiological Responses, Physical, and Technical Activities. *The Journal of Strength & Conditioning Research*, 25(9). [https://journals.lww.com/nsca-iscr/Fulltext/2011/09000/Small\\_Sided\\_Games\\_in\\_Soccer\\_Amateur\\_vs\\_.4.aspx](https://journals.lww.com/nsca-iscr/Fulltext/2011/09000/Small_Sided_Games_in_Soccer_Amateur_vs_.4.aspx)

- Dellal, A., Owen A Fau - Wong, D. P., Wong Dp Fau - Krusturup, P., Krusturup P Fau - van Exsel, M., van Exsel M Fau - Mallo, J., & Mallo, J. (2012). Technical and physical demands of small vs. large sided games in relation to playing position in elite soccer. (1872-7646 (Electronic)).
- Dellal, A., Varliette C Fau - Owen, A., Owen A Fau - Chirico, E. N., Chirico En Fau - Pialoux, V., & Pialoux, V. (2012). Small-sided games versus interval training in amateur soccer players: effects on the aerobic capacity and the ability to perform intermittent exercises with changes of direction. (1533-4287 (Electronic)).
- Diaz-Seradilla, E. A.-O., Rodríguez-Fernández, A. A.-O., Rodríguez-Marroyo, J. A., Castillo, D. A.-O., Raya-González, J., & Villa Vicente, J. G. (2022). Inter- and intra-microcycle external load analysis in female professional soccer players: A playing position approach. (1932-6203 (Electronic)).
- Dillern, T., Ingebrigtsen, J., & Shalfawi, S. A. I. (2012). AEROBIC CAPACITY AND ANTHROPOMETRIC CHARACTERISTICS OF ELITE-RECRUIT FEMALE SOCCER PLAYERS. *Serbian Journal of Sports Sciences*, 6(2), 43-49.  
<https://search.ebscohost.com/login.aspx?direct=true&AuthType=ip,shib&db=s3h&AN=77418968&site=ehost-live&scope=site&custid=gsu1>
- Doyle, B. A.-O., Browne, D., & Horan, D. (2022). Quantification of internal and external training load during a training camp in senior international female footballers. (2473-4446 (Electronic)).
- Dugdale, J., Sanders, D., Myers, T., Williams, A., & Hunter, A. (2020). A case study comparison of objective and subjective evaluation methods of physical qualities in youth soccer players. *Journal of Sports Sciences*. <https://doi.org/10.1080/02640414.2020.1766177>
- Figueiredo, A., Gonçalves, C., Coelho e Silva, M., & Malina, R. (2009). Characteristics of youth soccer players who drop out, persist or move up. *Journal of Sports Sciences*, 27(9), 883-891.  
<https://search.ebscohost.com/login.aspx?direct=true&AuthType=ip,shib&db=s3h&AN=43430394&site=ehost-live&scope=site&custid=gsu1>
- Ford, P. R., Bordonau, J. L. D., Bonanno, D., Tavares, J., Groenendijk, C., Fink, C., Gualtieri, D., Gregson, W. A.-O., Varley, M. A.-O. X., Weston, M. A.-O., Lolli, L. A.-O., Platt, D., & Di Salvo, V. (2020). A survey of talent identification and development processes in the youth academies of professional soccer clubs from around the world. *Journal of Sports Sciences*(1466-447X (Electronic)).
- Ford, P. R., & Williams, A. M. (2017). Sport activity in childhood: Early specialization and diversification. *Routledge handbook of talent identification and development in sport*, 116-132.
- Fransson, D., Nielsen, T. S., Olsson, K., Christensson, T., Bradley, P. S., Fatouros, I. G., Krusturup, P., Nordborg, N. B., & Mohr, M. (2018). Skeletal muscle and performance adaptations to high-intensity training in elite male soccer players: speed endurance runs versus small-sided game training. (1439-6327 (Electronic)).
- Gabbett, T. J., & Mulvey, M. J. (2008). Time-motion analysis of small-sided training games and competition in elite women soccer players. *Journal of Strength & Conditioning Research (Allen Press Publishing Services Inc.)*, 22(1533-4287 (Electronic)), 543-552.
- Götze, M., & Hoppe, M. W. (2021). Relative Age Effect in Elite German Soccer: Influence of Gender and Competition Level. (1664-1078 (Print)).
- Gulbin, J., Oldenziel, K. E., Weissensteiner, J., & Gagné, F. (2010). A look through the rear view mirror: Developmental experiences and insights of high performance athletes. *Talent Development and Excellence*, 2, 149-164.
- Hastad, D. N., & Lacy, A. C. (1994). *Measurement and evaluation in physical education and exercise science*. Gorsuch Scarisbrick.
- Haugen, T. A., Tønnessen E Fau - Hem, E., Hem E Fau - Leirstein, S., Leirstein S Fau - Seiler, S., & Seiler, S. (2014). VO<sub>2</sub>max characteristics of elite female soccer players, 1989-2007. (1555-0265 (Print)).
- Haugen, T. A., Tønnessen E Fau - Seiler, S., & Seiler, S. Speed and countermovement-jump characteristics of elite female soccer players, 1995-2010. (1555-0265 (Print)).

- Helsen, W., van Winckel, J., & Williams, A. M. (2005). The relative age effect in youth soccer across Europe. *Journal of Sports Sciences*, 23(6), 629-636.  
<http://ezproxy.gsu.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=s3h&AN=17267225&site=ehost-live&scope=site>
- Helsen, W. F., van Winckel, J., & Williams, A. M. (2005). The relative age effect in youth soccer across Europe. *Journal of Sports Sciences*, 23(6), 629-636.  
<https://doi.org/10.1080/02640410400021310>
- Hill-Haas, S. V., Coutts Aj Fau - Rowsell, G. J., Rowsell GJ Fau - Dawson, B. T., & Dawson, B. T. (2009). Generic versus small-sided game training in soccer. (1439-3964 (Electronic)).
- Hill-Haas, S. V., Dawson B Fau - Impellizzeri, F. M., Impellizzeri Fm Fau - Coutts, A. J., & Coutts, A. J. (2011). Physiology of small-sided games training in football: a systematic review. (1179-2035 (Electronic)).
- Howe, M. J., Davidson Jw Fau - Sloboda, J. A., & Sloboda, J. A. (1998). Innate talents: reality or myth? (0140-525X (Print)).
- Huijgen, B. C. H., Elferink-Gemser, M. T., Ali, A., & Visscher, C. (2013). Soccer Skill Development in Talented Players. *International journal of sports medicine*, 34(8), 720-726.  
<http://ezproxy.gsu.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=s3h&AN=90079013&site=ehost-live&scope=site>
- THE INTERCHANGEABILITY OF GLOBAL POSITIONING SYSTEM AND SEMIAUTOMATED VIDEO-BASED PERFORMANCE DATA DURING ELITE SOCCER MATCH PLAY. (2011). *Journal of Strength & Conditioning Research (Lippincott Williams & Wilkins)*, 25(8), 2334-2336.  
<http://ezproxy.gsu.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=s3h&AN=64295367&site=ehost-live&scope=site>
- Jastrzębski, Z., & Radzimiński, Ł. (2017). Default and individual comparison of physiological responses and time-motion analysis in male and female soccer players during small-sided games.  
<https://doi.org/10.14198/jhse.2017.124.04>
- Jastrzębski, Z., Radzimiński, Ł., & Stępień, P. (2016). Comparison of time-motion analysis and physiological responses during small-sided games in male and female soccer players. *Baltic Journal of Health and Physical Activity*, 8, 42-50. <https://doi.org/10.29359/BJHPA.08.1.05>
- Jokuschies, N., Gut, V., & Conzelmann, A. (2017). Systematizing coaches' 'eye for talent': Player assessments based on expert coaches' subjective talent criteria in top-level youth soccer. *International Journal of Sports Science & Coaching*, 12, 565-576.  
<https://doi.org/10.1177/1747954117727646>
- Kelly, D. M., & Drust, B. (2008). The effect of pitch dimensions on heart rate responses and technical demands of small-sided soccer games in elite players. (1878-1861 (Electronic)).
- Lacome M Fau - Simpson, B. M., Simpson Bm Fau - Cholley, Y., Cholley Y Fau - Lambert, P., Lambert P Fau - Buchheit, M., & Buchheit, M. (2018). Small-Sided Games in Elite Soccer: Does One Size Fit All? (1555-0273 (Electronic)).
- Lyons, M. J., Conlon, J., Perejmibida, A., Chivers, P., & Joyce, C. (2021). Sustained Passing Performance of Elite and Subelite Female Soccer Players Following a Female Match-Specific Exercise Protocol. *International Journal of Sports Physiology & Performance*, 16(4), 504-510.  
<https://search.ebscohost.com/login.aspx?direct=true&AuthType=ip,shib&db=s3h&AN=149393407&site=ehost-live&scope=site&custid=gsu1>
- Manuel Clemente, F. A.-O., Ramirez-Campillo, R. A.-O., Nakamura, F. A.-O., & Sarmiento, H. A.-O. (2021). Effects of high-intensity interval training in men soccer player's physical fitness: A systematic review with meta-analysis of randomized-controlled and non-controlled trials. (1466-447X (Electronic)).

- Mara Jk Fau - Thompson, K. G., Thompson Kg Fau - Pumpa, K. L., & Pumpa, K. L. (2016). Physical and Physiological Characteristics of Various-Sided Games in Elite Women's Soccer. (1555-0273 (Electronic)).
- Mendez-Villanueva, A. (2012). Tactical Periodization: Mourinho's Best-kept secret? *Soccer NSCAA Journal*.
- Meylan, C., Cronin, J., Oliver, J., & Hughes, M. (2010). Reviews: Talent Identification in Soccer: The Role of Maturity Status on Physical, Physiological and Technical Characteristics. *International Journal of Sports Science & Coaching*, 5(4), 571-592.  
<http://ezproxy.gsu.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=s3h&AN=56630562&site=ehost-live&scope=site>
- Mohr, M., Krstrup, P., Andersson, H., Kirkendal, D., & Bangsbo, J. (2008). Match Activities of Elite Women Soccer Players at Different Performance Levels. *The Journal of Strength & Conditioning Research*, 22(2), 341-349 310.1519/JSC.1510b1013e318165fef318166.  
[http://journals.lww.com/nsca-jscr/Fulltext/2008/03000/Match\\_Activities\\_of\\_Elite\\_Women\\_Soccer\\_Players\\_at.4.aspx](http://journals.lww.com/nsca-jscr/Fulltext/2008/03000/Match_Activities_of_Elite_Women_Soccer_Players_at.4.aspx)
- Morris, R., Tod, D., & Oliver, E. (2015). An Analysis of Organizational Structure and Transition Outcomes in the Youth-to-Senior Professional Soccer Transition. *Journal of Applied Sport Psychology*, 27(2), 216-234. <https://doi.org/10.1080/10413200.2014.980015>
- Owen, A., Twist, C., & Ford, P. (2004). Small-sided games: The physiological and technical effect of altering pitch size and player numbers. *Insight*, 7, 50-53.
- Pedersen, A. V., LorÅS, H., Norvang, O. P., & Asplund, J. (2014). MEASURING SOCCER TECHNIQUE WITH EASY-TO-ADMINISTER FIELD TASKS IN FEMALE SOCCER PLAYERS FROM FOUR DIFFERENT COMPETITIVE LEVELS. *Perceptual & Motor Skills*, 119(3), 961-970.  
<https://search.ebscohost.com/login.aspx?direct=true&AuthType=ip,shib&db=s3h&AN=100191008&site=ehost-live&scope=site&custid=gsu1>
- Rampinini, E., Impellizzeri Fm Fau - Castagna, C., Castagna C Fau - Abt, G., Abt G Fau - Chamari, K., Chamari K Fau - Sassi, A., Sassi A Fau - Marcora, S. M., & Marcora, S. M. (2007). Factors influencing physiological responses to small-sided soccer games. (0264-0414 (Print)).
- Randers, M. B., Nybo L Fau - Petersen, J., Petersen J Fau - Nielsen, J. J., Nielsen Jj Fau - Christiansen, L., Christiansen L Fau - Bendiksen, M., Bendiksen M Fau - Brito, J., Brito J Fau - Bangsbo, J., Bangsbo J Fau - Krstrup, P., & Krstrup, P. (2010). Activity profile and physiological response to football training for untrained males and females, elderly and youngsters: influence of the number of players. (1600-0838 (Electronic)).
- Reilly, T., Williams Am Fau - Nevill, A., Nevill A Fau - Franks, A., & Franks, A. (2000). A multidisciplinary approach to talent identification in soccer. (0264-0414 (Print)).
- Relvas, H., Littlewood, M., Nesti, M., Gilbourne, D., & Richardson, D. (2010). Organizational Structures and Working Practices in Elite European Professional Football Clubs: Understanding the Relationship between Youth and Professional Domains. *European Sport Management Quarterly*, 10(2), 165-187. <https://doi.org/10.1080/16184740903559891>
- Scott, D., Haigh, J., & Lovell, R. (2020). Physical characteristics and match performances in women's international versus domestic-level football players: a 2-year, league-wide study. *Science and Medicine in Football*, 4(3), 211-215. <https://doi.org/10.1080/24733938.2020.1745265>
- Sieghartsleitner, R., Zuber, C., Zibung, M., & Conzelmann, A. (2018). "The Early Specialised Bird Catches the Worm!" – A Specialised Sampling Model in the Development of Football Talents [Original Research]. *Frontiers in Psychology*, 9. <https://doi.org/10.3389/fpsyg.2018.00188>
- Sieghartsleitner, R., Zuber, C., Zibung, M., & Conzelmann, A. (2019). Science or Coaches' Eye? - Both! Beneficial Collaboration of Multidimensional Measurements and Coach Assessments for Efficient Talent Selection in Elite Youth Football. *Journal of sports science & medicine*, 18, 32-43.

Slimani, M., Znazen, H., Miarka, B., & Bragazzi, N. L. (2019). Maximum Oxygen Uptake of Male Soccer Players According to their Competitive Level, Playing Position and Age Group: Implication from a Network Meta-Analysis. *Journal of Human Kinetics*, 66(1), 233-245.

<https://doi.org/doi:10.2478/hukin-2018-0060>

Stevens, T. G., De Ruiter, C. J., Beek, P. J., & Savelsbergh, G. J. (2015). Validity and reliability of 6-a-side small-sided game locomotor performance in assessing physical fitness in football players. (1466-447X (Electronic)).

Thomas, K. T. a. T., J.R. . (1999). What squirrels in the trees predict about expert athletes. *International Journal of Sport Psychology*, 30, 221-234.

Unnithan, V., White, J., Georgiou, A., Iga, J., & Drust, B. (2012). Talent identification in youth soccer. *Journal of Sports Sciences*, 30. <https://doi.org/10.1080/02640414.2012.731515>

Vescovi, J. D., Rupf R Fau - Brown, T. D., Brown Td Fau - Marques, M. C., & Marques, M. C. (2009).

Physical performance characteristics of high-level female soccer players 12-21 years of age. (1600-0838 (Electronic)).

Ward, P., & Williams, A. M. (2003). Perceptual and Cognitive Skill Development in Soccer: The

Multidimensional Nature of Expert Performance. *Journal of Sport & Exercise Psychology*, 25, 93-111.

Williams, A. M., Ford, P. R., & Drust, B. (2020). Talent identification and development in soccer since the millennium. *Journal of Sports Sciences*, 38(11-12), 1199-1210. <https://doi.org/10.1080/02640414.2020.1766647>

Williams, A. M., & Reilly, T. (2000). Talent identification and development in soccer. *Journal of Sports*

*Sciences*(0264-0414 (Print)).

