# Integrative Reading

In this module, we will review the topics developed up to this point, with the objective of reinforcing knowledge that we consider indispensable for the completion of this course as well as for the ability to acquire the skills that we expect the students will develop.

We'll start with the history of team sports training, so as to set the context for the methodologies most used today and to try to highlight the most practical ways in which to apply these.

Three different trends exist within training methodologies. They are listed below:

- Pedagogical: based on logical conclusions taken from sports practice, meaning, evidence based. It's largest representative was Matveev (2005),due to the huge success of athletes that worked under his *periodization* regimen.
- Theoretical-teaching: starts using bibliographic references to accompany sports development calling to isolated experimental facts, scientific dissemination and sports physiology. Here we start accessing knowledge on the biology of movement, with resulting growth in the athletes' athletic performance due to more accurate decision-making with regards to training proposals. Despite this, a large portion of training programs continue to use the periodization proposed by Matveev (2005) with some modifications. As is the case of Bompa (2016) who adapts training processes to athletic calendars, using shorter macrocycles. This develops into a training process with more short-term objectives, therefore based on training intensity, rather than volume. As a result, the concept of rest and recovery becomes more important, both intra and inter-trainings.
- Applied science: here the focus of attention is centered on the suggestions of human movement biology based on scientific research. This still promotes greater growth of sport mastery levels. The big areas that make their contribution to this trend are: Movement physiology, biomechanics, bioenergetics, and functional anatomy, among others, in search of the scientific essence in the phenomenon of sports training. From this trend emerge the current training methods, which may come from different philosophies or ideologies:

    - Biological: has an analytical vision of the sport in which the physical performance of technical and tactical components is separated when developing the training program. Here we can

find multidisciplinary working methods, in which each area works in a complementary manner to the others, but all are isolated between themselves, only bringing them all together in formal play which comprises a small percentage of the total training volume.

- Holistic: analyzes the phenomena related to overall performance. The training process is based on this analysis; therefore, the different areas that make up athletic performance are worked on together. Methodologically, we are talking about an integrated effort. Here, technique and tactics are the medium for development of the rest of the capabilities that make up athletic performance. The necessary physical performance levels for athletic success will be delimited by technique and tactics. On the other hand, the difficulties of technical execution and decision-making will be determined by the participants' level and must be adapted to them, otherwise the activity's objective will be lost due to the athletes' inability to perform it.

Without taking methodology or philosophy into consideration, which are fundamental to a team's training program, we can identify three periods that make up an athletic calendar:

- Preparatory period: also known as preseason. From the standpoint of physical performance, this would be the acquisition period, since it is here that the facilitating conditional capacities of athletic performance are developed and increased, as well as endurance, strength, and speed (which is derived in some ways from the former, among other factors).

There are two big premises under which, historically, the concept of preseason has been guided, those which are discussed today, including methodologies proposed, make their disagreement clear. These are, on one hand, the idea that in order to get into good specific form we must maintain a good general form. This doesn't correspond with the principle of specific stimulus training which mentions that adaptations induced by training will be intimately related to the stimulus received. Furthermore, if as a trainer or coach I set up a training process for general physical conditioning based on a high volume and low intensity, I will end up with a group of athletes capable of turning long distances at low intensity, which is far from what we know as athletic performance in situational sports. The times do not match the needs. Five or six weeks is not an adequate amount of time to create adaptations in general in order to, later, start creating specific adaptations.

The other premise comes from the idea that the preparatory period serves to "fill the tank" of athletes, meaning, to provide them with sufficient energy to face the entire competition. The adaptations achieved during

this period should be periodically stimulated during the entire competitive period.

Both premises leave aside a fundamental component of the technical-tactical performance of athletes, which makes this a process of the squad members' adaptation and coadaptation to the model of play.

We should not leave aside some findings like those of Gabbett (2004) from *Rugby League* players, where it was determined that the athlete injury rate during the preparatory period, was largely related to training loads. Furthermore, a reduction of training loads is what is sought, thus pursuing a reduction of the quantity of injuries (without impact). The third factor to keep in mind here is the physical state of the athletes, meaning, we must monitor and manage training loads with the hope of reducing the quantity and severity of injuries, but at the same time not reducing loads significantly enough to generate a reduction in the players' physical shape.

- Competitive period: is understood to be from the beginning to the final stage of competition in which the team participates. From the standpoint of performance, it is known as the maintenance period. What is sought here, as this concept indicates and while it may appear redundant, is to maintain physical performance in order to be able to perform successfully in competition. When we talk about maintaining physical performance and its relationship to athletic performance, it is clear that we need to talk about training loads again. As we can observe in the case of basketball, looking at different seasons of a high competitive level team in Spain, the increase in the amount of training hours and competition during the season meant higher team performance, and created an increase in the quantity of injuries, keeping in mind that competition produces a larger quantity of injuries than training. However, the increase in the quantity of injuries was not sufficient cause for the team to decrease performance. (Caparrós, 2016)

In this period, it should be taken into account that games are the priority, so the exercise plan will be contingent on monitoring loads after arriving in excellent physical performance conditions on the day of the game. Modern training methods base their programming on the time between one game and another, which is generally a week. Thus, a week is the structure of time that new methodologies take as reference to structure training. Let's keep in mind that some teams participate in various competitions at the same time and, thus, usually have a match within a week of another competition. This is something that is considered during the weekly planning or training microcycle. These weekly training cycles are considered to be the optimal unit of time to monitor loads that allows

the team and individuals to arrive to the next match in their best condition. The key factors during the microcycle are the following:

- Recovery with regards to the previous match, physical as well as mental.
- Focus on performance based on the model of play.
- Possibility to develop new principles and sub-principles for offense as well as defense.
- Strengthening of weaknesses and correction of errors detected in previous matches.
- Load monitoring so as to arrive at the next match in optimal conditions.
- Stating of priorities in conjunction with the condition of the team during the tournament, the opponent, and other competitions.

- Transition period: also known as postseason. Is understood as the time between the end of competition and the start of the next preseason. From the point of view of physical performance, it is also known as a period of loss, due to the fact that this includes the players rest or vacation time, physically as well as psychologically. By this we don't mean to say that the player will go through this whole period without training. But, in order to face the next season, it's fundamental to produce a slight decrease in conditional capacities. Let's keep in mind as well that the biggest demand physically, and thus in terms of training, is achieved in-season, due to which, while not having matches during this period, there is an inevitable reduction in the players' physical performance. In this period, the absence from competition is taken advantage of in order to personalize and develop the deficiencies in some other conditional area, weight monitoring, injury recovery, improve flexibility levels if necessary, tactical and technical specialization according to the players position or role in the team, among others.

It is important to remember that the reduction in the players' maximum oxygen consumption is due to a reduction in systolic volume and not capillarization. Consequently, the performance levels of oxygen consumption could be recovered with a few high-intensity sessions.

The three periods mentioned previously are the components of each team's athletic season, which are all customized to the competitive structure, that determines the start and end times of each one of the three periods mentioned. This is known as the athletic calendar.

As an initial step, the team must know perfectly in what conditions they are facing the calendar. Meaning, knowing what resources they have and, based on this, determining the model of play based on the joining of resources, athletic objectives, and the idea of play.

"The construction of theoretical knowledge, based on practice, in each performance sport will be the basis for performance methodology in that athletic specialty. In this way efficiency in practice and knowledge of it will increase". (Rafael Martín Acero & Novoa., (2013))

The sentence quoted above makes it clear to us that the trainer and their technical staff must have absolute knowledge of the calendar of play when programming training, it should be customized based on this in order to achieve improved team performance over the course of competition.

This further strengthens the suggestion for taking the week as the fundamental structure of the training cycle. Let's keep in mind that the match is the moment of greatest psychobiological load, so on the one hand we must monitor training loads and minutes of play so that the majority of our players can arrive at the next match in optimal conditions and, on the other hand, we can precisely use it as a time to synchronously evaluate the physical shape with which the athletes are arriving to a competition, in order to provide week-to-week feedback on the training process.

We referred to the knowledge of the competitive calendar as one of the bases for the development of the model of play. Before this, we must know the particular characteristics of the sport in which we work.

Fundamental qualities of team sports in their acyclical complexes, are detailed below:

- Intermittency: they respond to the constant stopping and starting of the game. This will depend on its regulation, which will determine times, spaces and forms of play.
- Situation: each action generates countless possible reactions in teammates and opponents, successively until the next halt.

On the other hand, we should know the physiological demands of the sport on the following aspects:

- Physically: kilometers ran, speed of movement.
- Biologically: heart rate, blood lactate levels, VO2max.
- Technically : number of passes, shots, element handling.
- Tactically: number of sequences and counter-attacks.

We can draw the following conclusions regarding the mechanical demands of soccer:

- The distances traveled range from 9 to 12 km, with a variation of between 2 and 3 km. The average is around 10 km.
- The average effective playing time is approximately 48 minutes and 39 seconds. This is equal to 54% of total match time.
- The player is standing still or walking for between 40 and 54 minutes. Between 31 and 35 minutes of running at at least 15 km/h. Between 3 and 5 minutes of running at a speed between 15 and 25 km/h. Running only at speeds above 25 km/h occurs between 22 and 170 seconds.
- 51% of actions last less than 20 seconds, while only 9.5% last for more than 60 seconds.
- Regarding rest time, it is observed that the largest quantity of these last between 1 and 20 seconds and make up 75% of the total (round 44 times per match).
- The game density (or working protocol) ranges from 1:1.3 to 1:1.8. In other words, the pauses are slightly longer than the working time.
- Around 130 accelerations and close to 1000 rhythm changes are observed per match. (Solé, 2003).

From a physiological aspect, the conclusions are:

- Heart rate stays close to an average of 170 bpm during a match. Also, during 2/3 of the time of play, players are working at over 85% of maximum HR.
- The average oxygen consumption for the game is 3.5 liters per minute. This equals 76% of VO2max. Different percentages of VO2 are seen in relation to the position held: 69% for defenders, 66% for mid-fielders and 43.3% for forwards. Total estimated energy expenditure is 1530 Kcal in 90 minutes.
- Lactate values are found to be between 3 and 8 mMol/l and the individual variations can be from 2 to 12 mMol/l. There is a smaller concentration in the second part of the match, and the total distance covered and high intensity play also reduces this period.
- Although at times lactate concentration is elevated in active muscles, the constant recovery phases and intermediate as well as low intensity periods allow for quick elimination and reutilization of blood lactate, preventing it from reaching value limits.
- Muscle glycogen is of key importance during the match, since it is predominately used and can be exhausted prematurely.
- Soccer can be defined as a mixed sport in that, despite the long duration of exertion in which the aerobic system provides constant energy, there is a large number of explosive actions that require an anaerobic energy supply.
- The participation of the anaerobic alactic metabolism during the game is very important quantitatively because it is one of the main elements responsible for the decisive actions in a game (reflected in

the explosive force of the lower limbs and the speeds of very short runs).

Based on what we have seen, we'll do a brief review of the development of characteristics that we consider to be of overarching significance for physical performance in team sports.

With regards to endurance development, Massafret (1998) identifies the following objectives:

- Withstand physical as well as mental exhaustion during time of play, the match, and throughout the season.
- Accelerate the recovery process in between the drops in rhythm, micro and macropauses of the game, and between training and matches.
- Maintain optimum level of player performance in technical execution and decision-making.

Fundamental causes of general endurance training

- Creating a foundation for extensive technical, as well as tactical, training.
- Increase the capacity to withstand the rhythm of play needed to participate in the match at a high play rate for longer.
- Improve recovery capacity, both in-game and in between matches and training.
- Reduce injury risk caused by fatigue or by lack of rapid response, in facing unexpected situations.
- Improve mental capacity to withstand prolonged exertion.
- Diminish the loss of technical and tactical performance due to fatigue;
- To have a greater recovery capacity between maximum exertions.
- To improve health.

- Specific endurance training

the objective is to achieve that the player can connect their endurance levels to greater tactical and technical quality. It is for this reason that specific endurance development Solé (2003) is centered around three key points, that we will describe below:

- Technical endurance training: technique refinement, adapted to real-game energy demands.
- Endurance training in decision-making: the objective is for the different intensities under which the game occurs to not reduce the technical performance of the player or the team.

- Game endurance training: by way of a competitive training method, what is intended is to bring in what was developed in both previous sections to real game-time situations. This requires activities that have competitive components and whose rules are similar to those of the formal game.

- Optimization of specific endurance training

The specific endurance training proposal is based on the repeating and interval methods A good way to increase training specificity is to replace rests with active recovery, with the objective of simulating what happens during the game. For this, we must analyze what the range, intensity, and activity frequency is for maximum intensity as well as moderate intensity activities during our teams matches, and thus, use them as parameters when developing the activities.

The repeating method comes from the divided method in situational sports training, only that it takes variation in intensities and movement speeds in the stimulus as its main quality and, of course, the variation in rest for both type (active or passive) and time. Therefore, the player will encounter a certain randomness when exercising that will prevent them from establishing a precise working and rest rhythm.

For this method to give results, the trainer must know the most frequent working and rest times at different intensities that occur in the sport for which they are training.

This method considers the use of technical as well as decision-making elements of the sport, since it is based on the dynamic systems theory and, therefore, considers the game as a whole that cannot be developed if separated into components.

One of the parameters currently used most to determine the physical performance of the team's athletes is the ability to repeat sprints. This is due to game actions that are known as athletic success generators, meaning, those involved in transformative moments, have an intensity component intimately related to that of sprints. All goal actions include explosive, quick, maximum force, and agility movements. Furthermore, the ability of an athlete to be able to maintain the quality of these types of movements through repetitions tell us that this subject can participate in a greater amount these types of movements during a match. This means that the RSA is related to fatigue. Therefore, the other important concept to achieve high performance levels in these sports is fatigue recovery and tolerance to it.

In basketball they carry out approximately one thousand actions per match, each between two and five seconds. Furthermore, it is clear that

the greater ability to repeat these types of action with the greatest effectiveness possible and without reducing their performance, will lead to greater athletic performance. The same happens in soccer, within the 8 to 12 km that a player covers with the 800 different manifestations of mostly fast movement.

The main mechanisms that cause fatigue are the following:

- Substrate depletion.
- Metabolite accumulation.
- Increase in core temperature.
- Muscle damage induced by exercise.
- Hydro electrolyte alterations.
- Modifications in branch chain amino acids.
- Free radicals.
- Immune system depression.

As described above based on the development of fundamental physical qualities and the influence of fatigue on physical performance, we consider load monitoring fundamental so that the team members are in their greatest levels of physical performance for as long as possible, within the competition period.

Below, we present two training methods that come from the dynamic systems theory

1) Tactical periodization

This methodology comes from the thought that the game of soccer is a whole, a product of the way in which its different elements relate to each other. Furthermore, nothing assures us that we can achieve improvements in the game's components if we train in an isolated way. On the contrary, everything must be strengthened and improved within the medium which we want to develop. For this, the whole training process must be influenced by the model of play.

Then, considering that the activities will have real in-game components, these shall have an objective based on what we want the players to be able to do when it comes time to competing. It is important to note that tactical periodization is not a model of play, but rather a training method. Meaning, a working method to be able to capture, through training, the week's work in the match and in competition. Not everyone who uses tactical periodization as a training method necessarily have the same model of play. However, everything that tactical periodization uses must have a model of play as a principle of action.

The elements that influence the model of play's conformation are:

- The culture of the place where we want to propose the idea of play.
- History and culture of the club.
- Structure and objectives of the club.
- The coach's idea of play
- The game system or systems that we are going to use.
- Characteristics and level of the players.
- The club's championship history.

The aim is to make the greatest quantity of players, in the shortest time possible and under specific stimulus, respond in the same way or under the same concept of play. Furthermore, this training program model will attempt, through work, for these patterns of tactical response to be transformed into habits. It is in this way that the tactical aspect is where development of all other areas is deduced, collectively as well as individually. The physical abilities will depend on the tactics and will be developed through it, similar to technical strategic capabilities. Always consider that the tactical concept here doesn't simply refer to decision-making and general behavior, instead it refers to specific issues that they bring to the model of play. The model of play is going to determine, through individual and collective behavior, the physiological, bioenergetic, mechanical and even technical necessities for each player in relation to their team and their position.

The morpho-cyclic pattern is the temporary structure that guides this methodology, which is, not coincidentally, about a week, this being the time between one match and another. We should train the idea of play, principles, sub-principles, correct errors, strengthen virtues, and develop what we want the team to do in the next match. The exercises will always be related to the type of play that we want from our team.(Tamarit, 2007)

2) Structured training

Within the current training methods, we also find structured training, developed by Francisco Seirul.lo Vargas. To achieve a better analysis of this work-structuring method, we will look at a few concepts considered to be fundamental.

Tasks: or preferential simulated situations (PSS), they are modified and accepted play situations designed to favor some of our players' structures over others. This is where the name PSS comes from. This is how we will call each activity that is developed as a part of training. This is composed by content, which will become actual exercise, and by the conditions that are going to define it during execution, meaning, the intensity, repetitions, rest time, instruction, among others. Depending on the task's similarity

with play, we will have its specificity. Thus, we find ourselves with tasks of different natures, as we describe below:

- Generic in nature: totally different from the competition in its fundamental nature and load organization aspects. They are given habitually in the transition period and seek to improve some conditional ability or skill in particular.
- General in nature: The organization and nature of the load is equal to that of the competition, but decision-making is null.
- Directed in nature: Include specific coordinated components and non-specific decision-making. Mainly applied to technical circuits that include the stimulus of one of the player's physical capabilities.
- Special in nature: organization and nature of the load is equal to that of the competition and decision-making is specific based on the competition. Also known as small-sided game.
- Competitive in nature: composed of the contents of the competition with concrete tactical principles. Also known as expanded games. This is considered as the step before the formal game. (Roca, s.f.)
- Load dynamics within the microcycle

For this method, training load management is based on two components:

  - Volume: determined by total training time.
  - Intensity: determined by specificity of proposed task load and by heart rate. Both indicators increase through the week as the competition draws nearer. The only data that doesn't increase is the average heart rate during training, due to the increase in rest times during training to avoid fatigue in moments close to match-day.

During preseason, loads should gradually increase. Volume is high from the start, gradually increases to 100% two weeks before the start of competition. The microcycle before the start of the championship will have a volume of 50% of that used during competition.

Intensity, on the other hand, starts off lower with progressive growth. The maximum level of intensity reached in preseason is 70% to 80%.

During the league, it is recommended to use uniform loads, with uniform volume and intensity levels (as much as possible). As the league continues, the levels will be modified. Volume will reduce and intensity will increase.

The basic temporary unit for load managing will be the microcycle or training week, which in the case of this method will be called the Structured Microcycle. This will largely depend on the needs of the player. It will be used as reference for the next microcycle, just as it will depend on previous ones, for its organization, seeking to create sequences and interrelations.

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