Module 4. Endurance Training in Indoor Team Sports

BARÇA INNOVATION HUB
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Endurance Training in Indoor Team Sports

Throughout the **Training the Conditional Structure** course, we thoroughly explored the training of the conditional structure. In the first module, we introduced elements of the complexity approach, which allows us to understand and propose an alternative methodology (based on the pillars of structured training) for developing strength training. This ability is considered the core physical capacity from which all other abilities stem. This methodological approach differs from traditional strength training methods, which are mainly based on individual sports. In the second module of this course (Training the Conditional Structure), we explored both theoretically and practically the main elements of complexity, offering guidelines for designing preferential simulation situations, i.e. tasks.

In the third module, we demonstrated how strength is expressed over a short period of time. In other words, we proposed a method for speed training, once again based on complexity and structured training principles.

Finally, in this last module, we will complete our proposal for Training the Conditional Structure by addressing the question: How do we train strength when it needs to be sustained over a long period? By addressing this question, we'll develop a proposal for endurance training in indoor team sports.

It is clear that having a certain level of power or speed when performing any sports movement is crucial for optimizing athletic performance. However, it is equally true that repeating actions that occur during competition in indoor team sports—such as shooting at the goal in handball, futsal, or rink hockey, shooting in basketball, or passing—requires the capacity to maintain certain levels of power (or, in other words, power endurance) to respond effectively and, if possible, efficiently during a game.

At this point, we can refer to the following figure to better understand the proposal for endurance training, starting with strength as the core ability from which both speed and endurance stem.

Figure 1: Strength as the Core Physical Ability

Source: Original work adapted from Tous, 2017

	STRENGTH		
Power			Repeated power
	Speed	Endurance	

	ADM	Coordinative Skills	

The ability to produce sustained strength in indoor team sports

Endurance training (the ability to produce sustained strength) in team sports recognizes that endurance has long been a key element in physical preparation. Physical conditioning has played a significant role in performance, often giving it excessive importance and explaining nearly any action or result in competition. As a result, endurance has traditionally been viewed as a crucial element closely linked to performance and sports success, by players, coaches, technical staff, managers, fans, and the media.

Endurance training has been extensively studied in scientific literature. We have numerous studies and books offering various definitions that bring us closer to the concept of endurance, traditionally understood from an approach focused on individual or performance sports. Endurance is often defined as the physical ability that allows us to delay and/or resist fatigue during training or competition in efforts typically associated with long durations (Harre, 1987). It is also defined as the ability to resist both psychologically and physically to a load over a long period, eventually leading to insurmountable fatigue (manifested as a loss of performance) due to the intensity and duration of the effort. Finally, endurance is described as the ability to recover quickly after physical and psychological efforts (Zintl, 1991).

From the Barcelona School methodology, we propose a clear evolution from the previous definition to align the concept with the characteristics of team sports. The proposed definition for this physical ability, which allows strength to be expressed over a long period, is: endurance is "the ability to withstand and adapt to the physical, technical, and tactical demands set by a specific game model during a match and throughout the competition" (Massafret et al., 1991).

This definition, along with its connection to the complexity paradigm and dynamic complex systems, indicates that endurance training cannot be understood without considering the player, the sport, and more specifically, the style or game model of each sport and coaching staff. Therefore, we can state that maximizing endurance (without any other goal) is not proposed as a training objective, unlike in strength training, which we see as distinct from mere maximization. Thus, improvements achieved through traditional endurance training will not be directly related to winning; at least, not once a certain threshold necessary for game development is reached.

Endurance training in indoor team sports, like other physical abilities within the conditional structure, should enable the player to express their game in competition. Thus, only specific levels of this ability are necessary to allow the player to express their game according to the sport's characteristics and the coach's proposed style of play. Above these levels, players will not gain any performance-related advantage. It is important to highlight that the needs of each player, the team, and the game model will fundamentally determine the essential requirements of this physical capacity, so there will be no one-size-fits-all proposal. This characteristic is similar to what happens with strength training or coordinative structure (technical) training.

In these sports, and closely related to endurance training, we must consider fatigue as one of the possible conditioning factors (Newell, 1986) that affect the player and must be addressed in our training proposals; reaching certain levels of fatigue during competition could negatively impact performance, affecting the player as a hypercomplex structure and the team due to circular causality.

Just as we must understand sports performance from a complexity perspective and a holistic and multifactorial approach, fatigue will depend on elements such as the player's conditioning level, their playing position, the team and opponent's game model, and competitive density.

In summary, we should view endurance training as an individual, but also collective, process that allows each player to express their game within a specific game model, while minimizing levels of fatigue that could affect performance. This perspective, along with other elements, leads us to propose different types of endurance: coordinative or technical, cognitive-tactical, and competitive or game-related.

Before we proceed with the module topics, it is important to note that much of what we will present is influenced by Joan Solé (professor at the National Institute of Physical Education of Barcelona and a key figure in the Barcelona School's approach), whose classes have profoundly shaped our understanding of this physical capacity. Additionally, the complexity approach, structured training, and our own experience, both in developmental categories and with elite athletes, have contributed to shaping the following proposal.

How is endurance manifested?

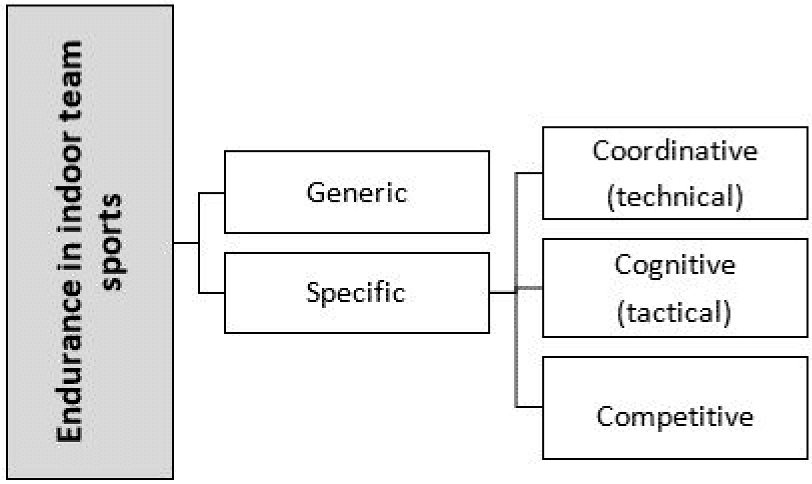
Endurance manifestations in individual sports are classified based on the predominant energy systems and the duration of the effort. For example, based on energy systems, we can distinguish between aerobic endurance, alactic anaerobic endurance, and lactic endurance. According to duration, we can differentiate between short-duration, medium-duration, or long-duration endurance. Additionally, we can consider the relationship of this capacity with other abilities, such as strength or speed, or with specificity.

This classification is very useful in individual sports. In indoor team sports, likely due to their influence from individual sports, this classification has also been widely used. However, our proposal will not rely on this classification, as we will see, because we believe it is inadequate; none of the energy systems fully match the needs of different team sports modalities.

Grouping situational sports into aerobic or anaerobic categories does not provide an accurate understanding of these sports, as energy supply and consumption always occur in an integrated manner and according to the changing and uncertain conditions of the game. As Professor Joan Solé indicates in his master's classes (Solé, 2002), multiple anaerobic efforts, both alactic and lactic, alternate during the game on an aerobic system base, emerging according to different game scenarios.

The traditional view of endurance (analytical, linear, and reductionist) is distant from the complexity of team sports and distorts programming based on the integration of different energy systems. To address a classification more aligned with game reality, we suggest using one of the pillars of structured training: **specificity**. Therefore, task orientation (generic, general, directed, special, and competitive) will facilitate the integration of energy systems. From a broad perspective, we can distinguish between generic endurance training, included in coadjuvant training, and specific endurance training, which fits into the optimizing training of structured training. We will now develop in more detail the two main categories of endurance training based on the summary of the following figure.

Figure 2: Classification of endurance manifestations in indoor team sports (above) and the relationship between task orientation and different manifestations of endurance (below)



Generic endurance

Traditionally, this type of endurance is known as the foundation that supports the development of other manifestations, being understood as transversal, as it can be related to all types of team sports. Generic endurance is linked to the aerobic system and involves a high percentage of muscle groups. When related to the player, understood as a hypercomplex structure, it highlights the involvement of coordinative, cognitive, conditional (and bioenergetic), socio-affective, and emotional-volitional structures. These show very little to no resemblance to the actual demands of the game. The following are the main characteristics of the structures.

- The **coordinative structure** is related to movements different from the sport practiced—movements from team sports (swimming, cycling, rowing)—or performed using fitness-related machines such as rowing machines (static), stationary bikes, ellipticals, or steps. It also includes running in any medium different from the sport's usual setting (mountain, beach). Training methods are of low specificity and generally correspond, although not exclusively, with the involvement of the aerobic system.

- The **cognitive structure** does not require decision-making or, when it does, the decisions are very simple.
- The **socio-affective structure** will not be involved due to the highly individual nature of this type of endurance. It will only be necessary when the approach is at a team level, potentially involving certain aspects of non-specific player interaction.
- The **emotional-volitional structure** may be required (occasionally, through increased demand depending on objectives and needs and in a non-specific way) since challenges that demand high effort from the player can be established.

Specific Endurance

The primary goal of specific endurance training is to equip the player with the capacity to optimize performance effectively, aligned with the sport's technical-tactical demands. The structures most involved in the proposed preferential simulation situations are the coordinative, cognitive, conditional (and bioenergetic), and socio-affective ones, which can exhibit a high or even maximum level of similarity and involvement compared to the actual game in competition. Please note that the involvement of the emotional-volitional and creative-expressive structures should also be present to a greater or lesser extent.

This classification includes the following manifestations of specific endurance.

Coordinative or Technical Endurance

The tasks proposed for this manifestation are closely related to the specific motor actions of the game, i.e., the technical movements or gestures referred to as contents, intended for training the conditional structure. Thus, the coordinative structure becomes the focus in this manifestation of endurance, which can involve simple decision-making, with the presence of certain levels of fatigue, and must account for effectiveness. Below are the characteristics of four structures.

- The **coordinative structure** is specific because it is fundamentally based on the motor actions that emerge during the game. From a traditional perspective, we could say that we train each player's individual technique.
- The **conditional structure** requires the integrated participation of energy systems.
- The **cognitive structure** shows a moderate (or even low) level of specificity and relates to individual tactics. It is associated, as mentioned, with specific movements but with some connection to tactical actions. However, it does not relate to decision-making based on the team's game model.
- In this context, the s**ocio-affective structure** is characterized by its distinctly individual nature. However, simultaneous communication between teammates in cooperative situations is also taken into account, though without the presence of active defense.

Cognitive or Tactical Endurance

In training tasks aimed at developing this manifestation of endurance, coordinative or technical actions are combined with cognitive or tactical actions, including sport-specific decision-making and, more specifically, the team's game model. The main goal of training for this manifestation is to optimize players' cognitive structure under specific levels of fatigue. The characteristics of the various structures involved in the tasks are detailed below.

- The **coordinative structure** is specific and based on movements that emerge to respond to various game situations, with decision-making based on the game model proposed by the coaching staff.
- The **conditional structure** is subject to the playing style implemented by the coaching staff, requiring the integrated participation of different energy systems.
- The **cognitive structure** shows a high level of specificity, though it does not include all players participating in a match. For example, tasks involving 4 vs. 4 or 5 vs. 5 would not be included in basketball. The player responds to the proposed tactical game situations.
- The **socio-affective structure** presents a high level of specificity in this manifestation, proposing relationships among players who interact more frequently during the game in our model.

Competitive Endurance

This is seen in training tasks that aim to simulate real game conditions. Thus, the most involved structures will self-organize with a high or almost maximum level of specificity for each player, adapting to the fatigue situations that arise based on the game requirements of our model and that of the opponent. This manifestation of endurance is directly associated with each player's needs in their playing position within the team. The following characteristics are highlighted in the structures primarily constituting the tasks.

- The **coordinative structure** is defined by the use of specific motor actions to respond to the unpredictable and ever-changing situations that arise during the game.
- The **conditional structure** will be represented by the highest expression of specificity through the integration of energy systems based on both our game model and the opponent's.
- The **cognitive structure** is focused entirely on optimizing performance based on the selected game model. Decision-making, both individual and collective, occurs under the strategies and tactics of our team and the opposing team.
- The **socio-affective structure** is also part of each player's and team's self-organization, cooperating and resolving various game scenarios to which they are exposed.

Dentro de la resistencia genérica, que sucede con la estructura cognitiva

- [ ] Alta demanda de la estructura cognitiva

La estructura cognitiva no requiere de toma de decisiones o, si lo hace, son muy simples

Necesita de procesos de adaptación genéricos para mejorar la resistencia

Las propuestas deben tener presente todo el tiempo la toma de decisión

SUBMIT

Within generic endurance, what happens with the cognitive structure?

High demand for the cognitive structure

The cognitive structure does not require decision-making or, when it does, the decisions are very simple.

It needs generic adaptation processes to improve endurance

Proposals must consistently consider decision-making

SUBMIT

What do we aim to achieve through endurance training?

The general objectives underpinning and justifying endurance training in indoor team sports are to:

- Withstand the fatigue produced by the imposed game model and the demands of the opposing team.

1 of 3

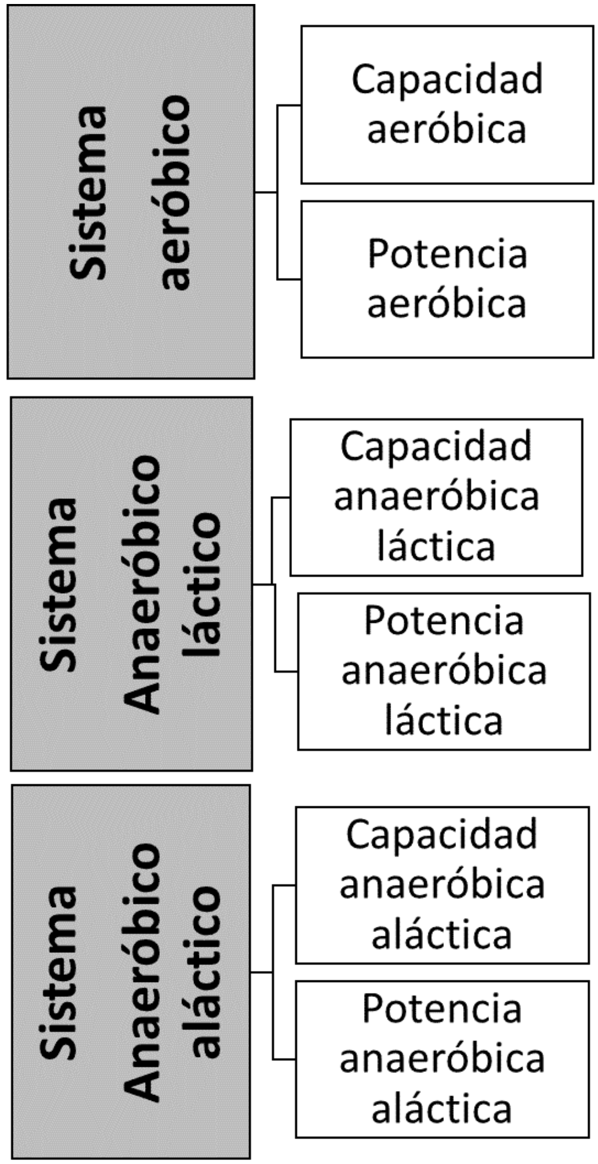
How can we train endurance in indoor team sports?

The traditional methodology based on individual sports relates to the analytical, reductionist, and linear approach that views sports performance as the sum of its parts. Therefore, training sessions consist of various

Traditional Methodology

This methodology typically focuses on developing and maximizing the three energy systems that supply the necessary "fuel" for sports performance in isolation. Training proposals prioritize the development of these systems based on their involvement in each

Figure 3: Endurance Manifestations for Each Metabolism



Source: Original work

Aerobic System	Aerobic Capacity
	Aerobic Power

Lactic Anaerobic System	Lactic Anaerobic Capacity
	Lactic Anaerobic Power

Alactic Anaerobic System	Alactic Anaerobic Capacity
	Alactic Anaerobic Power

Applying this methodology to indoor team sports usually involves adapting the guidelines used in individual sports. These adaptations have generally involved using game-specific elements, such as the ball or stick, in endurance training tasks, particularly in what is known as specific endurance, depending on the sport. In reality, this approach is very similar to the traditional training method.

Similarly, training sessions largely follow the guidelines used in performance sports, where each task includes elements aimed at developing the previously mentioned endurance manifestations. For example, the first task in a session develops alactic anaerobic power, the second one develops lactic anaerobic power, and the third one develops aerobic capacity.

Traditional methodology evolves based on the principle of progression, with sessions designed to develop capacity before advancing to power (from extensive to intensive). Capacity thus serves as the foundation for later improving power.

Finally, this methodology includes various tests or assessments that facilitate the control and evaluation of these endurance manifestations and clearly show the training process's progress towards improving competition performance.

Despite its widespread use in team sports, the link between physiological parameters of this physical capacity and in-game performance is minimal or non-existent.

INTEGRATED METHODOLOGY	GAME PACE

This methodology views endurance holistically, considering the overall participation, combination, and interaction of its different manifestations and energy systems to meet the game's pace demands, based on the team's game model (Solé, 2002). In our view, this approach clearly aligns more closely with the characteristics and needs of indoor team sports, where energy systems are engaged as a whole and always according to the game's energy demands.

Scientific evidence shows that an increase in effort time and the number of sprints requires greater involvement of the aerobic system and a significant decrease in anaerobic glycolysis. At the same time, there is a substantial contribution from the phosphagen system during repeated short, intense efforts related to the decrease in anaerobic glycolysis, as demonstrated, for instance, in futsal (Barbero and Barbero, 2003).

The integrated methodology suggests focusing on developing one of the three systems in designing preferential simulation situations, but it is necessary to engage all the systems as well. For instance, in order to train the conditional structure, we might emphasize one system more, but the other systems should also be involved in the task. These combinations will vary based on the objective, the type and timing of the microcycle, and the player's involvement in the task set by the coaching staff.

Another feature of the integrated methodology is the unpredictability or randomness of movements and efforts, and consequently, energy systems, during the game in team sports (Spencer et al., 2005) and in tasks. Generally, aerobic-oriented efforts will be combined with lactic and alactic efforts. Additional factors to consider include the duration of high-intensity actions, game and rest time (density) during competition, the game pace of the team, and the opponent, among others.

Another aspect of Professor Solé's methodology (2002) is that endurance training is grouped into two main focuses: capacity-oriented or power-oriented. Therefore, whether the goal is to optimize endurance for capacity or power, the preferential simulation situation must account for all three energy systems. Furthermore, this methodology includes concepts such as endurance, strength endurance, or speed endurance for capacity-oriented training. When oriented towards power, it includes concepts like speed strength, aerobic and anaerobic power, and speed endurance.

A significant characteristic of the integrated methodology is the use of the game and the level of specificity as primary parameters to control and prescribe the intensity of the proposed preferential simulation situations in the structured microcycle.

In traditional methodology, intensity is controlled by measuring physiological parameters related to internal load, such as lactate or heart rate. However, since the main goal of endurance training in integrated methodology is to enable players to handle the game's conditional, coordinative, technical, cognitive, or tactical demands (rather than maximizing any specific energy system), other parameters or indicators are needed. Therefore, the integrated methodology emphasizes external load variables to control and prescribe intensity, as these are directly linked to the game concept we aim to optimize. These variables relate to the level of task specificity and the game pace.

For the first indicator, higher task specificity is associated with greater intensity. The game pace is understood as the number of team possessions or the number of technical-tactical actions per unit of time. Hence, a higher pace indicates higher intensity. Logically, this pace indicator should be linked to the concept of game effectiveness.

INTEGRATED METHODOLOGY

GAME PACE

Ball possession is the foundation of our proposal for determining game pace. We define possession as the number of times a team controls the ball and initiates the offensive or attack phase. Possession ends when the defensive team recovers the ball and begins their offensive possession. In basketball, the following formula is used for calculation:

Field goals attempted + turnovers + free throws * 0.44 - offensive rebounds

Possessions are also a crucial value in advanced basketball statistics, which helps relate different structures.

We can delve deeper into this concept in indoor team sports by using it differently. Since possession is defined by the number of technical-tactical actions, both individual and collective, performed within a given time, game pace can be simply defined as the number of actions within a specific time. Although counting all these actions can be challenging, most indoor sports, such as handball or basketball, have pre-established plays that help count or estimate these actions.

Additionally, as noted earlier, we should relate pace to effectiveness to find the optimal game pace. We will now introduce Professor Solé's (2002) method for calculating game pace in team sports.

Offensive pace can be calculated as follows:

Offensive pace = (possession pace No. 1 + possession pace No. 2 ...) / Total number of possessions

For example, if possession number 1 includes 10 technical-tactical actions performed in 20 seconds, the pace will be: 10/20 = 0.5. This means that a technical-tactical action occurs every 2 seconds.

Defensive pace can be calculated as follows:

Defensive pace = Number of recoveries x Number of technical-tactical actions / Total time in defense

Finally, average pace is calculated as follows:

Average pace =
(Number of possessions + Number of recoveries) x Total number of technical-tactical actions / Total game time
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Total game time

Thus, we establish the following relationship between intensity and game pace:

Supramaximal intensity Pace significantly higher than the average pace
Maximal intensity Pace higher than the average pace
Medium intensity Pace similar to the average pace
Submaximal intensity Pace lower than the average pace

Consequently, game pace is also related to physiological or internal parameters, as summarized in the table below.

Table 1: Relationship between intensity, pace, and internal physiological parameters

Intensity	Pace	Relationship with internal physiological

		parameters
Supramaximal intensity	Pace significantly higher than the average	Predominance of the alactic and lactic systems. Tasks focused on power. Heart rate above the average match rate. Lactate concentrations over 8 mM/l.
Maximum intensity	Pace higher than the average	Shared predominance of aerobic and anaerobic lactic systems. Tasks focused on power. Heart rate above the average match rate. Effort approximately at VO_{2max}. Lactate levels between 6 and 8 mM/l
Medium intensity	Pace equal to the average	Predominance of the aerobic system. Tasks focused on capacity. Heart rate similar to the average match rate. Effort approximately at the anaerobic threshold. Lactate levels between 3 and 5 mM/l.
Submaximal intensity	Pace below the average	Predominance of the aerobic system. Tasks focused on capacity. Heart rate below the average match rate. Effort around the anaerobic threshold. Lactate levels between 2 and 3 mM/l

Source: Adapted from Solé, 2002

Scientific evidence shows that using such training tasks, including small side games, has positive effects on improving endurance manifestations like aerobic capacity and technical-tactical behaviors (Clemente et al., 2021). Additionally, research concludes that implementing small-sided games in high-level teams can replace traditional methods like interval training during the competitive period. This ability to develop endurance through small-sided games has also been demonstrated in other indoor sports, such as handball (Balasubramanian, 2014; Clemente et al., 2021; Iacono et al., 2015).

The following table presents a training proposal that uses both traditional and integrated methodologies, implemented through small-sided games in handball.

Table 2: Training program and training protocol over an 8-week period, with both traditional and integrated methodologies.

	HIIT	SSG
Testing		
Wk 1	Sprint tests (10, 20 m), agility test (HAST), maximal strength and lower limb explosive power, YYIRT1	
Training period		
Wk 2	2 × (2 × 6′:15″ [90%]–15″p)	2 × (5 × 2′25″–1′p)
Wk 3	2 × (2 × 6′30″:15″ [90%]–15″p)	2 × (5 × 2′35″–1′p)
Wk 4	2 × (2 × 7′:15″ [92%]–15″p)	2 × (5 × 2′55″–1′p)
Wk 5	2 × (2 × 7′30″:15″ [92%]–15″p)	2 × (5 × 3′–1′p)
Wk 6	2 × (2 × 7′30″:15″ [92%]–15″p)	2 × (5 × 3′–1′p)
Wk 7	2 × (2 × 8′:15″ [92%]–15″p)	2 × (5 × 3′10″–1′p)
Wk 8	2 × (2 × 7′30″:15″ [95%]–15″p)	2 × (5 × 3′–1′p)
Wk 9	2 × (2 × 7′:15″ [95%]–15″p)	2 × (5 × 2′55″–1′p)
Testing		
Wk 10	Sprint tests (10, 20 m), agility test (HAST), maximal strength and lower limb explosive power, YYIRT1	

*HIIT = intensity intermittent training; SSG = small-sided games; HAST = handball agility specific test.

As for HIIT protocol, 2 × (2 × 6′:15″ [90%]–15″p) in week 2 means: 2 sessions per week consisting of 15-second runs at 90% of YYIRT1 final speed interspersed with 15-second passive recovery (15″p) by walking for a total time of 6′15″. As for SSG protocol, 2 × [5 × 2′25″–1′p] in week 2 means: 2 sessions per week consisting of 5 bouts of 2′25″ of continuous handball small-sided games with 1-second passive recovery (1′p) between bouts.

Source: Iacono et al., 2015, https://goo.su/qkBH

Additionally, the relationship between play time and rest time (density) affects the game's demands and the players' physiological responses, influencing their endurance requirements in each sport. Therefore, understanding the density of each sport, as well as the types and numbers of movements required, is crucial for designing tasks and achieving objectives. The following data provides information on these elements across different court sports.

Table 3: Frequency of play intervals based on their duration in futsal

INTERVALOS DE JUEGO	1" a 18"	19" a 30"	31" a 60"	61" a 90"	Total
Cantidad (Rep)	120	32	7	2	160
Porcentaje	75 %	20 %	4 %	1 %	100 %

Source: Andrin, 2004, https://goo.su/K1k0ih

Table 4: Frequency of pauses between play intervals based on their duration in futsal

INTERVALOS DE PAUSA	1" a 15"	16" a 30"	31" a 60"	61" a 90"	Total
Cantidad (Rep)	133	13	10	4	160
Porcentaje	83 %	8 %	6 %	3 %	100 %

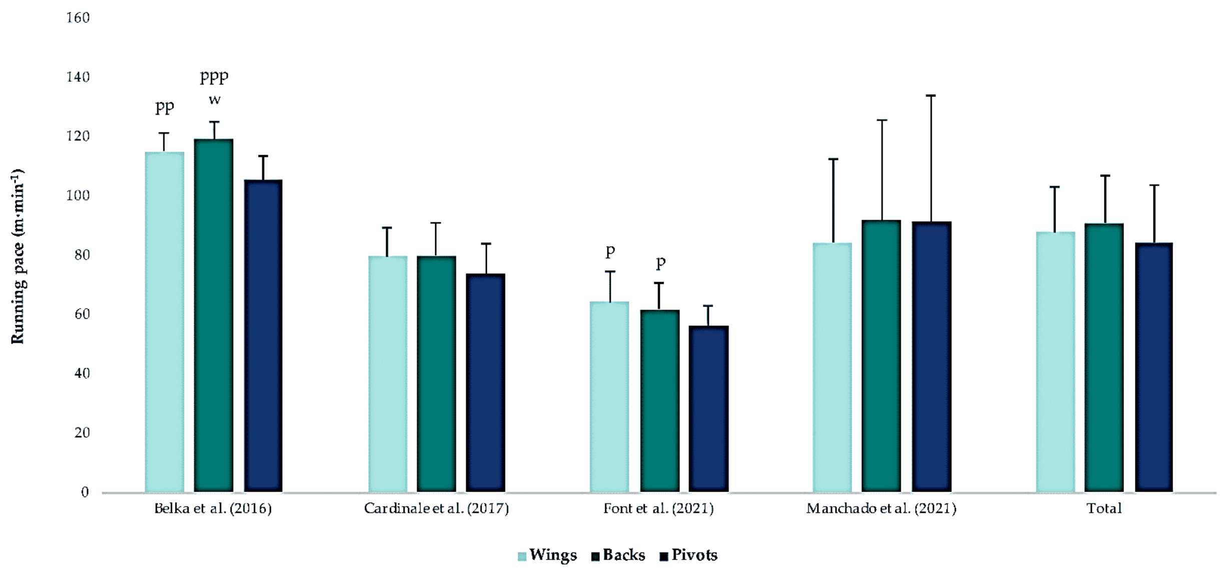
Source: Andrin, 2004, https://goo.su/K1k0ih

Table 5: Example of game density and pauses in basketball

Duración (segundos)	JUEGO		PAUSA	
	Frecuencia	Porcentaje	Frecuencia	Porcentaje
1 – 10	34	5.4	36	5.7
11 – 20	141	22.5	153	24.4
21 – 30	108	17.2	114	18.2
31 – 40	76	12.1	57	9.1
41 – 50	43	6.8	66	10.5
51 – 60	45	7.1	60	9.6
61 – 70	37	5.9	45	7.1
71 – 80	25	4.0	36	5.7
81 – 90	30	4.8	6	1.0
91 – 100	11	1.7	15	2.4
101 – 110	23	3.7	9	1.4
111 - 120	21	3.3	3	0.5
> 120	33	5.3	3	0.5
	627		603	

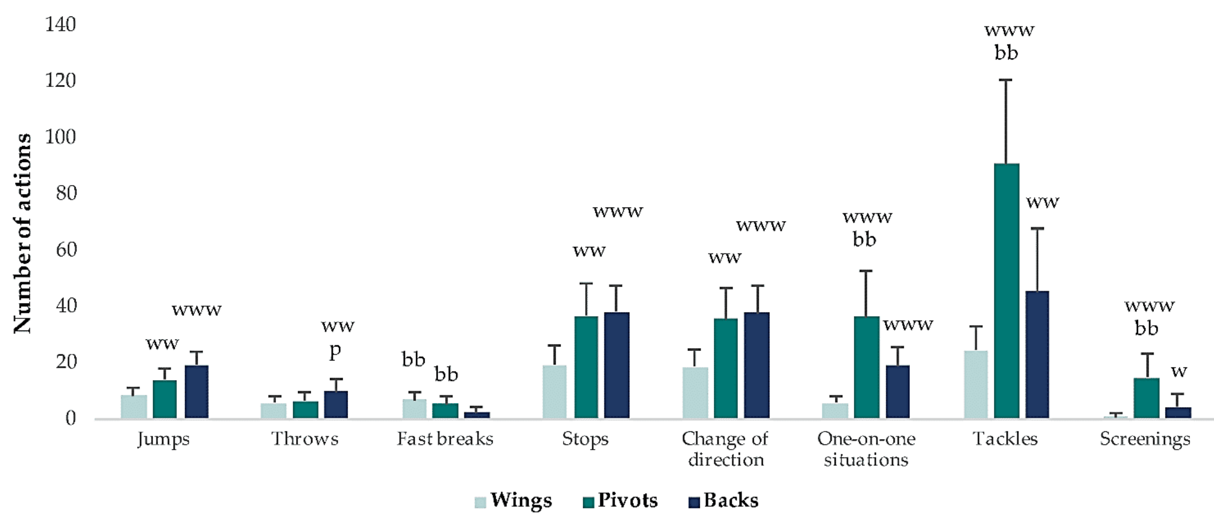
Source: Colli y Faina, 1987, https://goo.su/V35DvMX

Figure 4: Running pace according to positions in elite handball



Source: García-Sánchez et al., 2023, https://goo.su/gJqKn

Figure 5: Coordinative (technical) requirements by positions in elite handball



Source: García-Sánchez et al., 2023, https://goo.su/gJqKn

Which of the following types of paces is supramaximal intensity is associated with?

- Medium pace with high-intensity intervals
- Pace higher than the game pace
- Medium pace
- Pace significantly higher than the game pace

SUBMIT

Methods of endurance training in the integrated methodology —

According to Solé (2002), the proposed methods for endurance training within the integrated methodology are:

- **Continuous-variable**: running at varying speeds.

- **Iterative**:
  - Structured
  - Continuous
  - Segmented
- **Control:**
  - Competition
  - Modeled

Continuous-variable method —

This method fundamentally relies on varying intensity during the effort task, enabling joint training of different energy systems. Specifically, Bosco's proposal suggests combining maximal intensity runs of 10, 30, and 50 meters with recoveries of 30s, 70s, and 110s, respectively, maintaining an intensity around 150 beats per minute (active recovery). Up to 10 repetitions of 10m, 8-10 repetitions of 30m, and 5-6 repetitions of 50m can be performed, progressing from 2 to 3 sets of 8 minutes each, up to 25 continuous minutes.

Iterative method —

This method involves characteristics similar to complexity and structured training. It is particularly marked by uncertainty and randomness, as well as a variety of elements that define the load, such as stimulus duration, intensity, and rest. When related to game pace, it results from the random combination of three game paces (submaximal, maximal, and supramaximal).

Below, we briefly outline each method within the iterative approach.

Iterative-continuous oriented to capacity

This approach involves a task that integrates three endurance manifestations: aerobic capacity, lactic anaerobic, and alactic anaerobic.

For task design, aerobic capacity content should be included, typically lasting around 15 minutes. This aerobic subtask often serves as a transition between other anaerobic subtasks. The anaerobic subtasks range from 30 seconds to 1 minute 30 seconds.

Aerobic subtasks should be performed at a submaximal game pace (with physiological values between the aerobic and anaerobic thresholds, but never below the aerobic threshold). Actions involving maximal and supramaximal paces, related to alactic and lactic anaerobic capacities, will alternate randomly.

Capacity-oriented training implies that the duration of the lactic anaerobic capacity stimulus should be between 30 seconds and 1 minute 30 seconds (or up to 2 minutes). Meanwhile, the duration of alactic capacity should be between 10 and 20 seconds.

In summary, each task should include at least 3 subtasks representing aerobic, lactic, and alactic capacities. This method requires physiological parameters (internal load) between the aerobic and anaerobic thresholds, with a heart rate between 140 and 170 beats per minute, close to the anaerobic threshold, and lactate levels between 3 and 5 mM/l at the end of the task.

Iterative-continuous and long-segmented oriented to power

In the power orientation, the three endurance manifestations related to aerobic, lactic anaerobic, and alactic anaerobic power are combined. Here, the total task duration is significantly reduced compared to capacity orientation. A single repetition lasting 5 to 15 minutes is proposed, depending on the goal, season timing, and type of microcycle. For lactic anaerobic subtasks, stimuli of 15 to 30 seconds are recommended, while alactic subtasks should include stimuli between 5 and 10 seconds. In both cases, the intensity of execution will be maximal.

The aerobic subtask should reach an intensity between the anaerobic threshold and maximum oxygen consumption (85-100% of VO_{2max}). The duration of actions can vary depending on the preferred simulation situation, but 30 seconds to 1 minute is recommended. Again, aerobic subtasks act as a transitional phase.

At the end of the repetition, heart rate will be very high or maximal, and lactate levels will be between 8 and 15 mM/l.

This iterative continuous method can also be applied as a long segmented method, using more than one repetition with 3 to 7 minutes of rest to ensure the intensity of the next repetition, with active recovery.

Iterative-segmented oriented to capacity

The duration of lactic anaerobic resistance stimuli will range from 30 seconds to 1 minute 30 seconds, while alactic efforts will last between 10 and 20 seconds. The work-to-rest ratio (density) ranges from 1:1 to 1:3, including active pauses. The number of repetitions per set ranges from 8 to 15, depending largely on the team's training level and the type of microcycle. The number of sets will be from 1 to 3.

Lactic-oriented efforts should last between 30 seconds and 1 minute 30 seconds, while alactic efforts should last between 10 and 20 seconds. Density ranges from 1:1 to 1:3, with active pauses. The number of repetitions per set ranges from 8 to 15, depending largely on the team's training level and the type of microcycle, while the number of sets will be from 1 to 3.

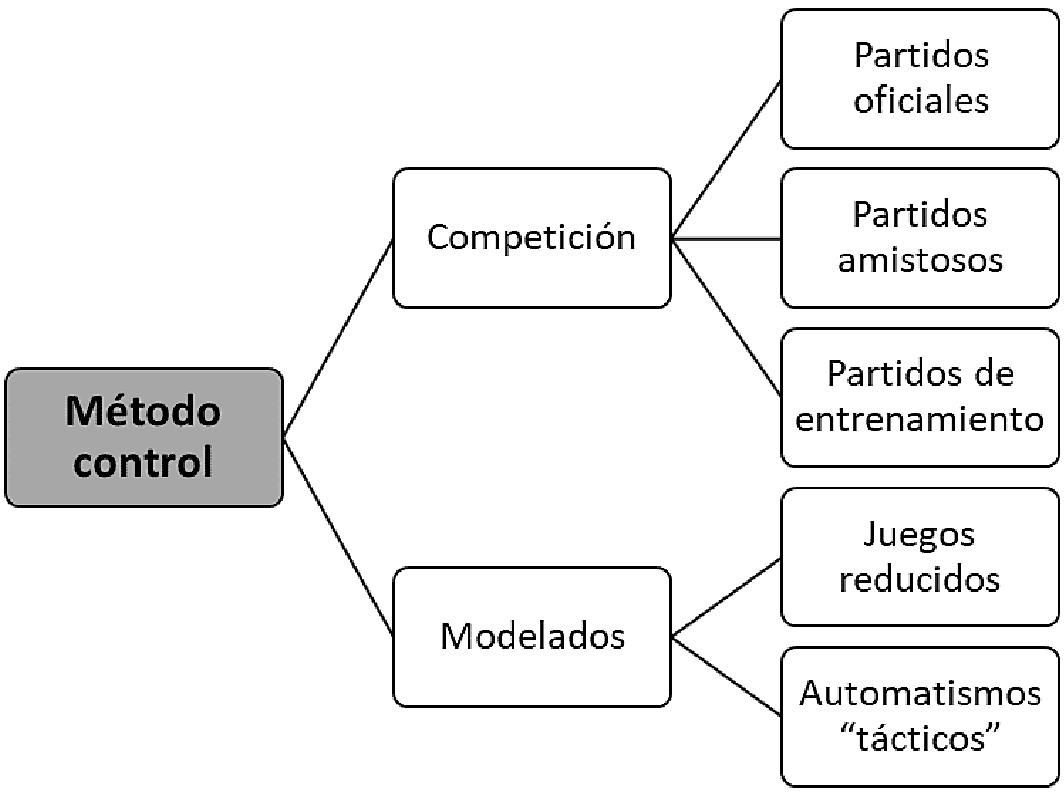
The iterative-segmented method aims to emphasize the development of a single endurance manifestation and follows traditional interval training rules but proposes random duration of stimuli, rest, and intensity. Lastly, we could also consider mixed options combining capacity and power, such as alactic anaerobic power and lactic anaerobic capacity.

Control method

The importance of this method in endurance training increases with the density of the competitive calendar, as seen in elite basketball, where top teams play over 90 games per season. This proposal includes a classification with two elements: small-sided games and tactical automatisms, acknowledging that each category has numerous variants.

The following figure summarizes the classification proposal for this method.

Figure 6: Classification of the control method



Source: Adapted from Solé, 2002

Control method	Competition	Official Matches
		Friendly Matches
		Training Matches
	Modeled Games	Small-sided games
		"Tactical" Automatism

This model clarifies that training matches included in competition tasks are preferential simulation situations of the game, without modifications. However, tasks in the modeled control method group feature variations in the regulations.

In some indoor sports, we might add a new group within the modeled category: possession games.

Since one of the module's objectives, like previous modules — for example, the strength training module — is to design preferential simulation situations to optimize performance and minimize injury risk, this section details the levels of specificity for endurance training. These levels are related to task orientation, training methods, and types of endurance (generic or specific) described earlier.

As a general rule, methods with lower levels of specificity are used at the beginning of a microcycle, evolving towards methods with higher specificity.

The following table shows the relationship between different orientations of endurance manifestations described throughout the module and the levels of approximation. As observed, greater specificity corresponds to greater similarity and specific involvement of structures. Let’s examine the relationship between the degree of involvement of the four structures at each level.

Table 6: Relationship between orientation, specificity levels, intensity, and structure involvement

Type endurance	Orientation	Level	Intensity	Structure involvement level

Specific	Competitive	Level 5	Medium Maximal Supramaximal	
	Special	Level 4	Maximal Supramaximal	
	Directed	Level 3 (> 2 players) Without active defense	Medium Maximal Supramaximal	
		Level 2 (1-2 players) Without active defense	Medium Maximal Supramaximal	
	General	Level 1	Medium Maximal Supramaximal	

Generic	Generic	Level 0 oriented	Low <70 % VO_{2max} Medium >70 % y <85 % VO_{2max} High >90 % VO_{2max}	
Generic	Generic	Level 0 not oriented	Low <70 % VO_{2max} Medium >70 % y <85 % VO_{2max} High >90 % VO_{2max}	

Source: Original work

References: Coor (coordinative structure); Cog (cognitive structure); Con (conditional structure); SA (socio-affective structure).

The following table summarizes the types of generic endurance training, their volume, intensity, and methods.

Table 7: Relationship between types of generic endurance training, volume, intensity, and training methods

Generic endurance			
Training type	**Volume**	**Intensity**	**Method**
Generic 1	Distance slightly longer than covered in a match (4-7 km)	Lower than average game intensity. Approximately at the aerobic threshold	Continuous harmonic
Generic 2	Distance covered in a match (3 to 4 km)	Equal to average game intensity Approximately at the anaerobic threshold	Continuous harmonic Continuous variable Long interval
Generic 3	10% of total time (4-5 min)	Higher than average game intensity	Long interval Medium interval Short interval

Source: Original work

The last two tables, along with the rest of the information included in the module, allow us to design training tasks focused on endurance and performance optimization. Below, we provide various examples to facilitate a better understanding of the previously explained theory and enable the design of endurance training tasks.

The following table presents a series of tasks, which are practical examples that can be modified and adapted according to the sport.

Table 8: Task design according to specificity levels in structured training

Optimizing training
Level 5
3 sets of 5 minutes, simulating a 5-a-side game, with increased game density (no standard time-outs or free throws) 2-3 minutes rest between sets Possession duration < 18 seconds Maximal pace Short modeling
Level 4
Reduced game in a 3-a-side setup on half a basketball court (2 teams at each basket). Start the game on signal, with durations between 24 to 72

seconds (lactic anaerobic capacity) and 10 to 20 seconds (alactic anaerobic capacity) with a density of 1:1. Switch roles between attack and defense as per the game.

2 sets of 10 repetitions with 5 minutes recovery between sets, including low-intensity shooting competitions.

Supramaximal intensity

Iterative segmented method oriented to power

Include various technical-tactical variants (free play, one-on-one, direct block, indirect block).

Level 3

3vs0 in waves with different lane counts (time) in basketball.
Players must reach the opposite court, passing a ball and scoring.
Example: 3vs0, 1 lane in 5 seconds (alactic) + 4 lanes in 24 seconds (lactic)

Density of 1:3 and 1:5, with active pause

Total duration: 5-10 minutes

Monitor effectiveness and set challenges.

Iterative segmented method oriented to power.

Level 2

Circuit with 7 stations involving various movements specific to the modality, either individually or in pairs. Randomly combine efforts of the three energy systems.

Monitor effectiveness and set challenges.

Lactic subtasks: 30 seconds to 1 minute 30 seconds
Alactic subtasks: 10 seconds to 20 seconds
Aerobic transitions between 30 seconds to 1 minute 30 seconds

Intensity: medium (game pace -actions- and/or average heart rate)

Iterative continuous method oriented to capacity

Coadjuvant Training

Level 1

3 sets of 15-10-20-10-20-15-20-10 meters, maximal intensity, with 20-30 seconds rest between repetitions and 3 minutes active recovery between sets. Includes multidirectional displacements specific to the modality on the court.

Level 0 not oriented

- 20 minutes (continuous variable method), alternating running at 85% maximum heart rate with running at 60% in an outdoor space.

- 3 sets of 2 km running in an outdoor space at 85% maximum heart rate, with 3 minutes rest.
-

Level 0 not oriented
- 30 minutes rowing (continuous method) at 65% maximum heart rate.
- 3 sets of 15 minutes stationary bike at 65% maximum heart rate, with 3 minutes rest.

Source: Original work

To conclude this module, it's important to note that during the microcycle, endurance intensity will increase (greater specificity), both in the endurance manifestation and the method used. This general guideline can also be applied during the preseason and competitive season phases.

Which of the following options are associated with endurance training methods in the integrated methodology?

- [ ] Control
- [ ] Specialized
- [ ] Iterative
- [ ] Continuous variable

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