Assessing Locomotor Demands of Pressing Actions in Elite Football: Insights for Testing and Training Prescription

Martin Buchheit, [1 2 3 4] **Zsolt Lázár,** [5] **Balázs Sinkó,** [5] **Barbara Kolozs,** [5] **Alvaro Echevarne,** [6] **Juan Guerra,** [4] **Pawel Krotki,** [4] **Ola Eriksrud** [7 8]

[1]Type 3.2 Performance, Montvalezan, France
[2]HIITscience, Revelstoke, Canada
[3]INSEP, Paris, France
[4]Optimo Performance and Medical Center, Estepona, Spain
[5]Budapest Honvèd FC, Budapest, Hungary
[6]CD Estepona, Estepona, Spain
[7]Norwegian School of Sport Sciences, Oslo, Norway
[8]1080 Motion, Västerås, Sweden

Pressing | Peak Speed | Deceleration | Soccer | Tactical Analysis | 15-0-5 Test | Player Invisible Monitoring | Performance Assessment | Resisted Sprint Training

Headline

Pressing is a key strategy in modern football, crucial for disrupting opponent play and regaining possession, which significantly impacts team performance (Low 2020, HowTheyPlay 2022). Effective pressing not only hampers the opponent's ability to maintain control, but also enhances a team's offensive opportunities by forcing errors in high-leverage areas (Low 2020, HowTheyPlay 2022). However, the intensity and physical demands of pressing also increase the risk of injuries. A study by Rekik (2023) highlights that pressing is the most common scenario preceding ACL injuries, occurring in 40% of the cases studied. This finding underscores the need for detailed assessments and specific training in pressing actions to mitigate injury risks while optimizing its effectiveness.

Some current deceleration tests and training practices often focus on linear stops (Graham Smith 2018, Harper 2023) which fail to capture the more complex maneuvers of actual gameplay where players must frequently press, turn, and re-accelerate to get back into position. This limitation highlights the need for deceleration tests and training practices that include a change of direction following the breaking phase, which are more reflective of real match situations. Enhancing the realism and ecological validity of test and training practices, we wanted to examine variations of the 5-0-5 change of direction test (Eriksrud 2024, Ryan 2023), since such tests may better simulate game-like conditions than tests focusing on linear stops.

Recent research, such as Eriksrud's 2024 study, suggests that extending the approach distances in variations of the 5-0-5 test, like the 10-0-5 and 15-0-5, results in higher peak speeds (15.8, 21.2, and 24.5 km/h for 5-0-5, 10-0-5 and 15-0-5, respectively) with increased deceleration demands. These findings make the 15-0-5 an ideal choice for our assessment and training routines, as it may more accurately mimic the dynamic requirements of pressing actions in football by capturing the essential ability to decelerate following high-speed runs, change direction, and re-accelerate again — all of which being key tactical maneuvers in competitive play.

Aim

This study compares the locomotor patterns recorded during the 15-0-5 change of direction test with those observed during actual match-pressing actions. This structured approach allows us to assess the protocol's capacity to replicate the physical demands of match-like pressing scenarios effectively, which would indirectly justify its' use for both testing and training purposes.

Methods

Participants in this study included adult players from a Second Hungarian League team analyzed during 20 pressing actions (Figure 1) and players from a Fourth Spanish League team performing the 15-0-5 test (Figure 2). The maximal sprinting speed (MSS, 30-m all-out sprints) of all players was assessed as part of their team monitoring process prior to the current assessment. Advanced motion video capture systems were used to define and locate pressing actions during matches, while GPS units (Statsport for the 15-0-5 and Catapult S7 during matches) gathered precise data on player movements and speeds. Due to differences in GPS brands, peak speed values were adjusted using calibration equations developed by the authors (based on Buchheit, 2014b). However, deceleration data, which has poorer accuracy (Buchheit, 2014a) and differs in calculation methods (0.5-s window for Statsport vs. 0.8-s window for Catapult, Buchheit & Simpson, 2017), could not be reliably integrated. As a result, direct deceleration comparisons between the two testing conditions could not be made.

Results

Similar peak speeds between the 15-0-5 test (25.4 ± 1.4 km/h, corresponding to 80-85% of players' maximal sprinting speed, MSS) and match plays (20-30 km/h, average 25.4 ± 3.7 km/h, 65-95% of MSS, average 77%) were observed, suggesting comparable locomotor demands (Figure 4). Decelerations during the 15-0-5 (over a 0.5-s window, Statsport) and matches (over a 0.8-s window, Catapult) were -6.8 m.s^{-2} ± 0.5 and -3.5 ± 1 m.s^{-2}, respectively. The correlation between peak speed reached and deceleration magnitude when pressing was unclear (r = 0.17; CI -0.35-0.62, Figure 3).

Fig. 1. Methodology used to identify and analyze pressing actions in football match play. This process includes tracking player movements, first identifying the start of pressing actions through video analysis (i.e., red dot highlighting the player of interest, upper panel), and then determining peak speeds and assessing deceleration demands throughout the entire action using GPS data (lower panel). Video and GPS data were synchronized for analysis.

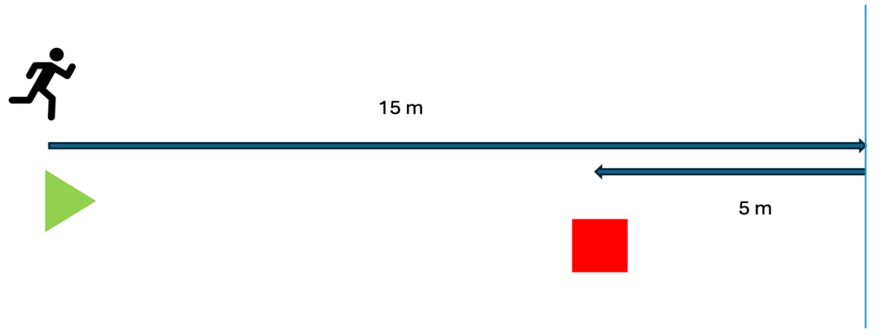

Fig. 2. Setup of the 15-0-5 protocol, which involves sprinting as fast as possible for 15 meters from the start (green triangle/play sign), then breaking, turning 180 degrees (blue vertical line), and reaccelerating for 5 meters to the end point (red square/stop sign).

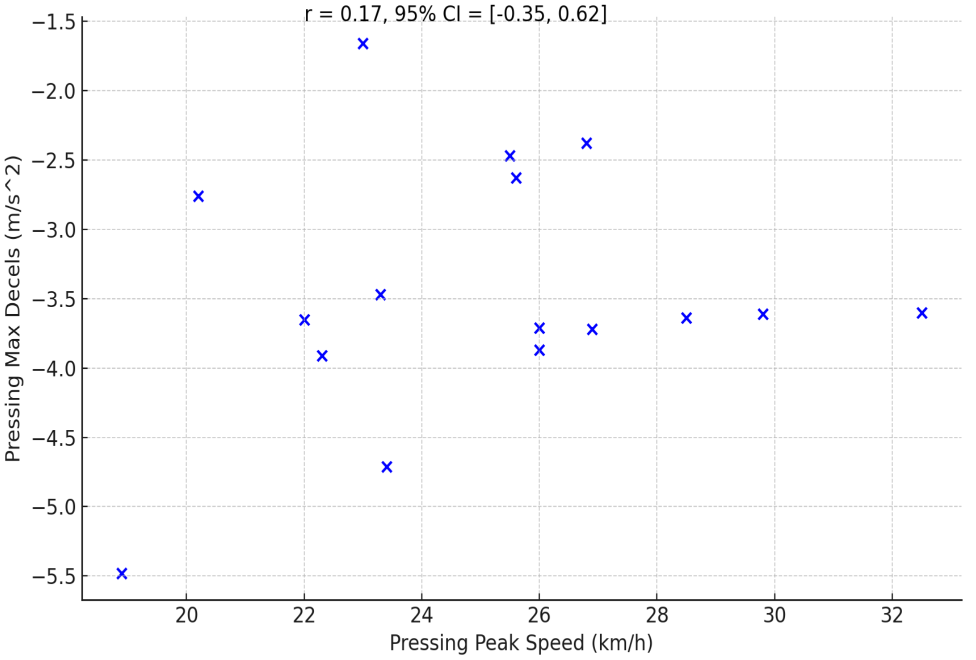

Fig. 3. Association between pressing peak speed and deceleration during pressing actions in football match play.

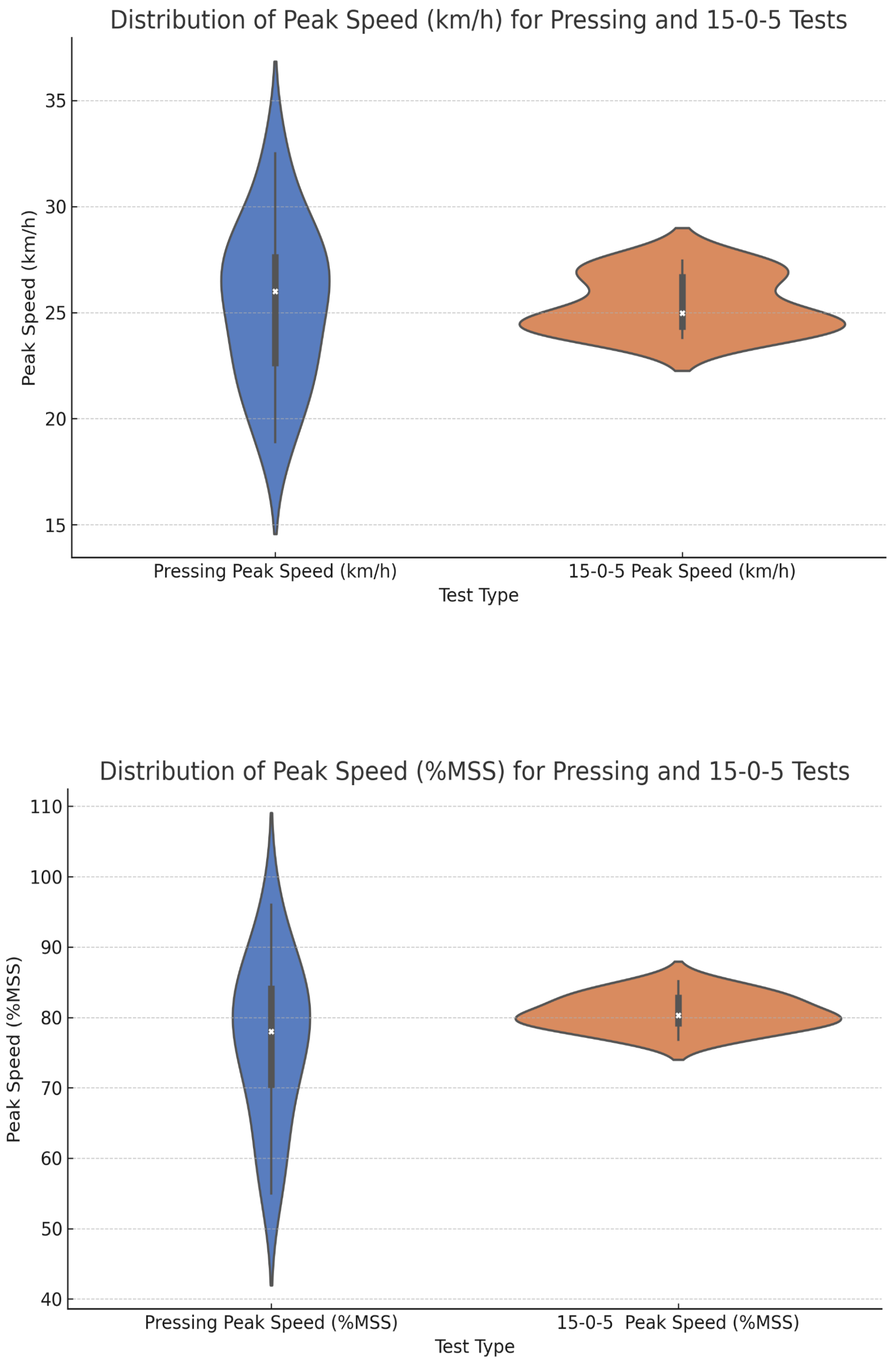

Fig. 4. Distribution of pressing peak speed values during match play and the 15-0-5 test, expressed in absolute values (upper panel) and as a percentage maximal sprinting speed (MSS, lower panel).

Discussion and Conclusions

The present findings suggest that the 15-0-5 test effectively mirrors the average peak speed demands of football pressing actions in matches (25.4 km/h, Figure 4), validating its use as both a screening and training tool in football. The peak speeds reached during the 15-0-5 protocol by the adult football players were also slightly greater than those previously reported by Eriksurd (2024) in elite youth soccer players (24.5 km/h), suggestive of the impact of player development/standards on the test results.

It is however worth noting that during matches, the variability in peak speeds demands (and likely decelerations) is greater than that of the demands of the 15-0-5 (i.e., 60-95% MSS vs. 70-80% for matches vs 15-5-0, respectively, Figure

4), which is likely influenced by tactical choices and the specific context of each action. Additionally, the angle of turn after deceleration likely varies greatly during matches (Harper 2019, Morgan 2022), impacting the magnitude of deceleration required, with sharper turns necessitating greater deceleration as indicated by Hader (2015). These latter factors, together with the fact that a pressing action doesn't obligatorily require a maximal effort to be successful, may partly explain the lack of correlation between peak speed reached and deceleration magnitude when pressing (Figure 3). Therefore, for greater training specificity, coaches might want to vary the approach distances, and thereby peak speeds (Eriksrud, 2024), but also use different angular turns during training sessions to induce different deceleration demands. Alternatively, the standardized format of the 15-0-5 protocol still provides reliable metrics (Barber 2016, Westheim 2023) for evaluating the athletic components of pressing actions in isolation, which may be useful for physical development and rehabilitation programs.

While in this study we utilized GPS for measurements, integrating motorized sprint resistance devices like the 1080 machine (Eriksrud, 2022; Westheim 2023) is noteworthy. This equipment enables more precise, continuous data collection and ongoing monitoring, accurately assessing players' training status and performance. Regular use of the 1080 machine during standardized 15-0-5 efforts, as part of strength and power sessions, can therefore be incorporated into an overall player monitoring framework. This "invisible" monitoring collects data during training, helping adjust training load based on players' readiness and neuromuscular fatigue, ultimately aiming to reduce injury risks (Carling 2018).

Although real gameplay will always remain the best method to train these capacities (Buchheit 2024), off-the-ball work can be crucial, especially for individual development programs (i.e., post-session top-ups and extra workouts) or in the return to play and sport process (i.e., more control, less chaos, Taberner 2019), providing a safer environment to build these capacities. Moreover, motorized machines can facilitate overload deceleration and reacceleration demands by adding load (Ward 2024), a capability not possible when only focusing on gameplay situations.

Key Findings

- The 15-0-5 protocol can serve as a practical tool for assessing and training the physical demands of pressing in football.
- The 15-0-5 protocol offers a standardized approach suited for accurate assessment but lacks both the variability and the perception action element of actual match play.
- To better simulate game conditions, future developments should incorporate variability in speed and deceleration demands, along with perception-action challenges.
- Using motorized sprint resistance machines to perform the 15-0-5 (and its variations) as part of strength and power sessions could allow precise and frequent assessments (i.e., "invisible" monitoring) and lead to improvements in pressing-related physical capacities through controlled overload stimuli.

References

1. Barber O, Thomas C, Jones P, McMahon J, Comfort P. Reliability of the 505 change-of- direction test in netball players. Int J Sports Physiol Perform 11: 377–380, 2016.

2. Buchheit M, Douchet T, Settembre M, McHugh D, Hader K, & Verheijen R. The 11 Evidence-Informed and Inferred Principles of Microcycle Periodization in Elite Football. Sport Performance & Science Reports, 2024, Feb, #218, V1

3. Buchheit M, Al Haddad H, Simpson BM, Palazzi D, Bourdon PC, Di Salvo V, Mendez-Villanueva A. Monitoring accelerations with GPS in football: time to slow down? Int J Sports Physiol Perform. 2014a May;9(3):442-5. doi: 10.1123/ijspp.2013-0187. Epub 2013 Jul 30.

4. Buchheit M, Allen A, Poon TK, Modonutti M, Gregson W, Di Salvo V. Integrating different tracking systems in football: multiple camera semi-automatic system, local position measurement and GPS technologies. J Sports Sci. 2014b Dec;32(20):1844-1857. doi: 10.1080/02640414.2014.942687. Epub 2014 Aug 5.

5. Buchheit M, Simpson BM. Player-Tracking Technology: Half-Full or Half-Empty Glass? Int J Sports Physiol Perform. 2017 Apr;12(Suppl 2):S235-S241. doi: 10.1123/ijspp.2016-0499. Epub 2016 Dec 14.

6. Carling C, Lacome M, McCall A, Dupont G, Le Gall F, Simpson B, Buchheit M. Monitoring of Post-match Fatigue in Professional Soccer: Welcome to the Real World. Sports Med. 2018 Dec;48(12):2695-2702. doi: 10.1007/s40279-018-0935-z.

7. Eriksrud. Deceleration demands in change of direction tests: insights from measurements using a motorized resistance device ME17 – Moderated E-poster session 03 – station 5, station 5, March 2, 2024, 12:30 – 14:00.

8. Eriksrud O, Ahlbeck F, Harper D, Gløersen Ø. Validity of Velocity Measurements of a Motorized Resistance Device During Change of Direction. Front Physiol. 2022 Feb 24;13:824606. doi: 10.3389/fphys.2022.824606. eCollection 2022.

9. Westheim F, Gløersen Ø, Harper D, Laugsand H, Eriksrud O. Reliability of phase-specific outcome measurements in change-of-direction tests using a motorized resistance device. Front Sports Act Living. 2023 Oct 23;5:1212414. doi: 10.3389/fspor.2023.1212414. eCollection 2023.

10. Graham-Smith P, Rumpf M, Jones PA. Assessment of deceleration ability and relationship to approach speed and eccentric strength. In: ISBS conference proc arch. 2018. p. 36.

11. Hader K, Palazzi D and Buchheit M. Change of direction speed in soccer: How much braking is enough? Kinesiology 47(2015) 1:44-52

12. Harper DJ, Carling C, Kiely J. High-Intensity Acceleration and Deceleration Demands in Elite Team Sports Competitive Match Play: A Systematic Review and Meta-Analysis of Observational Studies. Sports Med. 2019 Dec;49(12):1923-1947. doi: 10.1007/s40279-019-01170-1.

13. Harper DJ, Morin JB, Carling C, Kiely J. Measuring maximal horizontal deceleration ability using radar technology: reliability and sensitivity of kinematic and kinetic variables. Sports Biomech. 2023 Sep;22(9):1192-1208. doi: 10.1080/14763141.2020.1792968. Epub 2020 Jul 31.

14. HowTheyPlay. Tactical analysis: high-pressing and counter-pressing system in English football. 2022. Available from: `https://howtheyplay.com/team-sports/Tactical-A` nalysis-High-Pressing-Tactics-in-English-Football

15. Low ZWB, Coutinho D, Gonçalves B, Davids K, Araújo D, Folgado H. A systematic review of collective tactical behaviours in football using positional data. Sports Med. 2020 Feb;50(2):343-385. doi: 10.1007/s40279-019-01194-7.

16. Morgan OJ, Drust B, Ade JD, Robinson MA. Change of direction frequency off the ball: new perspectives in elite youth soccer. Sci Med Footb. 2022 Nov;6(4):473-482. doi: 10.1080/24733938.2021.1986635. Epub 2021 Oct 4.

17. Ryan C, Uthoff A, McKenzie C, Cronin, JC. New Perspectives of the Traditional and Modified 5-0-5 Change of Direction Test. Strength and Conditioning Journal. 45(1):83-92, Feb 2023.

18. Rekik RN, Bahr R, Cruz F, Read P, Whiteley R, D'hooghe P, Tabben M, Chamari K. Mechanisms of ACL injuries in men's football: A systematic video analysis over six seasons in the Qatari professional league. Biol Sport. 2023 Apr;40(2):575-586. doi: 10.5114/biolsport.2023.118024. Epub 2022 Jul 21.

19. Taberner M, Allen T, Cohen DD. Progressing rehabilitation after injury: consider the 'control-chaos continuum'. Br J Sports Med. 2019 Sep;53(18):1132-1136. doi: 10.1136/bjsports-2018-100157. Epub 2019 Feb 8.

20. Ward C, Catháin CÓ, Chéilleachair NN, Grassick S, Kelly DT. Does Resisted Sprint Training Improve the Sprint Performance of Field-Based Invasion Team Sport Players? A Systematic Review and Meta-analysis. Sports Med. 2024 Mar;54(3):659-672. doi: 10.1007/s40279-023-01952-8. Epub 2023 Oct 28.