Module 4. Test and Evaluation Mechanisms

Unit 4.1. Objectives of Testing and Evaluating Players

"What is not defined cannot be measured. What is not measured cannot be improved. What is not improved degrades over time." This thought is attributed to William Thomson Kelvin and undoubtedly applies to many other fields, including high-performance sports. Improving performance is precisely the main objective of all those involved in it, making evaluation an essential part of the process.

Haugen and Seiler (2015) present a series of reasons why the player's conditional evaluation is necessary, emphasising that well-developed physical capabilities increase the chances of success in competition. Firstly, evaluation enables understanding individual and collective behaviour during training and competition (Barnes, Archer, Hogg, Bush, and Bradley, 2014; Buchheit, Allen, Poon, Modonutti, Gregson, and Di Salvo, 2014; Castellano, Alvarez-Pastor, and Bradley, 2014; Cummins, Orr, O'Connor, and West, 2013), providing relevant information for the decision-making process of the coaching staff. Furthermore, it enables establishing a reference point for specific player profiles and positions. Lastly, evaluation provides a framework for individual and collective training prescription, as well as information on recovery strategies and load management.

Traditionally, similar or identical general tests have been used across different team sports (Wagner, Sperl, Bell, and Von Duvillard, 2019) to assess conditional performance through measurements of aerobic and anaerobic capacity, strength, power, etc. However, in the last decade, the emergence of tracking technologies and Global Positioning Systems (GPS) has brought about a new perspective on player evaluation. These devices allow for the immediate, accurate assessment of a multitude of physical, technical, and tactical parameters during training sessions and matches, and, unlike traditional methods, they do it in a specific manner (Haugen and Seiler, 2015). The emergence of these monitoring systems and analysis technology, collectively referred to as microtechnology, has sparked a debate about the need to continue using traditional evaluation methods, including those tests specifically designed for football (Mendez-Villanueva and Buchheit, 2013).

In his various scientific contributions, Professor Seirul·lo (2017) proposes some reflections on evaluation in team sports:

- Quantitative methods should be complemented with qualitative assessments. This gives significant importance on players' own perception of their performance.

- General tests should not be used to measure in-game behaviour or specific fitness levels. They can provide useful information, but it is not decisive for decision-making about the game. Evaluation should be based on the actions performed by the player in competition.

- The players' fitness level can only be known by observing them in competition and taking into account the context (season timing, opponent, coach, etc.).

Unit 4.2 Classification and Timing of Evaluation/Test

As mentioned in previous modules, evaluations can be classified based on when they are performed and their periodisation. Therefore, it is interesting to divide evaluations into pre-season tests, tests conducted two or three times within a season (typically pre-season, in the months of December or January,(pre- or post- Christmas), or before the start of the period with the highest competitive density). Finally, weekly evaluations due to their low invasiveness and their logistical ease in data collection and analysis.

Referring to the latter, the group of evaluations conducted periodically in each microcycle includes the variables mentioned before that define the load during training or a match, external load control variables from EPTS devices (HSR, HMLD, accelerations, decelerations, etc.), subjective variables of load assimilation such as RPE as internal load and wellness for monitoring adaptations.

Similarly, cardiopulmonary variables such as heart rate variability (HRV), resting heart rate, and respiratory rate serve as objective data for adaptive processes by athletes, along with variables describing sleep quality and quantity.

For the analysis of the neuromuscular component, conducting evaluations of the muscle chains involved in the sports gesture through tests that do not significantly interfere with the team's usual dynamics would be recommended, primarily for evaluating potential neuromuscular fatigue that may increase the risk of injury. For example, an isometric test for the posterior chain in outdoor sports like football and a CMJ for indoor sports. In the same way, thermography, which requires extra time for its implementation, could be considered as a tool to be used on a specific day of the microcycle, preferably on MD+1 or MD+2.

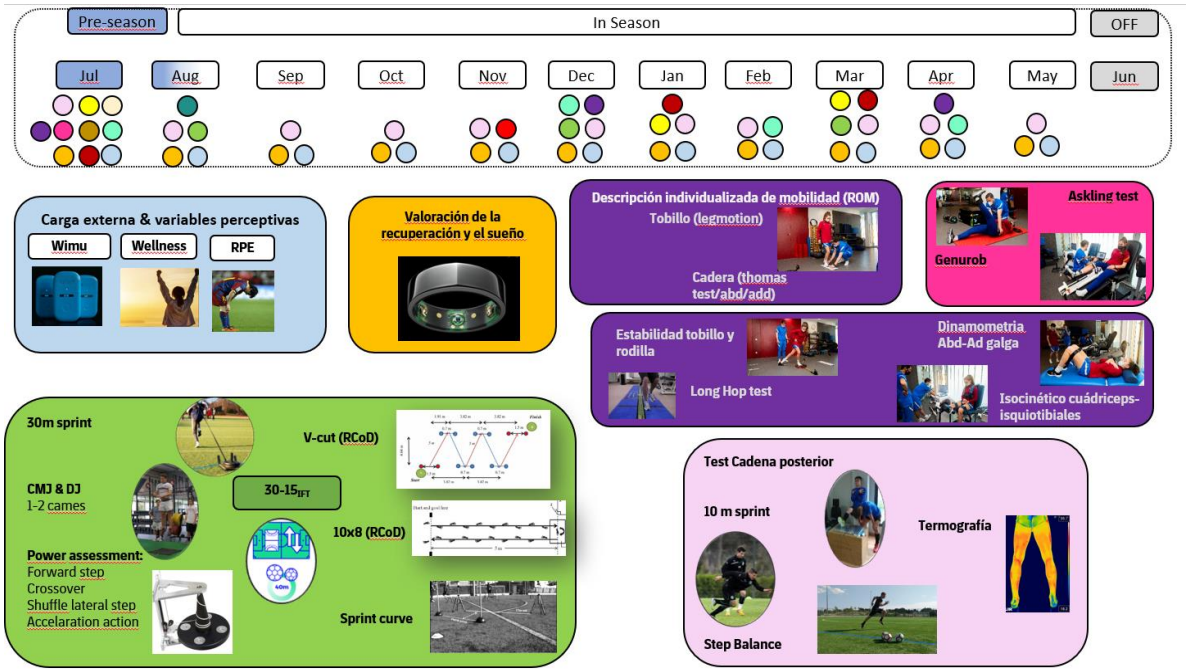
Focusing on evaluations conducted at two or three points in the season, these are defined as more invasive in their implementation, such as blood extraction, or those that involve

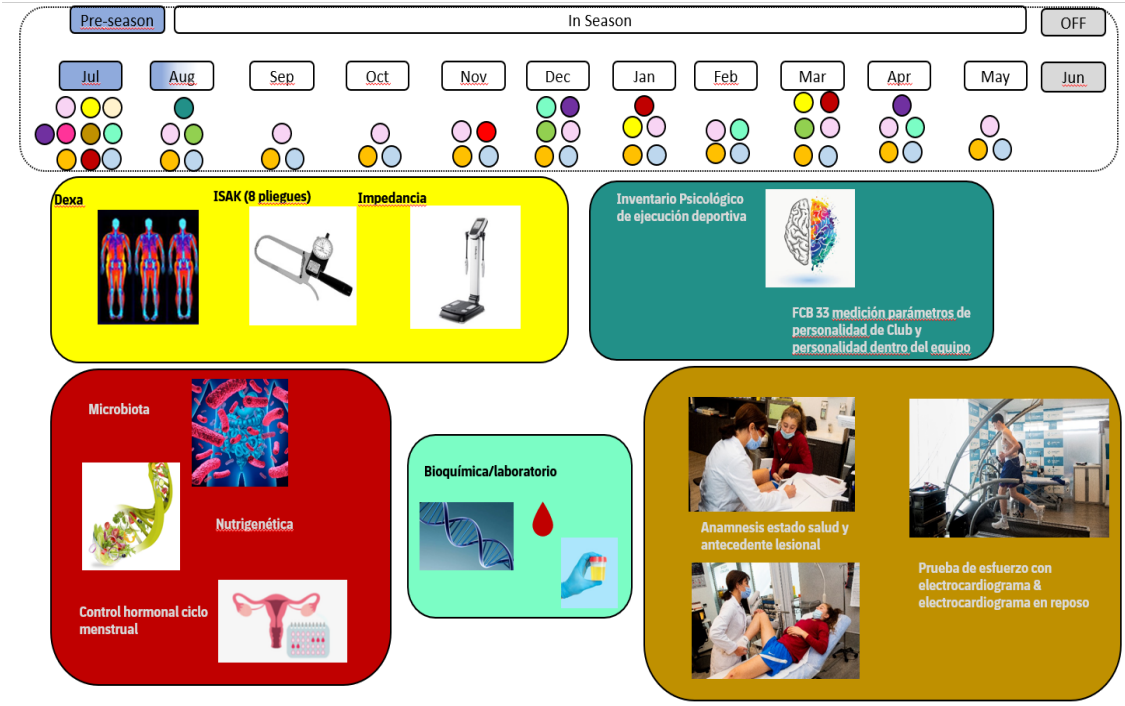
modifying the pattern or routine of training, such as range of motion assessments or evaluations of lean or fat tissue percentages.

Finally, there is a group of variables or data that describe intrinsic qualities, general characteristics, and provide a more analytical profile of the player, allowing for comparisons of the same athlete at a specific point in the season with previous years or seasons. These assessments could be defined as comprehensive analyses, including magnetic resonance imaging and ultrasound of different muscle components, updating injury history, genetic or epigenetic analysis, and assessment tests of supplementary capacities for the sport, such as aerobic capacity and oxygen consumption, among others.

Unit 4.3 Evaluation Proposal for Barcelona FC Women's Team

Image 1: Evaluation Proposal for Barcelona FC Women's Team





Source: prepared by the authors.

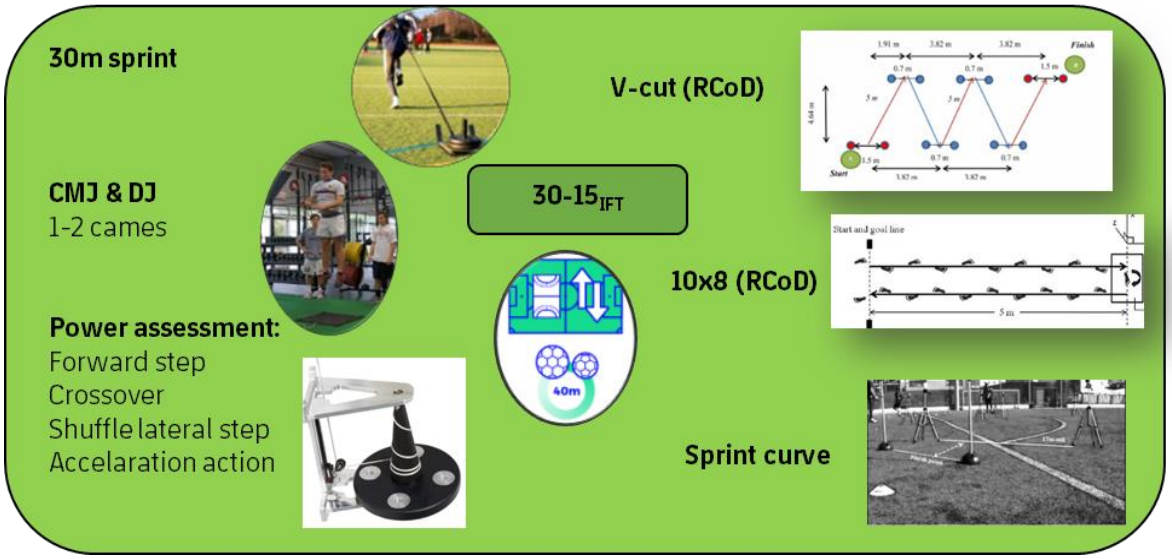
Impedancia	Impedance
Dexa	Dexa
Microbita	Microbiota
Nutrigenética	Nutrigenetics
Control hormonal ciclo menstrual	Hormonal control of menstrual cycle
Bioquímica/laboratorio	Biochemistry/laboratory
Inventarios Psicológico de ejecución deportiva	Psychological Inventory of Sports Performance
FCB 33 medición parámetros de personalidad de Club y personalidad dentro del equipo	FCB 33 measurement of parameters of Club personality and personality in the team

Anamnesis estado salud y antecedente lesional	Health status and injury history anamnesis
Prueba de esfuerzo con electrocardiograma & electrocardiograma en reposo	Exercise test with electrocardiogram & resting electrocardiogram

Below there is a proposal for specific assessments specifically aimed at Barcelona FC women's football, created by different departments that support the coaching staff.

In terms of conditional tests, it is proposed to conduct an aerobic capacity assessment for the players during pre-season using the 30-15 seconds test, a maximum incremental interval test on the field where the player performs 30 seconds of effort and 15 seconds of recovery while the pace increases with each step.

Image 2: Specific Assessments - Physical Conditioning Department



Source: prepared by the authors.

Furthermore, for the assessment of the ability to perform change of direction movements and the repeatability of such changes, it is proposed to conduct a T-test or, alternatively, a V-cut test. The V-cut test includes four directional changes every 5 meters, completing a total distance of 25 meters.

Image 3: Change of Direction Test

Source: file prepared by the authors.

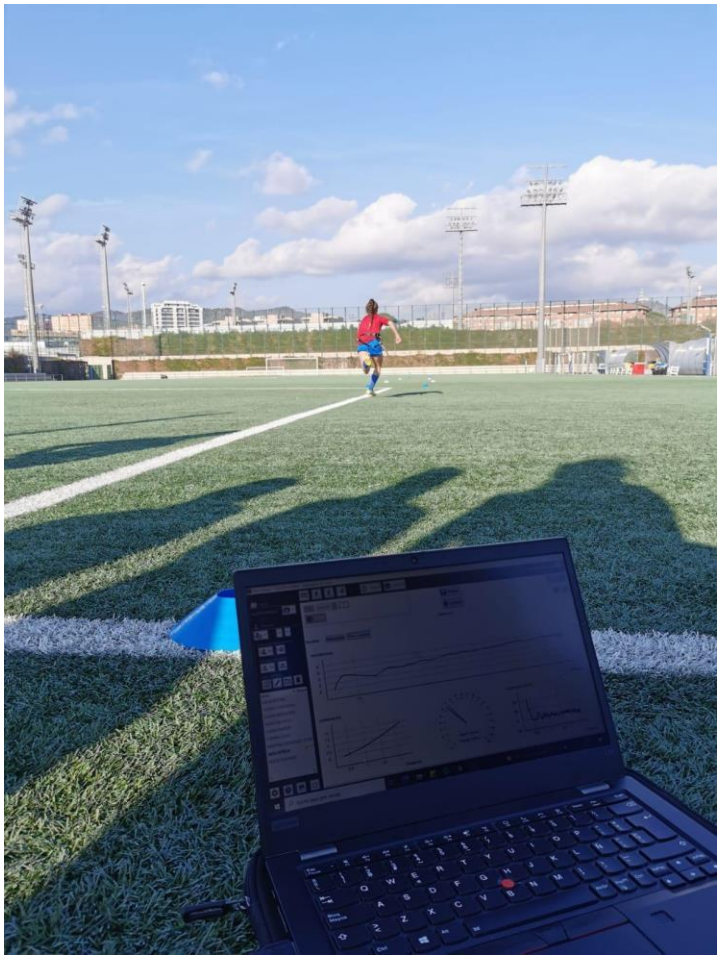
For the assessment of repeatability, six repetitions of the test are performed (three on each side) with a 10-second rest between repetitions.

It is important to highlight the possibility of repeating these tests in late December, early January to observe the players' progress in the first part of the season.

Next, we group together assessments proposed for three different moments throughout the season: pre-season, the beginning of the second half of the season (December-January), and prior to the period of maximum density or competitive importance (April). The analysis of power, strength, and speed in linear running, curved running, jumping, and specific game movements constitute the objectives of this group.

Regarding the analysis of strength, power, and speed in linear running, a 30-meter linear sprint test using a linear encoder is proposed. Similarly, for the assessment of the sprint in curves, the use of photocells is recommended, and the test should be conducted in the midfield area.

Image 4: Evaluation 30 m sprint with running encoder



Source: file prepared by the authors.

Focusing on jumps, perform a CMJ and a single- and double-legged drop jump, the latter with the objective of observing possible asymmetries in strength and power between both legs.

Image 5: Single-leg CMJ jump evaluation

Source: file prepared by the authors.

Image 6: Double-leg CMJ jump evaluation

Source: file prepared by the authors.

For a more specific analysis of game-specific movements, power assessment through a conical pulley of a front step, a go step, a closed step, and an acceleration would be the recommended movements for this evaluation.
Finally, as a supplement to the RV-Cut, we propose to perform a 10x8 RCOD, eight repetitions of 5 meters + change of direction + 5 meters (4 with each foot) with 10-15 seconds of rest in order to assess the capacity for repeated maximal efforts and the anaerobic ability of the players.

In terms of physiotherapy, during these three moments of the season, the following assessments are proposed: the long hop test, analysis of a single-leg frontal jump through video and of the distance covered for assessment of the anterior cruciate ligament (ACL); a drop jump, also proposed by the physical trainers, with videography to analyse the varus/valgus of the athlete using a checklist with different items; ankle range of motion measurements using leg motion; hip assessments including internal-external rotation, hip extension with contralateral flexion (Thomas Test), and abduction using an inclinometer; ankle and knee stability using Octobalance; and for strength and power, isokinetic testing of quadriceps-hamstrings at 60°/s

and 240°/s, as well as lower body abduction-adduction motion dynamometry using a force gauge with an adapter.

Image 7: Periodic evaluations by the Physiotherapy Department.

Source: prepared by the authors.

Estabilidad tobillo y rodilla	Ankle and knee stability
Long Hop test	Long Hop Test
Dinamometría Adb-Ad galga	Dynamometry Abd-Add force gauge
Isocinético cuádriceps-insquiotibiales	Isokinetic quadriceps-hamstrings
Descripción individualizada de movilidad (ROM) Tobillo (legmotion)	Individualised description of ankle mobility (ROM) (legmotion)
Cadera (thomas/test/abd/add)	Hip (thomas/test/abd/add)

The Medical Department, together with the Nutrition Department, perform the evaluation of body composition, height, and weight of the player using DXA with an open timing, according to the individual needs of each player. Additionally, apart from the pre-season, at Christmas,

early February, and early April, a blood test is performed to analyse biomarkers of nutritional status, hydration levels, immune system, oxidative stress, muscle status, performance, and their fluctuations throughout the season. In the pre-season, this analysis is complemented on a specific occasion (once per season) with a urine analysis, nutrigenetics analysis to create an individualised nutritional profile for each player, a study of the microbiota, and monitoring of hormonal behaviour during the menstrual cycle at different periods of the season.

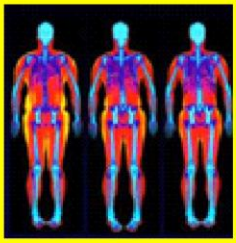
Image 8: Group of Assessments by the Medical and Nutrition Departments

Microbiota

Nutrigenética

Control hormonal ciclo menstrual

Dexa

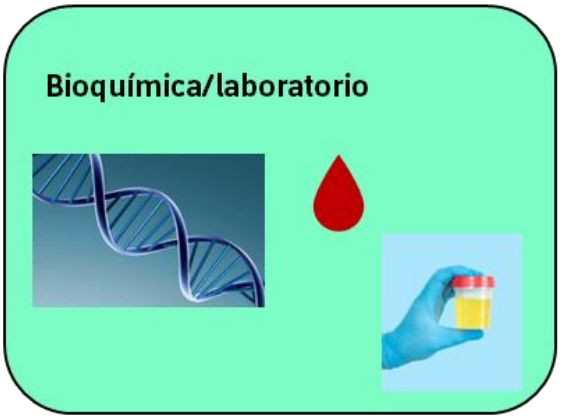


ISAK (8 pliegues)

Impedancia

Anamnesis estado salud y antecedente lesional

Prueba de esfuerzo con electrocardiograma & electrocardiograma en reposo



Source: prepared by the authors.

Microbiota	Microbiota
Nutrigenética	Nutrigenetics
Control hormonal ciclo menstrual	Hormonal control of menstrual cycle
Anamnesis estado salud y antecedente lesional	Health status and injury history anamnesis
Prueba de esfuerzo con electrocardiograma & electrocardiograma en reposo	Exercise test with electrocardiogram & resting electrocardiogram
Bioquímica/laboratorio	Biochemistry/laboratory

It is worth noting that during the season, some of the previous tests may be repeated if the staff and professionals from different cross-functional areas deem it necessary. For example, in case of injury, abnormal biomarker levels, health status, or body composition requiring monitoring.

Within the group of daily evaluations, in addition to the various load monitoring methods specified earlier, weekly evaluations are proposed within the microcycle. These include assessing asymmetries and the basic running pattern of the player through a step balance using the Wimu device, power, speed in a 10m sprint task obtained with the EPTS device, as well as an isometric test of the posterior chain to evaluate strength and power levels and their relation to neuromuscular fatigue.

Image 9: Periodic Evaluations Within the Microcycle

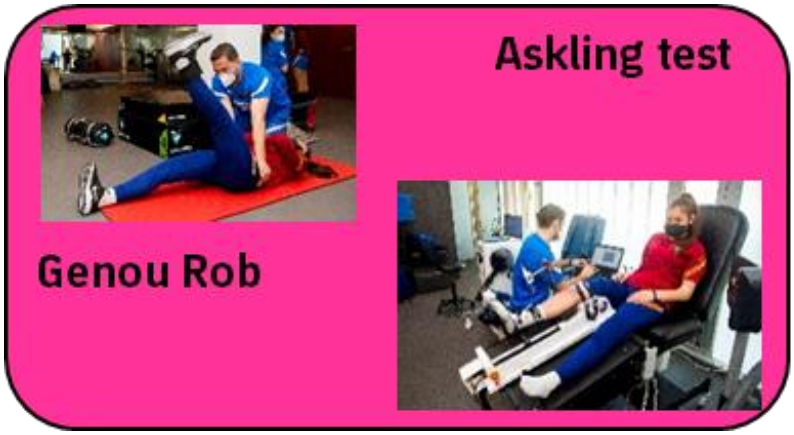
Source: prepared by the authors.

Carga externa & variables perceptivas	External load & perceptual variables
Valoración de la recuperación y el sueño	Recovery and sleep assessment
Test Cadena posterior	Posterior chain test

Termografía	Thermography
Step Balance	Step Balance

Sharing some assessments with the Strength and Conditioning and Medical departments, the Physiotherapy Department proposes the following protocols: on a specific occasion, meaning they are performed once during the pre-season, the test to assess anterior cruciate ligament laxity and, consequently, anterior and rotational knee stability using the Genou Rob; the Askling test using the EPTS device, where the Wimu device is placed on the ankle to evaluate posterior chain flexibility.

Image 10: Initial Season Assessments by the Physiotherapy Department.



Source: prepared by the authors.

Another analysis using Wimu devices focuses on the running movement pattern, where the utilisation of six devices placed on both ankles, knees, one device at the level of the L3 vertebra, and another in the usual cervical area is necessary.

Image 11: Step Balance Test Using Six Wimu Devices

Source: file prepared by the authors.

Finally, the integration of the Psychology Department with two types of evaluations that are proposed based on the needs during the season, and with a screening at the beginning of the season and one at the end of it to observe progress.

Image 12: Tests Carried Out by the Psychology Department

Source: prepared by the authors.

Inventario Psicológico de ejecución deportiva	Psychological Inventory of Sports Performance
FCB 33 medición parámetros de personalizad de Club y personalidad dentro del equipo	FCB 33 measurement of parameters of Club personality and personality in the team

The first evaluation is the Psychological Inventory of Sports Performance. It is a questionnaire based on seven mental factors that influence performance in competition: self-confidence, concentration, control of negative coping, control of positive coping, team confidence, attention, attitudinal control, and the 33 FCB questionnaire created by professionals from Barcelona FC. It is a test that consists of 116 questions that assess 33 parameters of the player's personality and the Barça personality or DNA required to belong to one of their teams. Currently, this questionnaire is in the final stages of validation.

References

Barnes, C.; Archer, D. T.; Hogg, B.; Bush, M.; and Bradley, P. S. (2014). The evolution of physical and technical performance parameters in the english premier league. En *International Journal of Sports Medicine*, *35*(13). https://doi.org/10.1055/s-0034-1375695

Buchheit, M.; Allen, A.; Poon, T. K.; Modonutti, M.; Gregson, W.; and Di Salvo, V. (2014). Integrating different tracking systems in football: multiple camera semi-automatic system, local position measurement and GPS technologies. En *Journal of Sports Sciences*,

32(20). https://doi.org/10.1080/02640414.2014.942687

Castellano, J.; Alvarez-Pastor, D.; and Bradley, P. S. (2014). Evaluation of research using computerised tracking systems (amisco® and prozone®) to analyse physical performance in elite soccer: A systematic review. En *Sports Medicine*, *44*(5). https://doi.org/10.1007/s40279-014-0144-3

Cummins, C.; Orr, R.; O'Connor, H.; and West, C. (2013). Global positioning systems (GPS) and microtechnology sensors in team sports: A systematic review. En *Sports Medicine*, *43*(10). https://doi.org/10.1007/s40279-013-0069-2

Haugen, T.; and Seiler, S. (2015). Physical and Physiological Testing of Soccer Players: Why, What and How should we Measure? En *Sportscience Norway. Email. Reviewer: Martin Buchheit*, *19*.

Mendez-Villanueva, A.; and Buchheit, M. (2013). Football-specific fitness testing: Adding value or confirming the evidence? En *Journal of Sports Sciences*, *31*(13). https://doi.org/10.1080/02640414.2013.823231

Wagner, H.; Sperl, B.; Bell, J. W.; and Von Duvillard, S. P. (2019). Testing Specific Physical Performance in Male Team Handball Players and the Relationship to General Tests in Team Sports. En *Journal of Strength and Conditioning Research*, *33*(4). https://doi.org/10.1519/JSC.0000000000003026