Conditioning in team sports games

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TITLE

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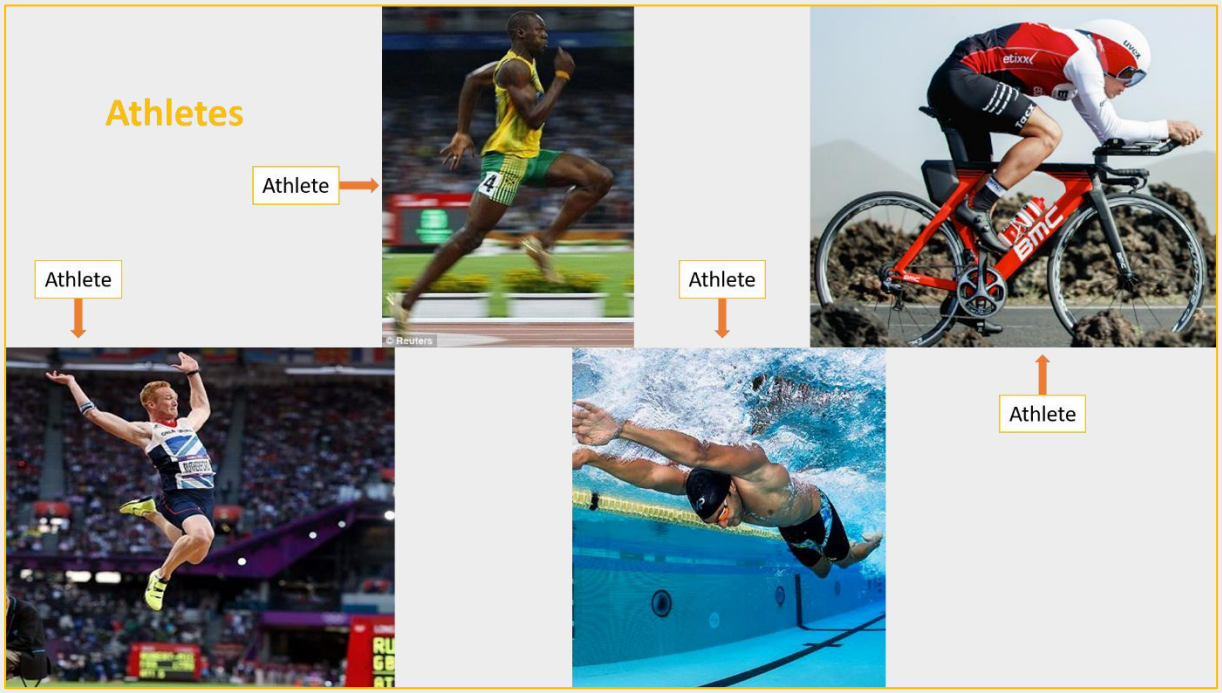
1. Conditioning specificity: Player or Athlete?

When comparing these 2 groups of sportsmen, we notice that we are not talking about '*different breed*' but about '*different species*'! In order to know why, we should define '*who*' is '*who*' in this context. ***Athletes*** are sportsmen coming from sports and sports disciplines without too much of a social engagement and, as such, they mostly rely on their abilities (Wolf-Wendel, Toma, & Morphew, 2001). On the other hand, ***Players*** play with the ball, they have considerable social interaction and they primarily rely on their skills (O'Sullivan, Zuckerman, & Kraft, 1998).

Picture 1 *Athletes rely mostly on their abilities*



There is no doubt that approaches to the athletes' conditioning is somehow different from the players' conditioning. Why? Differences are influenced by many factors that, in the end, create ***specific approach to conditioning training of the players*** – in particular players in team sports games (Nia & Besharat, 2010). Of course, one may try to coach them like athletes but most of the time it will result in ***a lot of conflicts, doubts and disputes that will, eventually, create disloyal and unconfident relationship*** with the conditioning coach (Van de Pol & Kavussanu, 2012).

In order to understand better differences between coaching athletes and coaching players, explanation of the specificity principle should be addressed. SAID or '*specific*

adaptations to imposed demands' is a term introduced by Baechle et al. (2008) and it generally refers to '*physiological adaptations depend on specific stimuli*' (Baechle & Earle, 2008). The essence of **training specificity** is that training responses elicited by a given exercise mode are directly related to the physiological elements of specific exercise stress (Kraemer & Gómez, 2001).

Picture 2 *Players rely mostly on their skills*

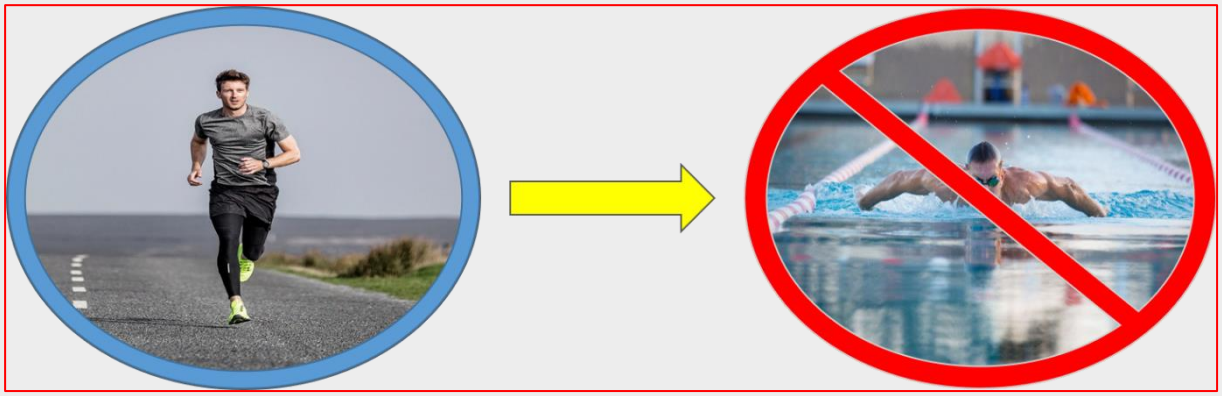
In other words, if you coach athletes in endurance sport and you focus primarily on endurance training, your progress will be significant. But when coaching players, things become different since coaching players is dominantly focused on training skills and social interaction manipulations. ***For players, abilities are there to help them execute skills more efficiently and implement tactics.***

Training specificity principle has three levels: ***metabolic specificity***, ***biomechanical specificity*** and ***psycho-social specificity***. For better playing performance, we need to train our players under physical effort similarly to the competition ones, in the movement patters similarly to the competition ones and, if being exposed to mental stress, then similarly to the competition ones, as well (Mujika, Halson, Burke, Balagué, & Farrow, 2018).

1.1. METABOLIC SPECIFICITY

Simply said*, physiological demands of training must be as similar as possible to physiological demands of a competition*. If we transfer it to the metabolic level: *aerobic training develops aerobic features but it does not develop anaerobic features (and vice versa).* For example, at the top levels, it is impossible to enhance swimming performance with dry aerobic training. In team sports games metabolic demands, quite often, depend on both aerobic and anaerobic systems. Thus, conditioning coach needs to find methods of training that stress both energetic systems at once (e.g. *Tabata* interval training).

Picture 3 *Running cannot enhance swimming performance at the top level!*



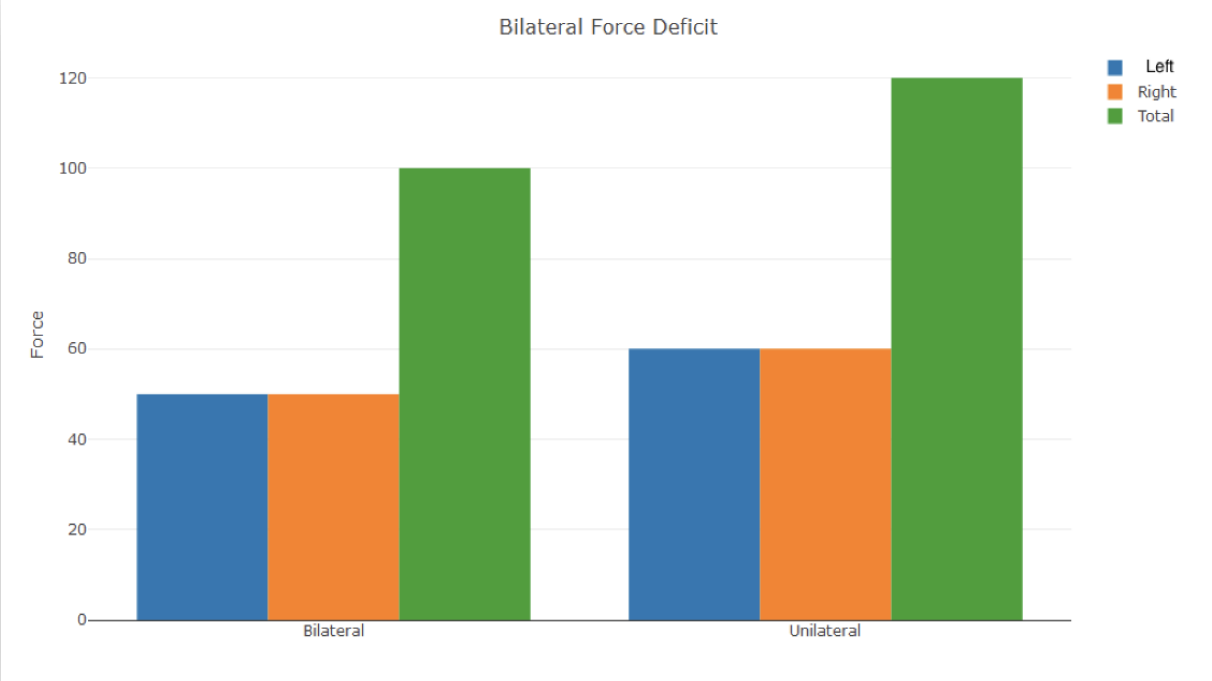
1.2. BIOMEHANICAL SPECIFICITY

Better strength responses in particular mode of strength training (Morrissey, Harman, & Johnson, 1995). If we want our players to move fast and explosively, we need to train them that way: fast and explosively! Dynamic conditions need dynamic stimuli → dynamic training regimen! Biomechanical specificity is easily explained by '*Bilateral Deficit phenomenon in cyclists*. Cyclist's movement contains sequences in which he pushes the pedal with one leg and then with another. This is referred to as unilateral movement. When testing force production on leg press, cyclist will produce more force when performing it with one leg (unilateral) than with both legs (bilateral) (Løvmo, 2011). Why? It is because they perform unilateral movement repeatedly during training and competition which, actually, represents the essence of their performance. On the other hand, bilateral movement is a kind of movement in which their muscle and nervous systems are not adapted (Picture 4). When we put this in the context of player's conditioning, it appears that training must be modelled in a way that players move the way they move during the competition. This principle should be respected in all exercises and training models.

1.3. PSYCHO-SOCIAL SPECIFICITY

In other words: ***For players in team sports games physical and mental capabilities are decisively linked!*** When developing any of the motor abilities with players in team sports games, psycho-sociological factors need to be taken into consideration. This is specifically important for cognitive, perceptual, motivational and emotional elements of performance (Akelaitis & Malinauskas, 2018; Kizildag & Tiryaki, 2012). It is not just about executing power or strength but about coaching players how to use those abilities in real game situations, too (M. Stone, Plisk, & Collins, 2002).

Picture 4 *Bilateral deficit phenomenon in cyclists – cyclist produce much more force when using movement that is natural in their sport – unilateral leg push*



Disproportionate **coaching of physiological and biomechanical principles may weaken mental skills development, such as: perception, decision-making and anticipation!** In the majority of team sports games, mentioned skills are more important than physical capacities (Baker, Cote, & Abernethy, 2003). Therefore, training in such a way is rather ineffective, counterproductive and disadvantageous for players.

There are 3 major differences when training athletes *vs.* players in the context of psycho-social specificity. These are:

1) Selection

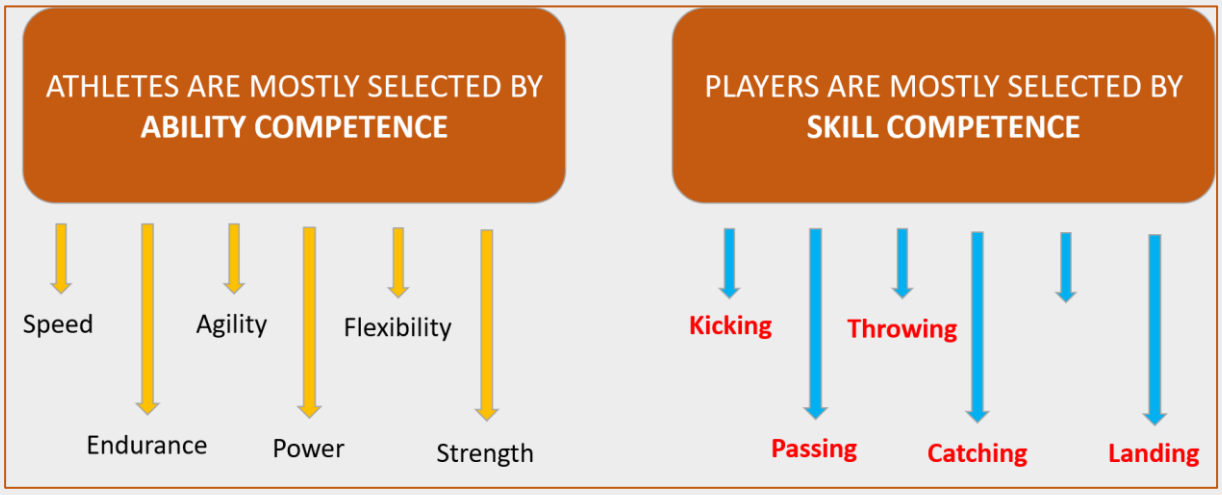
2) Social environment

3) Structure of the competition

Selection differences

Differences in selection are about the ***selection competence***. ***Athletes are mostly selected according to the ability competence while the players are mostly selected according to their skill competence*** (Trninić, Papić, Trninić, & Vukičević, 2008). When selecting an athlete, coaches dominantly look for ability features (Picture 5). On the contrary, when selecting a player, coaches dominantly look for skills (Burgess & Naughton, 2010; Johnston, Wattie, Schorer, & Baker, 2018). For a player in a given sport, it is more important to know how he manages the ball control than how fast he can run. This is because speed can be compensated with other factors while technical and tactical skills cannot. Also, ***in every team sports game skills are the foundation for the successful performance!***

Picture 5 *Competence of selection – abilities vs. skills*



Social environment difference

Sports social environment consists of 3 major factors that have significant influence on an athlete's/player's behaviour (Ribeiro, Silva, Duarte, Davids, & Garganta, 2017). They are:

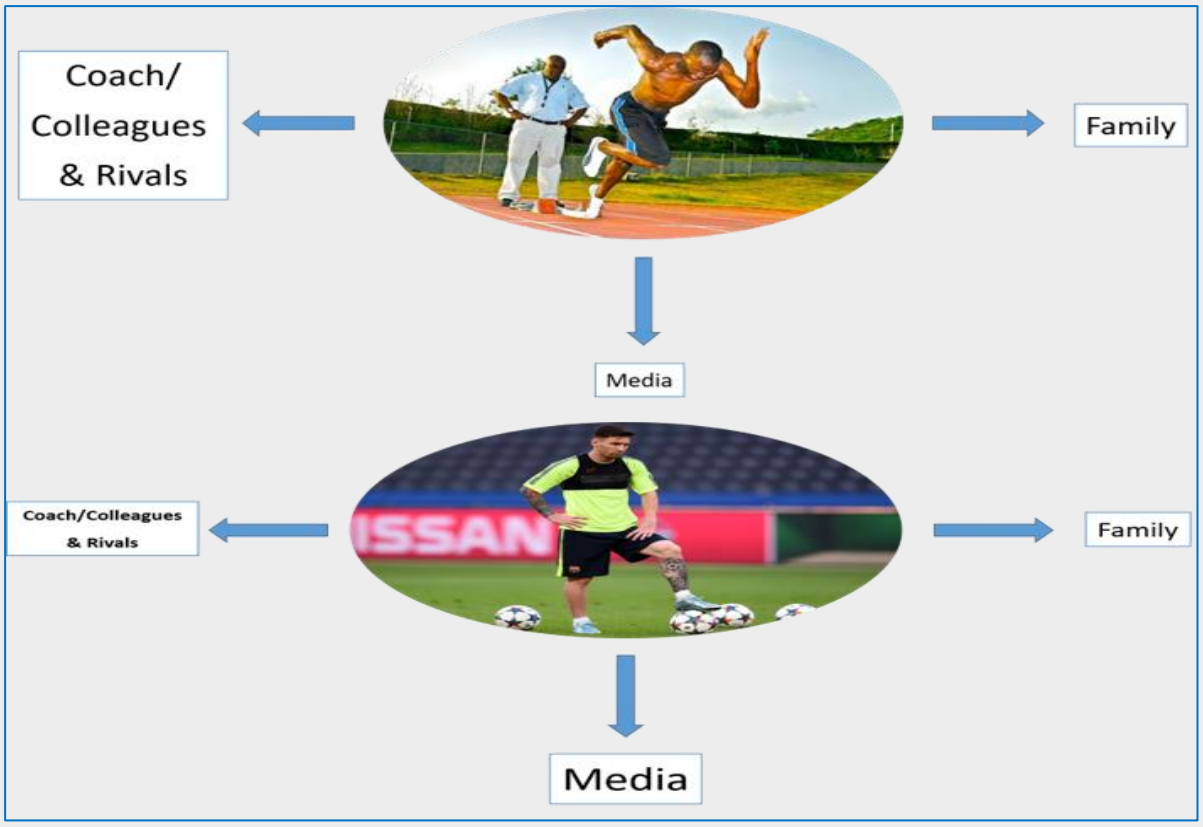
a) Relations to the coach, colleagues and rivals

b) Relations to family members

c) Relations to the media and perception of media importance

As seen in the Picture 6, athletes are very connected to their families but have huge respect for their coaches and colleagues. On the contrary, the media has enormous influence on player's behaviour (Piepiora, 2021; Singh, 2016). Respecting coach, colleagues and rivals is not at the top of the player's priority list. When working with players as a conditioning coach, we must have the aforementioned in our mind and we should be aware of '*our position within the pack*'. Even the head coaches have a lot of trouble establishing authority and respect when working with nowadays players. This phenomenon is present with younger age categories, too (Danioni & Barni, 2019). Discussed issue does not mean that the conditioning coach cannot positively influence player's behaviour, but rather that he needs to use different methods and '*more complex mind games*' than with the athletes when aiming to achieve training goals.

Picture 6 *Social environment difference is reflected through the relations with coach, colleagues, rivals, family and the media*



Different structure of the competition

Athlete's and player's competition structure ultimately differs in two things:

1 Competition frequency - athletes have significantly less competitions than players. This is present even in the youngest age categories. While the child who trains track and field has 1 or 2 competitions per year, his peers in soccer have 20 to 30 games per year. This makes a huge difference. On the senior level, differences are even more significant. In some professional team sports (e.g. handball, football or basketball) players have 2 games per week and competitive season can last up to 10 months (Issurin, 2010).

2 Nature of the competition - athletes primarily compete against themselves while players primarily compete against their opponents. Athletes are opposing themselves towards the stopwatch, distance they need to cover or weight they need to overcome. On the other hand, players are first and foremost focus on playing against their opponents. They do not have to do the best they can but just be better than their opponents. There are much more interferences that occur during team sports games than during an athletic competitions (Akelaitis & Malinauskas, 2018). Fans, coaches, referees, opponents are just some of those factors that can significantly influence player's performance during the game (Picture 7) (Popovych et al., 2020).

Picture 7 *Differences in the structure and nature of competition influences training approach*

1.4. SPECIFIC SPORTS CULTURE IN TEAM SPORTS GAMES

All of the above-mentioned psycho-social factors and differences in selection, social environment and nature of competition generate **specific sports culture**.

Coach uses ***a lot of associates,*** assistant coaches, conditioning coaches, performance analysists, goalkeepers' coach, etc. (Lebed, 2013). Although this causes multiple social connections, the connections are rarely strong. Typically, the ***more robust the team, the weaker the social connectedness between the team members*** (Duarte, Araújo, Correia, & Davids, 2012).

Also, significant ***influence of the media***, even from a very young age, can shape '***star behaviour***' (Kennedy, 2010). Media tends to boost players' ego, confirming, at the same time their value. But sometimes media can also create false value. ***Entertainment industry, sponsors and fans*** can also have strong impact on player's mindset (Picture 8). This can sometimes help build player's confidence but it can also cause an effect of overconfidence which is not good for the team sport and it is most likely that it will ruin player's career.

Another important factor that shapes sports culture is ***significant bigger income*** (salary) when comparing to an individual basic sports, such as: track & field, swimming or gymnastics (Antonietti, 2006). If we consider that players' salaries are quite often higher than coaches', it comes as no surprise that coaches in the contemporary team sports games have become very expendable. Consequently, if the player knows that his value is bigger than coach's, he probably also knows that, in any serious dispute between them, the coach will be the one who must leave the institution (club or national team). For the sake of keeping their job positions, coaches sometimes act like a babysitter to their players.

Picture 8 *Some of the elements that create sports culture in team sports games*

1.5. SPECIFIC CONDITIONING APPROACH IN TEAM SPORTS GAMES

As shown in Picture 9, specific conditioning training approach is the result of the specific sports culture and its impact on the player's mindset.

Picture 9 *Formation process of specific conditioning approach in team sports games*

In the text above, we have explained the reasons and genesis of this process. Now we would like to recommend you some practical principles that might help conditioning coach in team sports games:

1 Using small testing battery with exact tests that give as much information as possible/using too many tests will be very demotivating for players and results will be unreliable. Use only specific tests that can help a player enhance his performance.

2 Constant motivation during the training session/players need to be constantly motivated since they have a lot of distractions that can turn them off the right path.

3 Building confidence in relationship with players and avoiding conflicts/players need to trust their conditioning coach. Only when players believe him, the coach will have a chance to carry out his training plan and draw out the best from his players.

4 Conditioning coach needs to know and 'understand' the demands of the game/for modelling effective training, knowledge of the game demand is very important. That does not just apply having knowledge on the physical demands but on the psycho-social demands of the game, too.

5 Microcycle is the most important unit of periodization/as large part of conditioning coach's job is occurring during the competitive season, planning and implementation of microcycle is very important. Conditioning coach must be involved in all parts of sports preparation of microcycle (not just conditioning) and must help and advice the head coach on this matter.

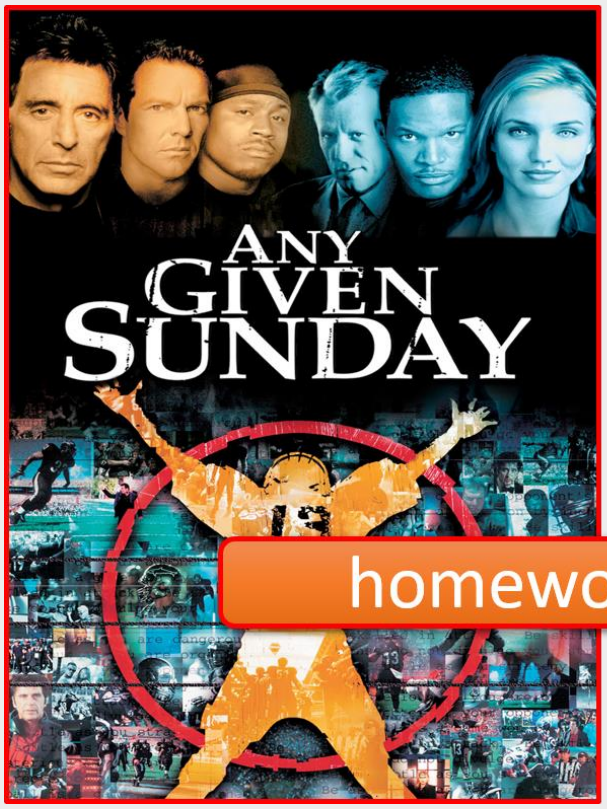
6 Most of the time, the job of a conditioning coach in team sports games is not the development of abilities but maintaining capacities and keeping players healthy/the worst player in the team is the one who does not play. Injuries are the biggest enemy of all sportsmen and reducing its rate and severity is something that the conditioning coach can contribute a lot. Every head coach and player will be grateful for this to the conditioning coach.

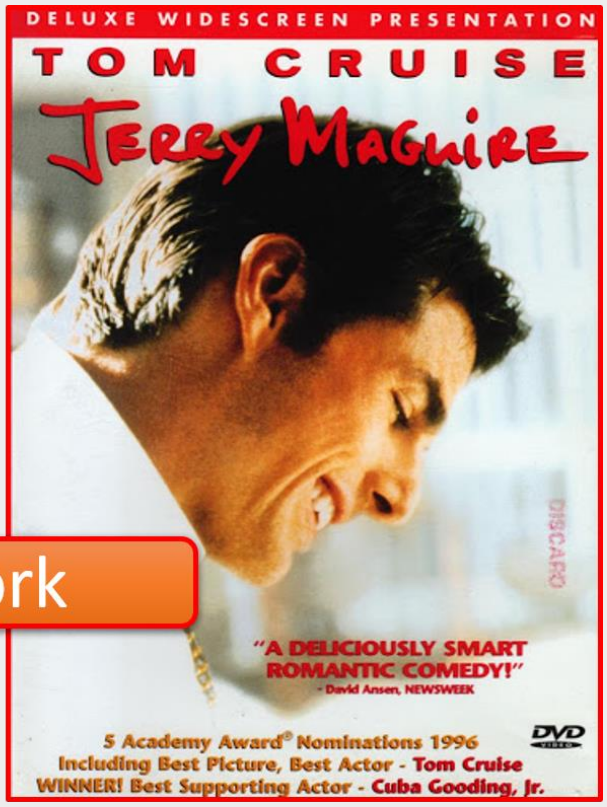
Homework

For homework, watch 2 movies that will help you understand better specific sports culture in team sports games:

1) Jerry Maguire

2) Any given Sunday





Summary

→ Athletes primarily rely on their abilities while players primarily rely on their skills.

→ Specificity principle is foundation for the better understanding of the difference between players and athletes.

→ Training specificity principle has 3 levels: metabolic specificity, biomechanical specificity and psycho-social specificity.

→ Psycho-social specificity is the most important for the understanding of conditioning in team sports games.

→ In team sports games, physical and mental capabilities are irrevocably linked.

→ Excessive coaching of only physiological and/or biomechanical principles will block the development of technical, tactical and mental skills.

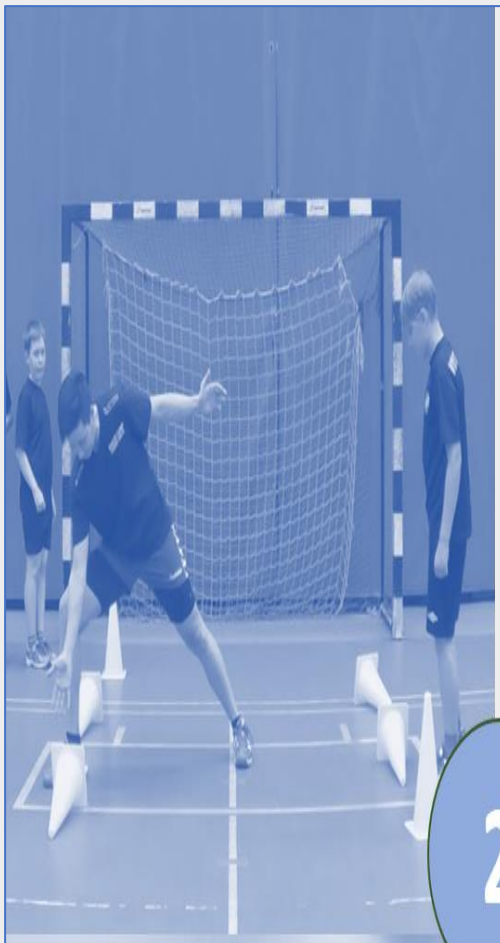
→ 3 biggest psycho-social differences between athletes and players are: selection, social environment and structure of the competition.

→ Selection, social environment and nature of competition generate specific sports culture in team sports games.

→ Specific sports culture in team sports games is influenced by many factors, such as: robust team, media, entertainment industry, sponsors, fans or big salaries

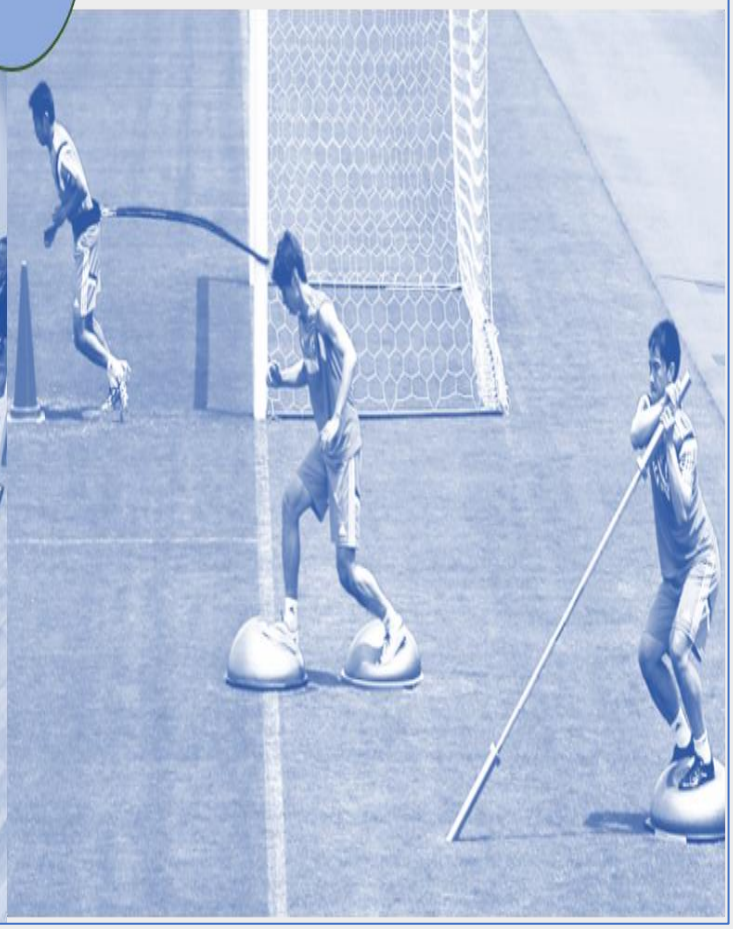
→ Specific conditioning training approach is the result of the specific sports culture and its impact on player's mindset.

→ Conditioning training approach in team sports games has 6 principles: small test battery, motivation, building confidence with players, understanding game demands, microcycle planning and injury reduction.



Basic, specific and situational conditioning in team sports games

2



2. Basic, specific and situational conditioning in team sports games

Every conditioning program in team sports games needs to stimulate players in the most effective way. It must try to develop all player's capacities with maximal respect to competition schedule and technical-tactical training requirements. Nevertheless, the biggest obstacle for the program design, in team sports games, is **TIME**. The majority of team sports games has very long competition season; some of them even longer than 9 months (Table 1). When looking at Table 1, we must take into consideration that "*No competition season*" refers to time between the end of the previous competition season and the beginning of new competition (Issurin, 2010). This period consists of "*off season period*" and "*preparation period*".

Table 1 *Top level team sports competition characteristics / national team competitions and continental competitions are not included*

Nr.	Competition	Period	Competition season duration	No competition season duration
1.	***NBA***	22.10. – 21.06.	9 months	123 days
2.	***Euroleague basketball***	03.10. – 20.05.	8 months	136 days
3.	***Handball DKB***	23.08. – 09.06.	10 months	25 days
4.	***Serie A***	24.08 – 24.05.	9 months	92 days
5.	***Premier league***	09.08. – 17.05.	9 months	84 days
6.	***UEFA Champions League***	17.09 – 30.05.	9 months	110 days
7.	***EHF Champions League***	11.09. – 31.05.	9 months	103 days
8.	**AVERAGE**	**August – June**	**9 months**	**94,14 days**

For example, the world strongest handball league, *DKB Bundes liga,* runs from 23rd of August to 9th June (Debanne & Laffaye, 2017). It means that players must compete for almost 10 months. It is evident that preparation period is very short (less than 1 month) and that during the off-season period players cannot get enough rest nor can they enhance their capacities levels. The off-season period serves only for detrain and rest. Also, it must be considered that the majority of players that play in top leagues also play for their national teams. These top leagues halt their competition during celebrations of World championships, Continental championships and Olympic games. In such a way, players participate in several different competitions during the season (national championship, club continental championship and national team championship). So, instead of resting, players have more

competition and even less time for conditioning development than they should. Consequently, the most ***important part of conditioning program is one that occurs during competition period***.

Coach together with strength and conditioning coach must synchronize all parts of sports preparation: **conditioning**, **technique**, **tactic** and **psycho-social preparation**. Every head coach has his own idea of a play. This idea dictates the playing system which represents the foundation for the training system development (Bangsbo & Peitersen, 2000). Strength coach is in charge of preparing players for the demands of the playing system. He is not there to show "*what he knows*" but to integrate his knowledge into ideas of the head coach and the system of the play (Reid, Morgan, & Whiteside, 2016). He must be aware of what is possible to achieve in these conditions and how to do it. For this reason, it is very important that strength and conditioning coach understands the demands of the game and of the playing system.

Following this, there are 3 modes of conditioning which intertwine in conditioning programs of all team sports games:

1) Basic conditioning

2) Specific conditioning

3) Situational conditioning

Logic behind these training modes of conditioning is straightforward: ***player must be technically and tactically prepared but technique and tactic must be executed with highest intensity of strength, power, speed and agility***. If the player trains just technique and tactic, neglecting conditioning, he will not be able to play on the highest level and most probably will be much more susceptible to injuries. On the other side, if the player exaggerates with conditioning, and ignores technical and tactical part of training, the result will be the same – lack of high performance. So, the idea is to integrate all of the elements together (Schelling & Torres-Ronda, 2016). Especially if we have already detected that time is a huge issue and that it is not efficient to train mentioned elements separately – like in individual sports (e.g. track and field, swimming, rowing).

One of the ways how to do it is by training basic abilities, specific abilities and situational abilities in the same training cycle. For this purpose, we need to define what are the characteristics of these types of conditioning.

2.1. BASIC CONDITIONING

This mode of strength and conditioning is focused on the development and maintenance of basic motor abilities and functional (energetic) capacities. *Basic motor abilities are those that we use in natural form of movements,* such as: jumping, running, kicking or throwing. Natural form of movements is essential part of every team sports game movements structure (Michalsik & Aagaard, 2015). There are 7 basic motor abilities; ***strength, speed, agility, balance, coordination, flexibility, precision*** and one that we define as functional (energetic) ability – ***endurance***. They are the foundation for the development of specific motor abilities. For example, if some player has explosive upper extremities (as basic motor ability combined with good shooting technique), it is expected that he can develop "strong shoot" in handball. "Strong shoot" in handball represents specific motor ability (Picture 1).

Picture 1. *Example of basic and specific ability in handball – medicine ball jump throw (1) and handball jump shoot (2)*

Basic motor abilities do not depend on the player's technique but they can help better execution of mentioned skills. This is especially evident in sports game movement skills that

have minimum of technique involvement, e.g. sprint or cutting movement with the ball in football (picture 2). Every player must have decent level of basic motor abilities as good foundation for *developing specific and situational abilities*, *effective recovery, effective movement patterns* and *protecting himself against severe injury occurrence*.

When training basic motor abilities, it is very easy to control training load and parameters, such as: volume and intensity (Vanrenterghem, Nedergaard, Robinson, & Drust, 2017). As training advance to more specificity, these variables become harder to control. This is another advantage of basic conditioning in team sports games. Strength is the only ability that cannot be developed in situational mode and very hard in specific mode. This is why it has to be done through the basic conditioning mode.

Generally speaking, basic conditioning is the pillar of high performance but if not connected with other two types of conditioning, the transfer on high performance in team sports games will be very low.

Picture 2. *Sprint and change of direction movement with the ball in football – basic and specific motor abilities*

2.2. SPECIFIC CONDITIONING

This mode of strength and conditioning is focused on the development and maintenance of specific motor abilities and specific functional/energetic capacities (Scanlan,

Wen, Tucker, Borges, & Dalbo, 2014). It is the first level of specificity principle utilization in conditioning of team sports games.

Specific motor abilities are a combination of basic abilities and sport technique. The coach needs to connect elements of basic abilities with associated technique in a logical sequence. For example, if we want a player to run faster while dribbling the ball, it will not be achieved just with fast running training. So, the coach needs to create exercises in which a player will run as fast as possible while dribbling the ball. Players need to be guided throughout the exercises by technique correction while gradually increasing intensity of execution.

Transfer to better playing performance could be seen in part of the game technique enhancement. Controlling training load is a little bit more difficult than in basic conditioning mode since the player needs to be focused, not just on intensity, but also on proper skill execution. Some strength dimensions could be developed in this mode of training but not all of them.

2.3. SITUATIONAL CONDITIONING

Situational conditioning is the mode of strength and conditioning focused on development and maintenance of situational motor abilities and functional/energetic capacities. It is the second level of specificity principle utilization in conditioning of team sports games. *Situational motor abilities are a combination of sports specific abilities and tactical skills.* Exercises are dominantly oriented toward development of tactical skills for the given sport, such as: decision making, playing system enforcement, anticipation, etc. They should be executed with high speed and intensity – sometimes even higher than during the game (Iacono, Eliakim, & Meckel, 2015). In this way, players adapt their abilities and technique to the system of play. Undoubtedly, some abilities are easier to incorporate in this training mode than the others. It is recommended to train endurance capacities for game using this type of conditioning. Good example of situational conditioning are small-sided games that are often used in handball, football, basketball etc (Hill-Haas, Dawson, Impellizzeri, & Coutts, 2011; Iacono et al., 2015; McCormick et al., 2012). There is a huge amount of scientific work on the "small-sided games" topic and majority of authors recommend this way of training as a substitution to basic endurance training (Picture 3).

Conversely, it is very hard to train strength dimensions in situational training mode in team sports games because it is impossible to establish controlled conditions for its development. If the coach cannot control volume or intensity during strength training, he is entering a "*grey zone*" of conditioning in which many bad things can happen to players – particularly injuries. Therefore, strength should be trained and coached with basic and specific conditioning modes.

Picture 3. *Many scientific works verified value of small-sided games training*


SMALL-SIDED GAMES IN TEAM SPORTS TRAINING: A BRIEF REVIEW

JAMEL HALOUANI,[1] HAMDI CHTOUROU,[1,2] TIM GABBETT,[3,4] ANIS CHAOUACHI,[1] AND KARIM CHAMARI[5]

ORIGINAL RESEARCH

Heart Rate Responses During Small-Sided Games and Short Intermittent Running Training in Elite Soccer Players: A Comparative Study

Dellal, Alexandre[1,2,3]; Chamari, Karim[3]; Pintus, Antonio[4]; Girard, Olivier[5]; Cotte, Thierry[6]; Keller, Dominique[1,2]

2.4. UTILIZATION OF BSS TRAINING MODES

As shown in Table 2, every training mode has advantages and disadvantages. This is why the coach needs to know strategies for utilization of the BSS (basic-specific-situational) training modes.

Table 2. *Comparison of different conditioning types advantages and disadvantages*

Conditioning type	Advantages	Disadvantages
Basic conditioning	→ Easier to train → Faster to learn → Doesn't demand mental effort like other types → Easy to control training load	→ Low transfer on playing performance → Demands a lot of time for supercompensation → Sometimes boring
Specific conditioning	→ Connects basic ability with skills and sport technique → For players interesting to train	→ Medium transfer on playing performance → Harder to control training load → Demands knowledge of sports technique
Situational conditioning	→ High transfer on playing performance → Combines tactical and physical elements of conditioning → High intensity in game situations	→ Impossible to control training load → Strength can't be train in this mode

Anyway, as time available for preparation and competition schedule impose the way of training, there are two main methods of utilization:

1) Mode dominant method / having more time for preparation coach separates training program in 3 periods. In every period one training mode becomes the dominant one in the conditioning program. These periods can be of equal or unequal duration. If the coach estimates that the team needs to develop more particular abilities, than he will emphasize that the training mode should be held during more days. But sequence always starts with the basic training mode, continues with specific and finishes with situational training mode. For example, if the team has 3 weeks for preparation, in the 1st week the basic training mode will dominate; in the 2nd week the specific training mode will dominate and in the 3rd situational mode of conditioning training will dominate.

Table 3. *Example of "Mode dominant method" in 3 weeks cycle*

MC	Micro-cycle 1					Micro-cycle 2					Micro-cycle 3				
TR	*M*	*T*	*W*	*T*	*F*	*M*	*T*	*W*	*T*	*F*	*M*	*T*	*W*	*T*	*F*
AM		TE	BC	TE	BC		TE	SC	SC	TA		TE	SIC	TE	TE
PM	BC	TA	TE	TA	TA	SC	TA	TA	TA	TA	SIC	SIC	TA	SIC	TA

Legend: BC – Basic conditioning mode, SC – Specific conditioning mode, SIC – Situational conditioning mode

2) Combined method / In situations when there is not enough time, all 3 training modes can be combined in one micro-cycle. In this way, the coach decides which is the best way to maintain abilities that are of the highest importance for performance efficiency. Modes are mixed regarding the existing situation of the team and players. This mode is less effective for abilities development but are more effective for their maintenance when players participate in many competitions over short time of period.

Table 4. *Example of "Combined method" in 2 weeks cycle*

MC	Micro-cycle 1					Micro-cycle 2				
TR	*M*	*T*	*W*	*T*	*F*	*M*	*T*	*W*	*T*	*F*
AM	BC	TE	SC	TE	BC		TE	SC	SC	BC
PM		SIC	TA	TA	SIC	SC	SIC	TA	SIC	TA

Legend: BC – Basic conditioning mode, SC – Specific conditioning mode, SIC – Situational conditioning mode

Homework

1) Create 1 basic motor ability training in a chosen team sports game (e.g. basic speed development in football)

Form for creating conditioning training of basic abilities

SPORT	Handball		
TRAINING MODE	Basic		
AIM	Speed		
EXERCISE 1	Sprint 20 meters		
	SETS	REPS	PAUSE
	3	3	1 min
EXERCISE 2	Sprint 30 meters		
	SETS	REPS	PAUSE
	2	2	2 min
EXERCISE 2	Sprint 10 m after visual signal		
	SETS	REPS	PAUSE
	1	5	2 min

2) Create 1 specific motor ability training in chosen team sports game (e.g. specific speed development in basketball)

Form for creating conditioning training of specific abilities

SPORT	Handball		
TRAINING MODE	Specific		
AIM	Speed and agility		
EXERCISE 1	Fast break opening after agility ladders drills		
	SETS	REPS	PAUSE
	2	3	1 min
EXERCISE 2	Fast break shoot without opposition (1 vs. 0)		
	SETS	REPS	PAUSE
	2	2	2 min
EXERCISE 2	Fast break shoot after defensive movement (1 vs. 0)		
	SETS	REPS	PAUSE
	5	2	2 min

3) Create 1 situational ability training in chosen team sports game (e.g. situational agility development in handball)

Form for creating conditioning training of situational abilities

SPORT	Handball		
TRAINING MODE	Situational		
AIM	Speed, agility & endurance		
EXERCISE 1	3 vs. 2 attack transition / defenders set		
	SETS	REPS	PAUSE
	3	3	1 min
EXERCISE 2	3 vs. 2 attack transition / defenders retrieving from center		
	SETS	REPS	PAUSE
	2	2	2 min
EXERCISE 2	3 vs. 3 attack transition + defence transition		
	SETS	REPS	PAUSE
	1	5	2 min

Summary

→ *Basic abilities are those that we use in natural form of movement.*

→ *Specific motor abilities are the combination of basic abilities and sport technique.*

→ *Situational motor abilities are the combination of sports specific abilities and tactical skills.*

→ *Basic, specific and situational conditioning modes should be utilized in team sports games training.*

→ *Each of the utilization frequencies depends on the competition schedule – more competition more specific and situational conditioning, less competition (or breaks) – more basic and specific conditioning.*

→ *Utilization of basic, specific and situational conditioning modes differs in different team sports games and should be adopted to the game demands.*

→ *Every training mode has its advantages and disadvantages and it should be used accordingly of the coach's estimation what is most important in the given moment – no magic formula.*

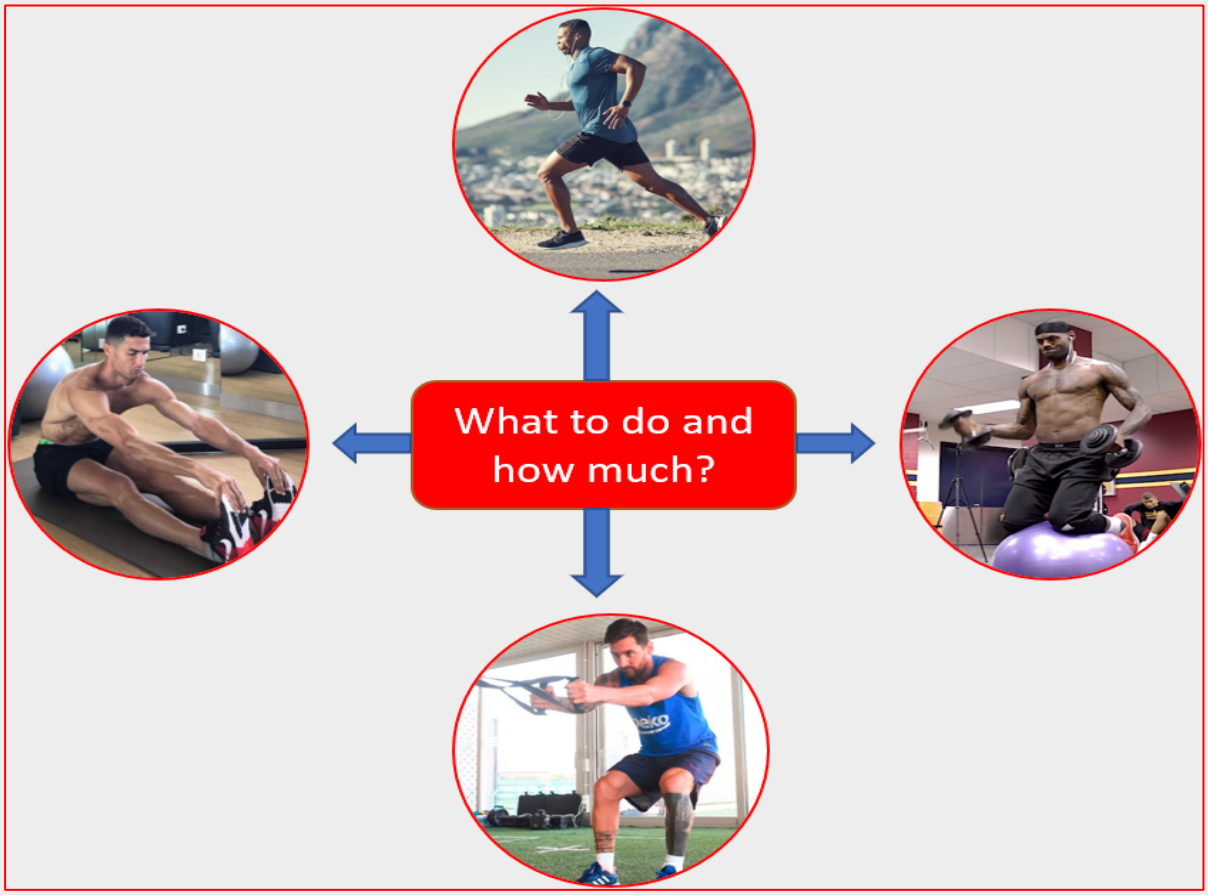
Physical demands of different sports games

3

3. Physical demands of different sports games

Most of us will agree that players need to train – not just play their sport? Yes or no? Sure! They need to train in some way, be coached in some training system. This means that they need to be loaded and stressed so that they can develop their physical capacities (Gamble, 2013). Sure! A coach must set some training rules and variables, such as: intensity or volume or time or distance or rest periods (Martens, 2012). Sure! Or all of it in a logical way which optimize player's performance. But according to what? According to which criteria? Why, how, how much or when (Picture 1)?

Picture 1. *What to do and how much? – A question that every coach asks himself*



Most of the training systems are developed according to the coach's *personal training habits*, *playing experience*, *system of training that she/he experienced as a player* or (maybe most expected criteria) according to ***impression*** or ***feeling for the training*** (Picture 2).

But when asked questions about energetic capacities, movement structure frequency, kinetic parameters or metabolic dynamics – variables that characterize training and

competition - the answers are far away from reality. And not just that! There is a number of coaches that tend to ***create training myths about conditioning*** in a given sport (Martens, 2012). These myths often lead to failed training systems that do not work in practice.

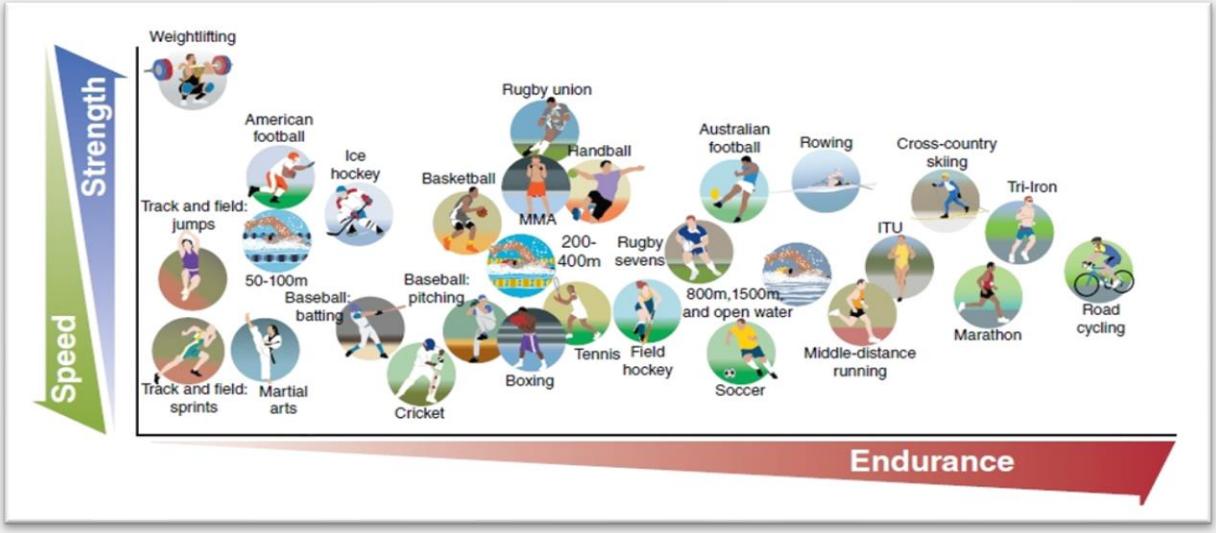
Picture 2. *Birth of training myths - impressions and feeling for training*

Another approach, that is also wrong in team sports games conditioning, is the one in which **conditioning coach uses just the principles of basic conditioning in any sport he works**. He has the same way of training, uses the same exercises, training methods and principles when coaching basketball, football and/or handball team. In general, ***this conditioning style places emphasis on basic conditioning mostly, ignoring specific and situational***. Well, this "modus operandi" may work in individual sports with the very long preparation periods and activities that depend on the "*raw basic capacities*". But this approach has limited usefulness in team sports games since it has insufficient transfer to playing performance and the player's game efficiency. It is common with coaches that have background in basic sports, such as: track and field or Olympic weightlifting.

It is important to detect why it is wrong to use the same approach and training principles (especially basic ability dominant) with different sports games. The answer is very simple: ***different sports games have different demands*** (Picture 3)! **These demands of the game may be technical and physical!** Understanding them is essential for talent identification but also for creating balanced and efficient conditioning program in any sports game. Every conditioning coach must be familiar with the character of stress that players overcome during the competition. Having enough scientific supported knowledge about it (not myths) can help

him design training system that will enable players to adapt to that stress and be more resilient to its negative effects, such as possible injury occurrence (Bloomfield, Polman, & O'Donoghue, 2007; Karcher & Buchheit, 2014).

Picture 3. *Different sport – different demands – in relation to speed-strength-endurance*



There are 5 groups of parameters that define game demands:

1) Kinematic / parameters that describe "game physics" (dimensions, velocities, time, etc.).

2) Kinetic / biomechanical parameters that describe the player's movement structure during the game. There are 2 sub-groups: ***natural movement forms*** (gross motor skills) and ***technical activity*** (sport technique movement characteristics).

3) Metabolic / parameters connected with the player's metabolic response to game stress (hormones, biomarkers, lactates, heart rate, etc.).

4) Psycho-social / parameters that represent psychological load and social interaction characteristics typical for the given team sports competition.

5) Anthropometrical / parameters of morphological characteristics, especially important for team sports games with huge differences on different playing positions.

So, conditioning coach chooses, from these group parameters, those that are valuable to him for creating **playing profile** that, in the end, determines the training system. He has 4 major concerns (Picture 4): strength, speed (power and agility), endurance and injury reduction.

Picture 4. *Conditioning coach major concerns that must be connected with game demands*

All 4 of them should be addressed in relation to game demands:

1) STRENGTH / Questions: What type of strength is the most important for the player's performance? In which movements do the players use it? Answers: kinetic parameters should be analysed → technical and basic movement activities.

2) SPEED (POWER & AGILITY) / Questions: What type of speed is the most important in the player's performance? In which movements do the players use it? How fast must the player move during the game? Answers: kinetic and kinematic parameters should be analysed → technical and basic movement activities and velocity of movement.

3) ENDURANCE / Questions: What type of energetic system is stressed (aerobic or anaerobic)? What kind of anaerobic system (glycolytic or phosphagen)? Aerobic-anaerobic ration? Game duration? Rest intervals? Answers: metabolic & kinematic parameters should be analysed → heart rate, biomarkers, distances and velocities.

4) INJURY REDUCTION / Questions: Injury prevalence? Which injuries are the most typical and when they are occurring? Where do they occur (anatomically)? Which syndromes are the most common? Which risk factors to take into consideration? Answers: medical reports and kinetic parameters should be analysed → technical and basic movement activities.

If the conditioning coach knows which question to ask, he also must know where to find the answers. There are 2 different ways of game demands recognition:

1) Scientific articles research / implies reading sports science articles and materials that deal with the "game demands issue" (Picture 5). In this way the coach can notify relevant information and use it for the program design. It is important to choose accurate keywords

during the database research. Here are some of them that can be useful: "*game demands*", "*match demands*", "*physical demands*", "*physiological demands*", "*game activity*", "*training load*", "*playing profile*", etc.

Picture 5. *Sports science articles of the "game demands" are the best source for conditioning concept creation*


PHYSIOLOGICAL AREA

Match demands of elite preadolescent team handball players: a preliminary study

Requisiti in partita dei giocatori scelti preadolescenti di pallamano a squadre: studio preliminare

Journal of Science and Medicine in Sport

Original paper

Match demands of professional Futsal: A case study

RUGBY SEVENS MATCH DEMANDS AND MEASUREMENT OF PERFORMANCE: A REVIEW

Sports Med

SYSTEMATIC REVIEW

The Activity Demands and Physiological Responses Encountered During Basketball Match-Play: A Systematic Review

2) Visual monitoring and analysing of the competition / sometimes when the coach finds the relevant data in the literature review, he can analyse competition itself. Analyses like this are mostly limited to some technical activity frequency but this does not mean that this is useless. On the contrary, when connected with some internal load measures, this data can give the coach very important insight of some specific player's endeavour. For example, defence contact counts and heart rate during the handball match.

One of the tools that can help the coach in creating conditioning concept is the "*game demands screen*" (Table 1). The coach "just" needs to find data in scientific articles about different features for sports game that he works with and tag it (highlighted with yellow colour in Table 1). In this way he gets raw game characteristics template that will allow him to create "*conditioning concept*". Consequently, conditioning concept is used as a background for training program design. It is not a problem to pick a training method if you have appropriate conditioning concept that relies on objective data. For example, if you have detected that the most important strength type is the maximal strength then you know how to develop it. But if you have detected wrong strength type, you will design wrong training program. Accordingly, your players will not be adapted to competitive stress which could lead to weak

performance and injury occurrence. Therefore, the process of conditioning program design in team sports games should go through the following phases (Picture 6):

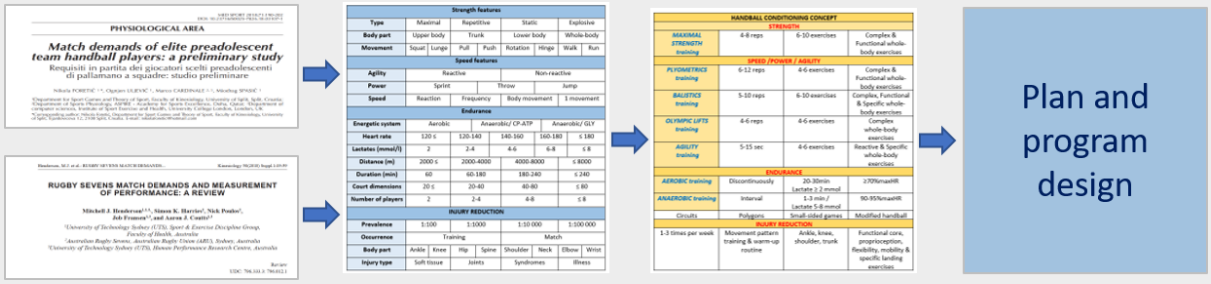
1) Finding relevant scientific articles of the game demands

2) Tagging the most important features considering strength, speed, endurance & injury prevention

3) Creating conditioning concept

4) Designing conditioning training program

Picture 6. *The process of conditioning concept creation and the plan and program design*



In the end, we must be aware that, as every different team sports game has different demands, every playing position also has its own specificities. Specificities of playing position are not characterized just by technical and tactical roles but, very often, by physical demands. In some sports, this is more evident that in the others. Generally speaking, games with more players have more playing positions (García, Vázquez-Guerrero, Castellano, Casals, & Schelling, 2020; Karcher & Buchheit, 2014). All of them should be treated in the same way as different sports games. Generally, this is not an easy task; therefore, coaches can homogenize process of conditioning concept by cutting on 2-4 typical playing positions. Anyhow, this is another topic that will be discussed later.

Table 1. *Team sports game demands screen / example of handball*

Strength features								
Type	Maximal		Repetitive		Static		Explosive	
Body part	Upper body		Trunk		Lower body		Whole-body	
Movement	Squat	Lunge	Pull	Push	Rotation	Hinge	Walk	Run
Speed features								
Agility	Reactive				Non-reactive			
Power	Sprint			Throw			Jump	
Speed	Reaction		Frequency		Body movement		1 movement	
Endurance								
Energetic system	Aerobic			Anaerobic/ CP-ATP			Anaerobic/ GLYC	
Heart rate	<70%		70-80%		80-90%	90-95%	> 95%	
Lactates (mmol/l)	2		2-3,5		3,5-5	5-8	≤ 8	
Distance (m)	2000 ≤		2000-4000		4000-8000		≤ 8000	
Duration (min)	60		60-180		180-240		≤ 240	
Court dimension	20 ≤		20-40		40-80		≤ 80	
Players per team	2		3-6		6-10		≤ 10	
Injury reduction								
Cause	Traumatic				Overuse			
Occurrence	Training				Match			
Body part	Ankle	Knee	LPHC	Spine	Shoulder	Neck	Elbow	Wrist
Tissue	Muscle		Ligaments/tendons		Bones		Joints	
Type	Sprain		Rupture		Fracture	Dislocation	Contusion	

Table 2. *Handball conditioning concept developed according to game demands screen*

HANDBALL CONDITIONING CONCEPT			
STRENGTH			
MAXIMAL STRENGTH training	4-8 reps	6-10 exercises	Complex & Functional whole-body exercises
SPEED /POWER / AGILITY			
PLYOMETRICS training	6-12 reps	4-6 exercises	Complex & Functional whole-body exercises
BALISTICS training	5-10 reps	6-10 exercises	Complex, Functional & Specific whole-body exercises
OLYMPIC LIFTS training	4-6 reps	4-6 exercises	Complex whole-body exercises
AGILITY training	5-15 sec	4-6 exercises	Reactive & Specific whole-body exercises
ENDURANCE			
AEROBIC training	Discontinuously	20-30min Lactate ≥ 2 mmol	≥70%maxHR
ANAEROBIC training	Interval	1-3 min / Lactate 5-8 mmol	90-95%maxHR
Circuits	Polygons	Small-sided games	Modified handball
INJURY REDUCTION			
1-3 times per week	Movement pattern training & warm-up routine	Ankle, knee, shoulder, trunk	Functional core, proprioception, flexibility, mobility & specific landing exercises

Homework

Create a conditioning concept for any team sports game using the *"team sports game demands screen".* When finished, cite references you have used.

Strength features								
Type	Maximal		Repetitive		Static		Explosive	
Body part	Upper body		Trunk		Lower body		Whole-body	
Movement	Squat	Lunge	Pull	Push	Rotation	Hinge	Walk	Run
Speed features								
Agility	Reactive				Non-reactive			
Power	Sprint			Throw		Jump		
Speed	Reaction		Frequency		Body movement		1 movement	
Endurance								
Energetic system	Aerobic			Anaerobic/ CP-ATP			Anaerobic/ GLYC	
Heart rate	<70%		70-80%		80-90%		90-95%	> 95%
Lactates (mmol/l)	2		2-3,5		3,5-5		5-8	≤ 8
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Duration (min)	60		60-180		180-240		≤ 240	
Court dimension	20 ≤		20-40		40-80		≤ 80	
Players per team	2		3-6		6-10		≤ 10	
Injury reduction								
Cause	Traumatic				Overuse			
Occurrence	Training				Match			
Body part	Ankle	Knee	LPHC	Spine	Shoulder	Neck	Elbow	Wrist
Tissue	Muscle		Ligaments/tendons		Bones		Joints	
Type	Sprain		Rupture		Fracture		Dislocation	Contusion

Summary

→ Due to the lack of data and knowledge, coaches are inclining to create training myths and training systems according to their personal experiences, impressions and/or "training feeling".

→ Common wrong approach in team sports games is the conditioning based on principles and ignorance of specific and situational.

→ Different sports games have different demands and these demands may be technical and physical.

→ 5 groups of parameters that define game demands are: kinematic, kinetic, metabolic, psycho-social and anthropometrical.

→ For creating training system, the conditioning coach has 4 major concerns: strength, speed (power and agility), endurance and injury reduction.

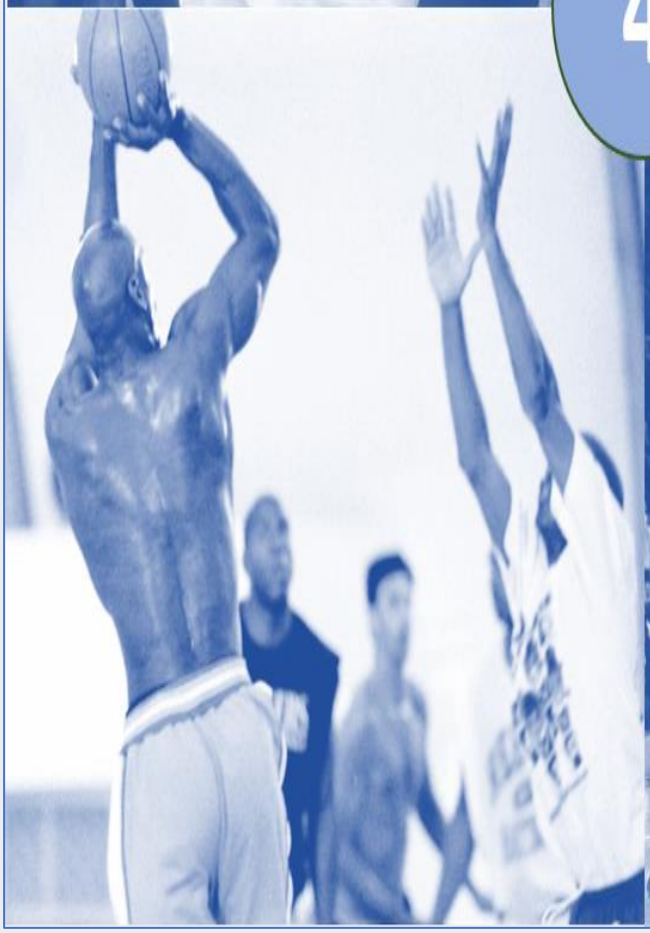
→ 2 different ways of game demands recognition are scientific articles research and visual monitoring and analysing of the competition.

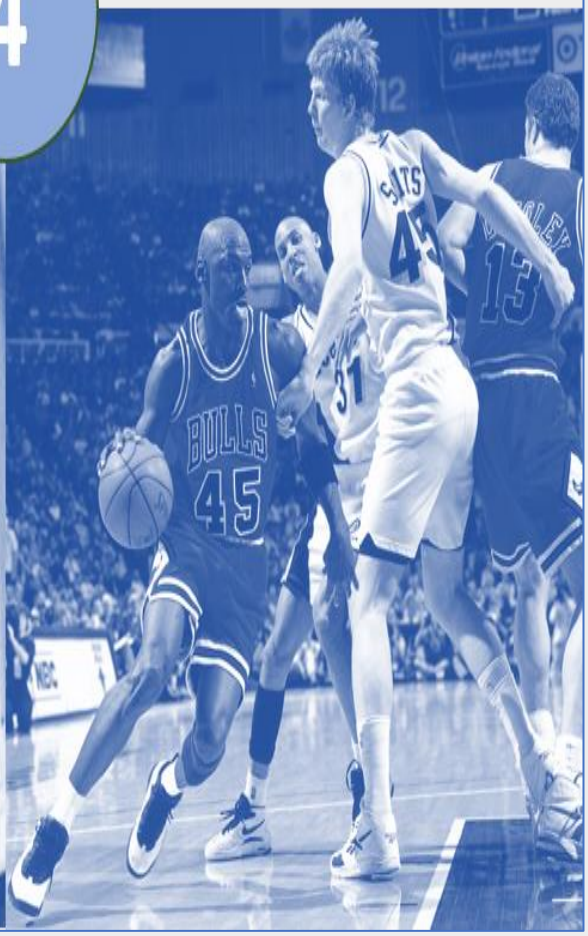
→ The "game demands screen" is a tool for establishing conditioning concept.

→ The process of conditioning in team sports games should be the following: finding relevant scientific articles of the game demands, tagging most important features considering strength, speed, endurance & injury prevention, creating conditioning concept and finally designing conditioning training program.

Microcycle planning in team sports games

4





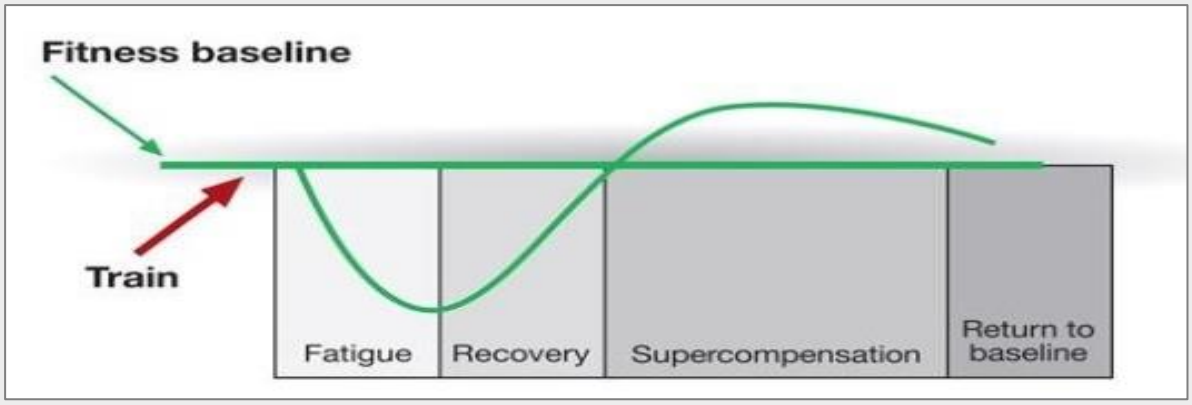
4. Microcycle planning in team sports games

4.1. PERIODIZATION

One of the most difficult parts in managing the training process is planning and programming of the training work. Planning is based on diagnostic procedures of the current state and assumption of the desired state that we want to reach in a certain period of time. For this purpose, we use periodization of work by which we set goals and tasks that should be realized in the observed period. **Periodization is, therefore, a process of dividing a training program into smaller time segments so as to ensure optimum sports form in the most important competitions** (Bompa, 2000). These smaller segments are known as macro-, mezzo- and micro cycles.

Periodization is based on the theoretical framework called the ***General Adaptation Syndrome*** **(GAS)** that explains how athlete's body reacts and adopts to specific sports stressor (Verkhoshansky, 2012). According to the GAS, when an athlete is exposed to stressor, i.e. training, shock or an alarm occurs as a first reaction. After that, the organism starts adapting to stress in order to increase its specific abilities that are targeted. This phase is known as the supercompensation. If the organism continues to be exposed to stress, this can cause exhaustion, maladaptation and eventually an over trained state. For this reason, periodization is used to manipulate with the stress and recovery periods and adaptation effects in general (Gamble, 2006). The GAS paradigm was effectively updated with the ***Fitness fatigue model*** (Chiu & Barnes, 2003). There are 2 major improvements in *Fitness fatigue model*: firstly, *Fitness Fatigue Model* distinguishes actions of a given stressor on individual neuromuscular from the metabolic systems; secondly, opposed to the single common response described by the GAS, it describes a dual adaptive response that results in both fitness and fatigue after-effects (Gamble, 2006).

Picture 1. *Super compensation*



In general, sports season can be divided in three main parts:

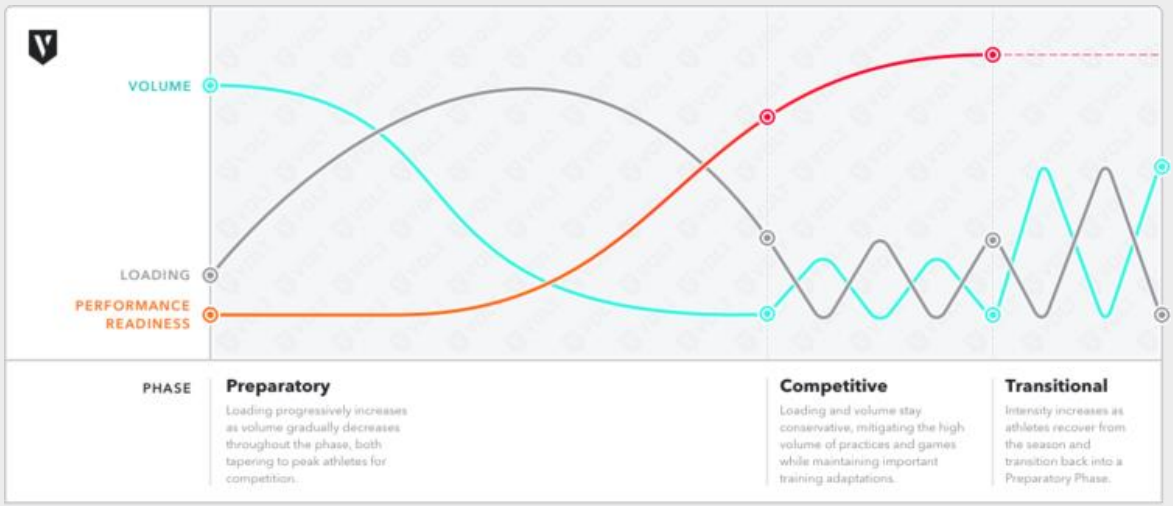
1) Preparation period

2) Competition period

3) Offseason

Today, there are a lot of periodization models in sport that are usually classified depending on whether we are talking about individual or team sports. Individual sports are characterized by 1 or 2 major competitions during the season and therefore all the efforts of coaches and athletes are aimed at the peaking of the sports form at particular event. Classical periodization model consists of prolonged training cycles arranged in such a way so as to gradually prepare players for the peak of the form for the most important competition of the season.

Picture 2. *Annual periodization in individual sports*



On the other hand, in team sports games, competitive season lasts at least 35 weeks during which teams have from 20 (American Football) to more than 80 games (Football, Basketball…). Although some consider the end of season (April to June) as the most important one, athletes' good shape on every particular game during the season, actually, stands as the most crucial one. This implies completely different periodization strategies in team sports games when compared to individual sports. Considering this and the fact that coaches have the team of 30 individuals with different characteristics and abilities, it is evident that planning in team sports games is a very delicate thing (Lyakh et al., 2016).

4.2. TEAM SPORTS GAMES SEASON

Gamble (2006) emphasizes couple of challenges coaches face during periodization in team sports games:

- Extended season of competition – Frequent matches and extended competition period disables coaches to use classical periodization model.

- Multiple training goals – Team sports games require working on many anthropological aspects of athletes (e.g. hypertrophy, maximum strength, explosive power, metabolic conditioning and injury prevention) and all of this should be done in harmony with the particular periods of the season.

- Interaction of strength and endurance training – From the aspect of fatigue and differential and also incompatible hormonal responses, coaches must be careful when combining strength training with metabolic conditioning.

- Time limit imposed by technical and tactical training – As season approaches, in particular during the competitive period, the focal point of the trainings are mostly tactical and technical aspects of each sport. Therefore, strength and conditioning coaches have to adjust to that short period of time they have available, in the best possible way.

- Impact of physical stress from games – The game represents maximum level of physiological and psychological stress for players. Therefore, the volume and intensity of training in the recovery phase, i.e. in the days after the game is limited and needs to be carefully controlled.

One season in team sports games consist of the following parts:

Preparation period – Usually lasts from 4 to 8 weeks (depending of sport and league) during which the development of the player's strength and conditioning is of high importance and requires large part of the training process. Amount of strength and conditioning contents gradually decreases as the competitive season approaches. The goal of this period is to get players on high level of physical performance for the start of the season.

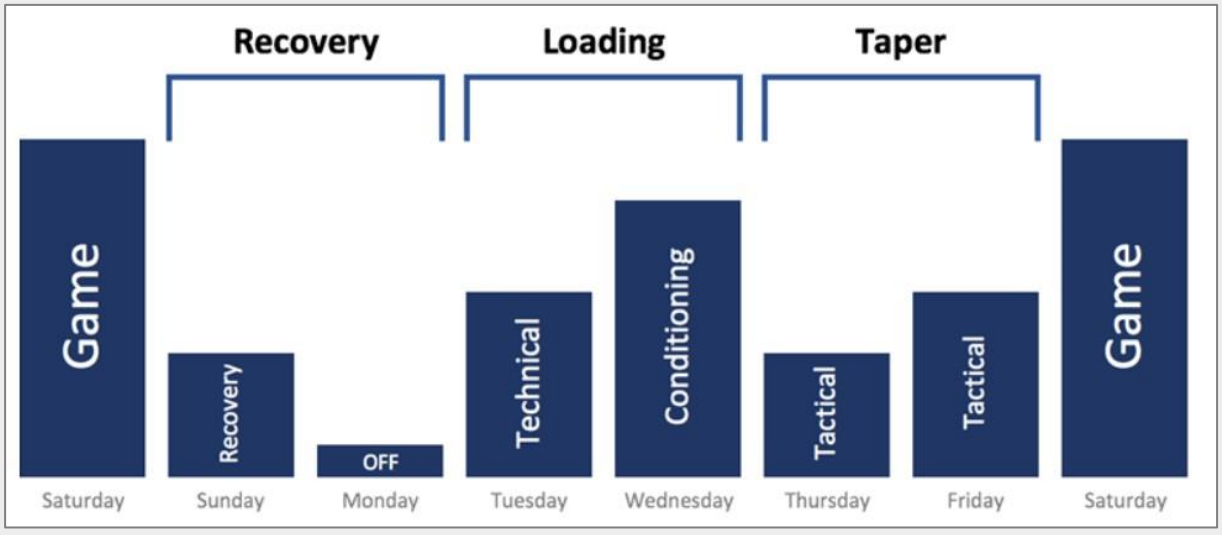
Competition period – It lasts around 35 weeks and consists of microcycles created depending on the match schedule. During this period, the goal is to maintain high level of sports form and to prepare players for each game. These microcycles can last from 3 to 14 days but coaches usually make plans on weekly basis.

Offseason – After all competitions are over, players must recover from exhausting season in total. After some period of passive rest, it is very important that players start with light training in order not to completely lose strength and conditioning capacities.

4.3 TEAM SPORTS GAMES MICROCYCLES

Considering the scope of this course, in the following sections we will focus on the microcycle planning throughout the competition period. Also, in the concrete example of football, we will show specific guidelines regarding planning and programming the training process. As previously indicated, microcycle can last from 3 to 14 days but for the simplicity reasons, we will be using classical calendar week of 7 days with only 1 game at weekends.

Picture 3. *Microcycle example*



Microcycles can furthermore be divided in 3 blocks:

1) Recovery

2) Loading

3) Taper

Each mini-block has a specific purpose and specific variation that can be implemented. Considering the importance of each block, we plan for recovery mini-block first, then the taper mini-block, and, if there are extra days left, we can use them for the loading mini-block. This depends on the duration of the weekly plan and on other circumstances.

Recovery mini block

The most important thing after the game is to recover players. Although stress from games varies depending of the final outcome, strength of the opponent and importance of the game, players are fatigued after they played, on both, physiological and psychological aspect (Heaton et al., 2017). Since games can be very emotional, the recovery mini-block can help with cooling down the heads together with the objective analysis of team performance. Practice has taught us and researches have confirmed that fatigue is the highest on the 2nd day after the game. Therefore, we have 2 most common variations of the recovery mini block.

The first variation is the most common one in away matches. After the game, the team travels back home and the next training session is organized in the morning of the next day after the game. The team needs to be divided in 2 groups:

- Players that played most of the game or whole 90 minutes, do the recovery. It can be an active recovery on the bikes or running on the pitch followed by rolling and stretching or completely passive recovery, such as: massage, hydrotherapy and stretching. In the active recovery, we should include low intensity workout around 20-30 minutes with the couple of changes of pace in order to increase heart rate a bit and stimulate blood circulation. It is advisable to take energetic drinks in order to accelerate this second phase of glycogen restoration.

- Players who did not play or were not even on the trip with the team need to do the compensation training with the intention of simulating and mimicking game load. Of course, that training can never be a direct substitution for the game but coaches should target at the similar amount of total and high intensity distances covered.

With this recovery variation, the whole team will have the 2nd day after the game off and afterwards they should start from the same point in loading mini block.

Picture 4. *Recovery mini block variation 1*

Another variation is suitable for the home games. The plan is that immediately after the game players are split in 2 groups, as described above in the 1st variation, and they do the recovery/compensation training. From stance of time, the management and the periodization this is by far the best option because it saves one day in a week for training and the whole team can start from the same point with loading mini block on the 2nd day after the game. Negative side of this variation is the possible lack of player's motivation after the game, especially in case of bad result as well as for players who expected to play but did not.

Picture 5. *Recovery mini block variation 2*

Taper mini block

After the recovery mini block, coaches need to plan taper mini block. The main goal of this part of the week is to refresh players after the loading mini block and to prepare them for the

next game. It usually deals with 2 training sessions which are focused mainly on technical skills and tactics. As with the recovery block, 2 variations are the most commonly used. In the first variation, intensity and volume of training decreases as the game approaches and players practically cool down on the last day before the game.

Picture 6. *Taper mini block 1*

The idea is that players get completely fresh and then rump up all systems on the game day.

The second variation is opposite – activities decrease 2 days before the game and then start to rump up the day before the game so the players are innervated and in tonus for the game.

Picture 7. *Taper mini block 2*

The second variation is superior to the first one due to 2 reasons. Firstly, usually the last day before the taper mini block was the hardest loading day and players needed to recover from that session; and secondly, it is not the best option if players cool down completely the day before the game as their “engines” need to gradually heat up to be optimally ready for the game.

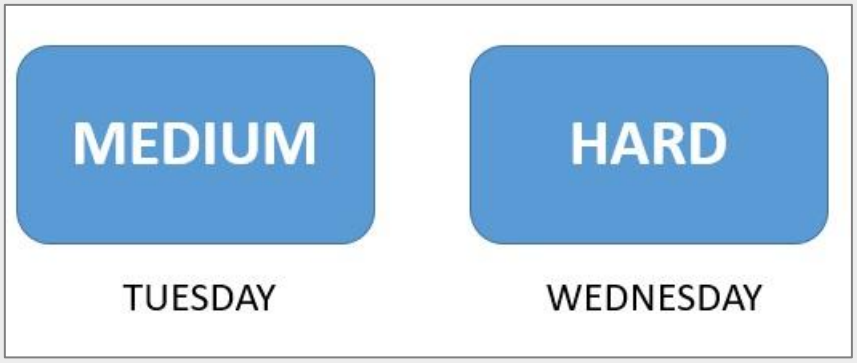
Loading mini block

After we have planned the recovery and the taper block, we use the rest of the days left for loading. Usually the loading block will be from 2 to 4 days, depending on the game schedule and how we create the recovery block. In some situations (e.g. national team break), it can last more days. In those situations, we can create 2 mini blocks loadings or some friendly games. If we have 3 days on our disposal, the most common variation is likely to be one of the shown on the Picture 8, with 2 hard sessions and 1 lighter between them. If the first loading day comes after the free day, we need to pay special attention to warming up as players need to gradually prepare for higher intensities.

Picture 8. *Loading mini block 1*

In case of 2 loading days, the best option is to have one medium and one hard session. The last day of the loading block in all scenarios is usually reserved for the hardest training.

Picture 9. *Loading mini block 2*



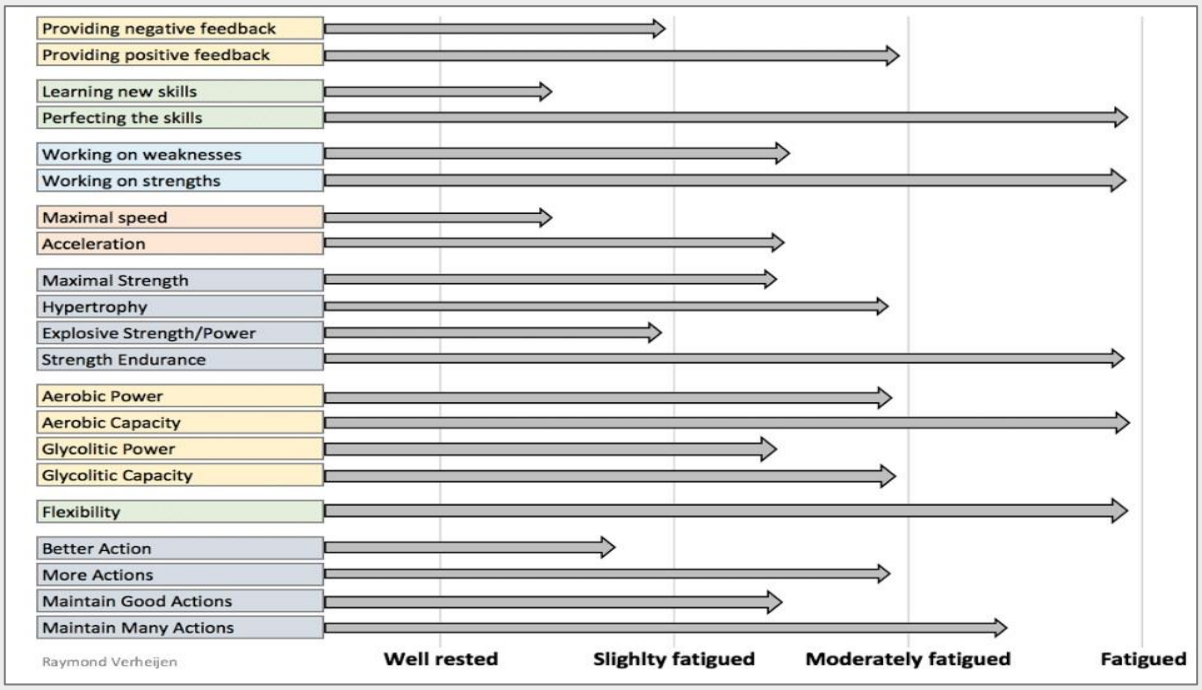
Game day

Organizing the game day is also very important part of the microcycle planning. If the team has home game, coaches need to decide whether players will go to a quarantine or will sleep at home the night before. When the team has an away game, coaches need to decide

when will they go and how will they travel. The activation or even light tactical session on the game day is definitely recommended to gear up players, especially if the game is late in the afternoon or late in the evening and players spend their whole day in hotel or stadium. Players who are not in the team should definitely have their trainings which content will depend on the plan for recovery mini block.

It is important to emphasize that there is no right formula for the microcycle planning. There are a lot of different approaches that lead to a certain goal but the general rules should be taken into consideration. The microcycle planning should be flexible and agile, as coaches need to improvise a lot of time and adapt to all kinds of new situations that occur during the season. In the following picture, there are some recommendations on when certain qualities might be developed. All qualities can be performed pretty much all the time but they cannot be truly developed every day due to fatigue levels and injury likelihood.

Picture 10. *When to develop certain qualities*



It is also important to be aware of the kind of training that should be combined and of the non-compatible training modalities (Issurin, 2016).

Picture 11. *Compatible and incompatible training modalities*

Targeted ability	Compatible training modalities	Non-compatibile training modalities
Aerobic endurance	Alactic sprints, strength endurance, maximal strength(hypertrophy) - afterwards	Anaerobic glycolitic endurance
Anaerobic glycolitic endurance	Aerobic restoration, mixed aerobic-anaerobic endurance, strength endurance	Aerobic endurance, maximal strength done before
Alactic (sprint) ability	Aerobic endurance, aerobic restoration, explosive strength (hypertrophy) - afterwards	Anaerobic glycolitic endurance - restricted
Maximum stregth-hypertrophy	Maximum strength (innervations), stretching exercises, aerobic restoration	Any exhaustive loads afterwards because they disrupt restoration
Learning new technical skills	Any training modalities after performing	Any training modalities before performing

Load monitoring

In order to keep the training process under control and to make sure that we have reached the set goals for specific training or phases, a consistent monitoring of athletes' workload is required. Load monitoring represents a crucial tool for controlling state of player's fitness level and injury reduction (Halson, 2014). There are several options for load monitoring and advancement of science and technology has helped in that field:

- **Global Positioning System (GPS) technology** – The GPS technology is frequently used and is highly applicable in the public health field to determine levels of physical activity. In the last years and with the improvement of their accuracy, safeness, usability and design, the GPS devices have become an everyday tool in professional sport. This technology allows coaches to monitor players movement and to collect information regarding their running performances that includes variables like total distance covered, the distance covered at different intensities (i.e., speeds), and the number of accelerations and decelerations (Modric, Versic, Sekulic, & Liposek, 2019). Therefore, this technology represents a valid measure of an external load.

- **Heart rate** – Although it is more valuable for the monostructural cyclic sports, heart rate measuring can give us insight into the internal training load. No matter if it is integrated with the GPS devices or simply used as a separate system, heart rate monitoring helps coaches evaluate training efforts of each player in the team (Buchheit et al., 2013).

- **Rating of Perceived Exertion (RPE) scale** – The RPE is frequently used for quantitative measure of the perceived exertion during the physical activity. The ratings go from 1-10 with 1 being absolutely no effort and 10 being maximum effort. It is important to explain to players what these numbers mean so that they can subjectively evaluate the effort level of each training. In addition, it can be a very useful tool for coaches but they must not rely only on this way of load monitoring (Day, McGuigan, Brice, & Foster, 2004).

4.4. PRACTICAL EXAMPLE OF MICROCYCLE PLANNING FOR FOOTBALL

To illustrate all the aforementioned, see below for the concrete example of season microcycle for football team.

Saturday – The team has activation in the morning. After the game, players who played most of the match do recovery in 4, 10-minute sets that consist of: bike low intensity ride, rolling, bike ride with 15 seconds speed-up every minute, stretching. After the active recovery, players have massages and other passive therapies. The non-playing team has the substitute training with around 7-8 km of total distance, including 1km of high intensity running (>19,8 km/h).

Sunday – Day off

Monday – Training is in the afternoon hours so that players can have more time for their full recovery. The goal is to have trainings that have high volume (9-10km total distance) but without intensity. Players do aerobic running drills (30''-30'') and low intensity technical and tactical exercises.

Tuesday – The team has 2 training sessions. Morning is reserved for strength and power training in the gym and afternoon is reserved for tactical training with low volume. Sometimes it can be organized all in one training session.

Picture 12. *Strength and power training*

Wednesday – The hardest session is on Wednesday as 2 days from the last game have already passed and players have 3 days until the next one. Players do some HIT running drills and football specific conditioning drills (small sided games). The goal of this session is to have around 6-7km total distance and around 1km of high intensity with high intensity accelerations and decelerations at game level. It is very important to do live monitoring of the training to be sure that the goal has been achieved.

Picture 13. *Small sided game*

Thursday – After the hard training on the previous day, players need to recover so they do tactical training with low volume and intensity. This day is suitable for team injury prevention program.

Friday – On the day before the game, head coaches usually want to practice set pieces and prepare specific tactic for upcoming opponent. The SAQ innervations and coordination phase are optimal for this training to excite players. Training contains intensive drills but with longer rest periods in between.

Saturday – Game

Picture 12. *Microcycle example*

SATURDAY	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Game Recovery Substitute training	Off	Technical training Aerobic endurance	Strength and power Tactical training	Tactical training high intensity Conditioning	Tactical training low intensity	Tactical training medium intensity SAQ innervation	Game

Homework

For homework create an example of in-season microcycle with one official match for any team sports game. Show microcycle in table and afterwards explain each session in few sentences.

Summary

→ Periodization of the training is essential part of job for every strength and conditioning coach.

→ Sports season mostly consists of preparation, competition and off-season period.

→ Microcycle in team sports games is divided in: recovery, loading, and taper mini block.

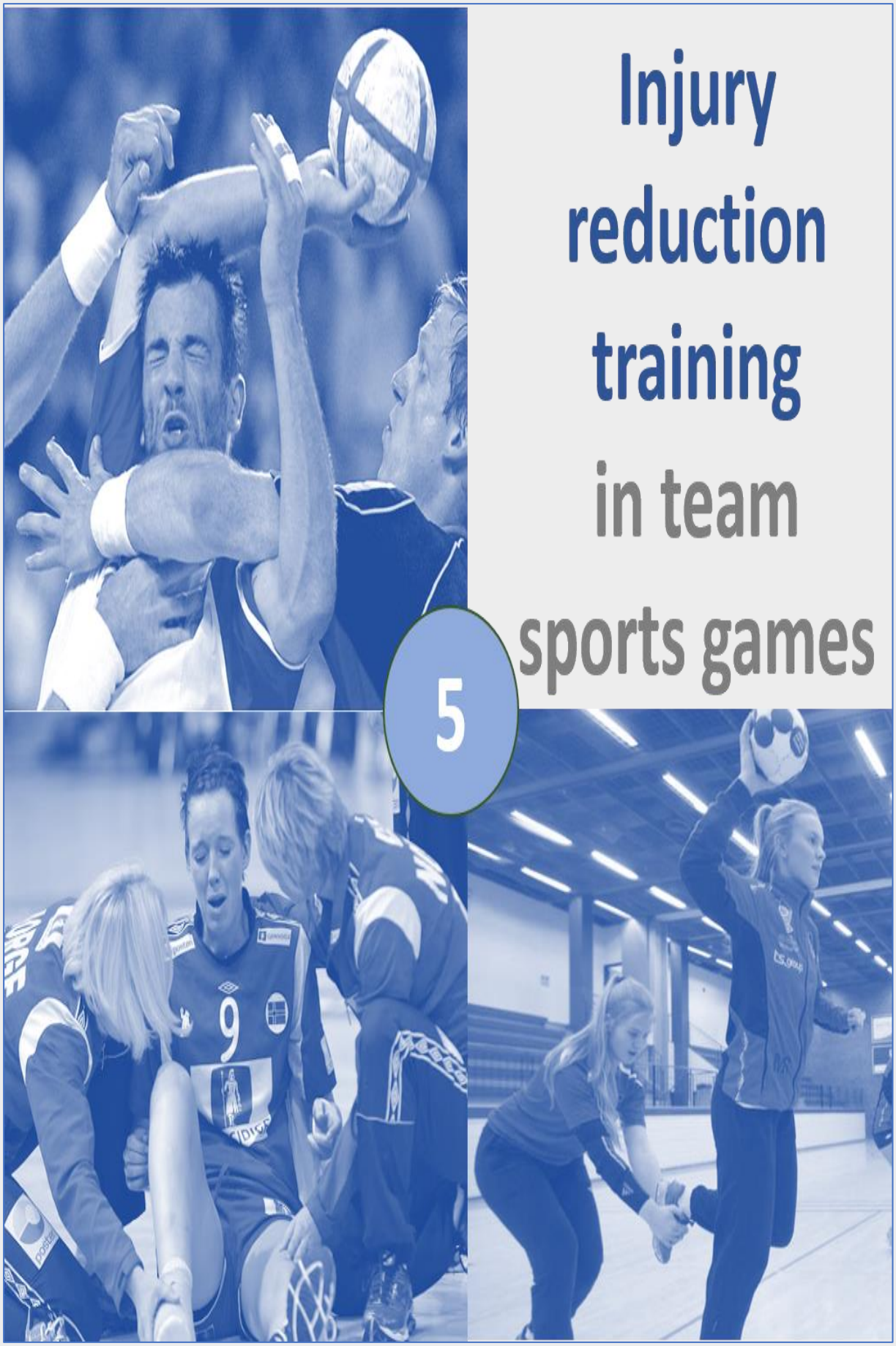
→ In microcycle planning, coaches should first organize recovery mini block, then taper and finally, if there are any days left, use them for loading mini block.

→ Recovery mini block can have many variations but the main goal is to recover players physically, mentally and emotionally from the match.

→ Taper mini block usually consists of 2 days used to fresh players after the loading mini block and prepare them for the next game.

→ Loading mini block mostly lasts from 2 to 4 days, depending on how we create recovery block and game schedule.

→ Load monitoring is crucial tool in every phase so as to keep the training process under control as well as to make sure that we have reached the set goals for specific training.


Injury
reduction
training
in team
sports games
5

5. Injury reduction training in team sports games

5.1. INJURIES

Physical activity undeniably has a positive effect on numerous aspects of human health (Bouchard, Blair, & Haskell, 2012). Sport as a part of the physical activities is a social phenomenon that attracts interest of many people but, at the same time, it has moved beyond the boundaries of pure fun. Athletes have become professionals and for them (and not only for them) sport has become pure business. Career of an athlete is evaluated mostly through the prism of the achieved results and therefore they are working extremely hard to achieve their goals. At all levels of sporting activities with an increasing participation rates, intensity and demands of sport and with the extension of the duration of the training process, the potential risk of injury seems to increase. Injuries appear in various forms and degrees, they occur due to different mechanisms and the way how they are present in individuals and how they should be treated varies a lot. According to International Olympic committee (IOC), sports injury can be defined as a damage to the tissues of the body that occurs as a result of sport or exercise (Junge et al., 2008). Most common way of injury classification is by mechanism (Flint, Wade, Giuliani, & Rue, 2014):

Acute – Acute injuries occur as a result of a traumatic situation in training or competition. They occur when the force (which can be direct and indirect), that has been exerted on the tissue (i.e. muscle, tendon, ligament, and bone), exceeds the strength of that tissue. Acute injuries can be classified according to the injured tissues (e.g. bone, cartilage, ligament, muscle, bursa, tendon, joint, nerve or skin) and the type of injury (e.g. fracture, dislocation, sprain or strain).

Chronic – Chronic injuries may be caused by long-term accumulation of micro-damage of the particular structures of the locomotor system. They occur when repetitive micro trauma overloads the capacity of the tissue to repair itself. Little or no pain might be experienced in the early stages of these injuries; the athlete might continue with activities; tissues do not have needed time to heal.

Picture 1. *Injuries classification*

Site	Acute Injuries	Overuse Injuries
Bone	Fracture Periosteal contusion	Stress fracture Bone strain Stress reaction Osteitis Periostitis Apophysitis
Articular cartilage	Osteochondral/chondral fracture Minor osteochondral injury/lesion	Chondropathy (e.g. chondromalacia)
Joint	Dislocation Subluxation	Synovitis Osteoarthritis
Ligament	Sprain/tear (grades I - III)	Inflammation
Muscle	Strain/tear (grades I - III) Contusion Cramp Compartment syndrome (acute)	Compartment syndrome (chronic) Delayed onset muscle soreness (DOMS) Focal tissue thickening/fibrosis
Tendon	Tear (complete or partial)	Tendinopathy
Bursa	Traumatic bursitis	Bursitis
Nerve	Neuropraxia	Nerve entrapment Minor nerve injury/irritation Adverse neural tension
Skin	Laceration Abrasion Puncture wound	Blister Callus

Injuries have negative impact on an athlete; they can temporarily or permanently remove him from the sports practice while his absence can be noted by the whole team through results worsening. Injuries also represent a major financial cost, firstly in the form of rehabilitation expenses, and secondly in a form an indirect form of cost when clubs and sponsors pay players who do not participate in trainings and competitions (Ostojić, 2006). The process of rehabilitation and the return to practice can be long and it can also exhaust the athlete mentally and emotionally. Given the negative consequences of injuries, athletes as well as all direct and indirect sport participants have interest in reducing the number of injuries or ultimately preventing them at all. There has been a significant increase in interest in creating preventative procedures that would reduce the rate of injury in sports by developing protective equipment, changing rules and improving fitness status. In some areas, certain success has been observed; however, additional research efforts and the development of contemporary approaches are needed (with an emphasis on developing successful preventative measures).

5.2. INCIDENCE AND COST OF THE INJURIES

You have probably noticed in the title of this section the word 'Reduction' instead of 'Prevention'. If we approach it strictly semantically, prevention would imply that we can totally stop player's injuries; but the reality is quite opposite. If we do a good job and take care about all the things that will be mentioned later in this section, we can reduce the number of injuries. But no matter how good coaches we are and no matter how much great diagnostic, training or therapeutic equipment we have, it is simply impossible to stop players of getting injured. Sometimes injuries will occur because of an external force made by the opponent; sometimes it will occur because of some player who did not eat well enough or who did not have enough sleep. Sometimes it might also be due to some players who just do not have body capacities needed to handle demands of top-class sport (See picture below).

Picture 2. *Vincent Kompany's injuries*

Nevertheless, it does not mean we cannot affect injury rate in our teams. With proper work, monitoring and good coordination between all people included within the training process, we as strength and conditioning coaches, can make more players available for each particular game which will undoubtedly affect the final outcomes of the games.

Over the past 20 years, a large number of studies, that have analysed the degree of risk of injury in sports, have been conducted. The overall incidence of injuries in sports is relatively high and appears to be increasing steadily in some sports. The incidence rate ranges from 1.8 to 5 injuries per 1,000 hours of sports participation activities. Furthermore, researches show that sports trauma accounts for 10 to 15% of all accidents in Germany and Finland. 20 years ago, only 1.5% of interventions in emergency medicine resulted from sports activities and today it is about 10%. If we analyse the overall incidence of all traumas, 17% have sports aetiology. Finally, in the younger population (0-19 years) 16% of all injuries are of sports origin, opposed to 7% of injuries resulting from traffic. 25-40% of all injuries are classified as acute, while 60-75% are chronic (Ostojić, 2006).

Picture 3. Absence days for most common injuries

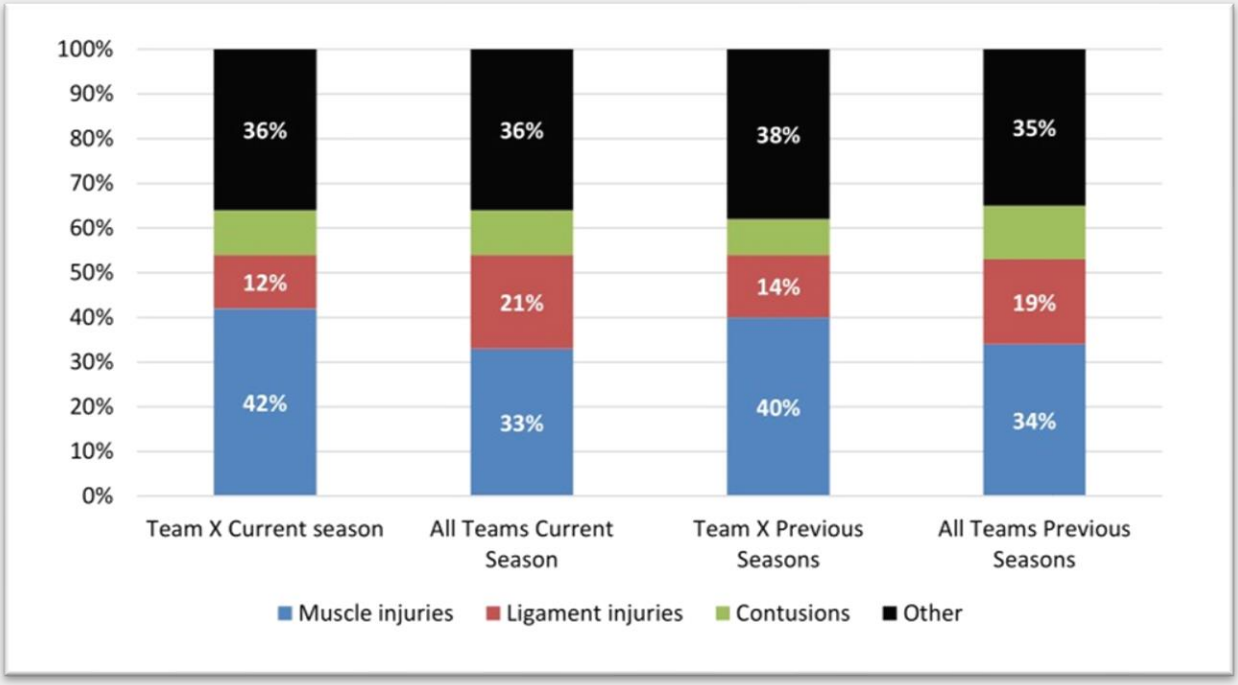
Table 1 Descriptive statistics regarding absence days for the 31 most common *index injuries*. The injuries are arranged according to their median absence

Injury	Frequency (% of total)	Mean (95% CI)	Median (95% CI)	25th;75th percentile	10th;90th percentile	Re-injury rate (%)
Thigh contusion	651 (3.3)	6.4 (5.6 to 7.1)	4.0 (3.0 to 4.0)	2.0;7.0	1.0;12.0	1.4
Foot contusion	537 (2.7)	6.8 (5.9 to 7.6)	4.0 (4.0 to 4.0)	2.0;7.0	1.0;14.0	4.1
Knee contusion	465 (2.3)	6.1 (5.3 to 6.9)	4.0 (4.0 to 4.0)	2.0;7.0	1.0;13.0	2.8
Low back pain	405 (2.0)	8.3 (6.7 to 10.0)	4.0 (4.0 to 5.0)	2.0;8.0	1.0;14.0	18.8
Ankle contusion	385 (1.9)	5.9 (5.1 to 6.7)	4.0 (3.0 to 4.0)	2.0;6.0	1.0;11.0	2.6
Calf contusion	314 (1.6)	6.2 (5.1 to 7.3)	4.0 (3.0 to 4.0)	2.0;6.0	2.0;12.0	1.3
Ankle joint capsular injury	287 (1.4)	8.3 (7.0 to 9.6)	4.0 (4.0 to 5.0)	3.0;10.0	2.0;20.0	10.8
Quadriceps muscle injury (functional)	218 (1.1)	4.9 (4.3 to 5.5)	4.0 (3.0 to 4.0)	2.0;6.0	1.0;9.0	13.8
Calf muscle injury (functional)	215 (1.1)	5.6 (4.9 to 6.3)	4.0 (4.0 to 5.0)	2.0;7.0	1.0;12.0	15.3
Lower leg contusion	200 (1.0)	6.1 (5.0 to 7.1)	4.0 (3.0 to 5.0)	2.0;7.5	1.0;14.0	2.0
Hamstring muscle injury (functional)	709 (3.6)	5.9 (5.5 to 6.2)	5.0 (4.0 to 5.0)	3.0;7.0	2.0;11.0	16.1
Groin pain	256 (1.3)	13.5 (10.2 to 16.8)	5.0 (5.0 to 7.0)	3.0;12.5	1.0;26.0	32.4
Concussion	235 (1.2)	8.7 (6.6 to 10.8)	5.0 (5.0 to 6.0)	4.0;8.0	2.0;14.0	5.5
Ankle joint synovitis	128 (0.6)	10.8 (7.8 to 13.7)	5.0 (5.0 to 7.0)	3.0;11.0	1.0;20.0	38.3
Achilles tendon pain	370 (1.9)	18.4 (14.3 to 22.6)	6.0 (5.0 to 7.0)	3.0;15.0	2.0;42.0	38.4
Knee joint synovitis	279 (1.4)	11.6 (9.7 to 13.6)	6.0 (5.0 to 7.0)	4.0;13.0	2.0;27.0	48.0
Knee joint capsular injury	143 (0.7)	12.8 (9.0 to 16.7)	6.0 (5.0 to 7.0)	3.0;13.0	2.0;24.0	10.5
Knee patellar tendinopathy	231 (1.2)	17.9 (13.5 to 22.3)	7.0 (6.0 to 8.0)	3.0;16.0	2.0;44.0	33.3
Groin other muscle-related or tendon-related pain	216 (1.1)	13.4 (10.2 to 16.5)	7.0 (6.0 to 8.0)	4.0;15.0	2.0;30.0	6.9
Ankle medial ligament injury	196 (1.0)	13.4 (11.2 to 15.7)	7.0 (6.0 to 9.0)	4.0;15.0	3.0;34.0	13.3
Groin adductor pain	1754 (8.8)	13.5 (12.6 to 14.4)	8.0 (8.0 to 9.0)	4.0;15.0	2.0;27.0	17.7
Ankle lateral ligament injury	1260 (6.3)	14.9 (13.7 to 16.0)	8.0 (7.0 to 9.0)	4.0;18.0	2.0;32.0	13.7
Hip flexor pain	264 (1.3)	13.8 (11.6 to 15.9)	8.0 (7.0 to 10.0)	4.0;18.0	2.0;29.0	13.3
Hamstring muscle injury (structural)	2379 (13.8)	18.0 (17.2 to 18.8)	13.0 (12.0 to 14.0)	7.0;22.0	4.0;36.0	17.5
Quadriceps muscle injury (structural)	914 (4.6)	19.5 (18.1 to 20.9)	13.0 (12.0 to 14.0)	7.0;23.0	4.0;41.0	15.6
Calf muscle injury (structural)	818 (4.1)	17.4 (16.3 to 18.6)	13.0 (12.0 to 14.0)	8.0;22.0	4.0;35.0	14.4
Knee LCL injury	146 (0.7)	23.8 (18.9 to 28.7)	13.0 (9.0 to 19.0)	6.0;30.0	4.0;56.0	10.3
Knee MCL injury	760 (3.8)	24.6 (22.6 to 26.6)	16.0 (15.0 to 18.0)	7.0;35.5	3.0;56.0	10.3
Knee cartilage injury	223 (1.1)	48.7 (40.3 to 57.1)	22.0 (15.0 to 30.0)	8.0;62.0	4.0;134.0	36.3
Knee lateral meniscus injury	128 (0.6)	50.1 (41.8 to 58.4)	36.0 (29.0 to 42.0)	18.5.0;65.5	8.0;128.0	23.4
Knee ACL injury	183 (0.9)	210.2 (197.9 to 222.6)	205.0 (198.0 to 218.0)	173.0;238.0	129.0;292.0	6.6

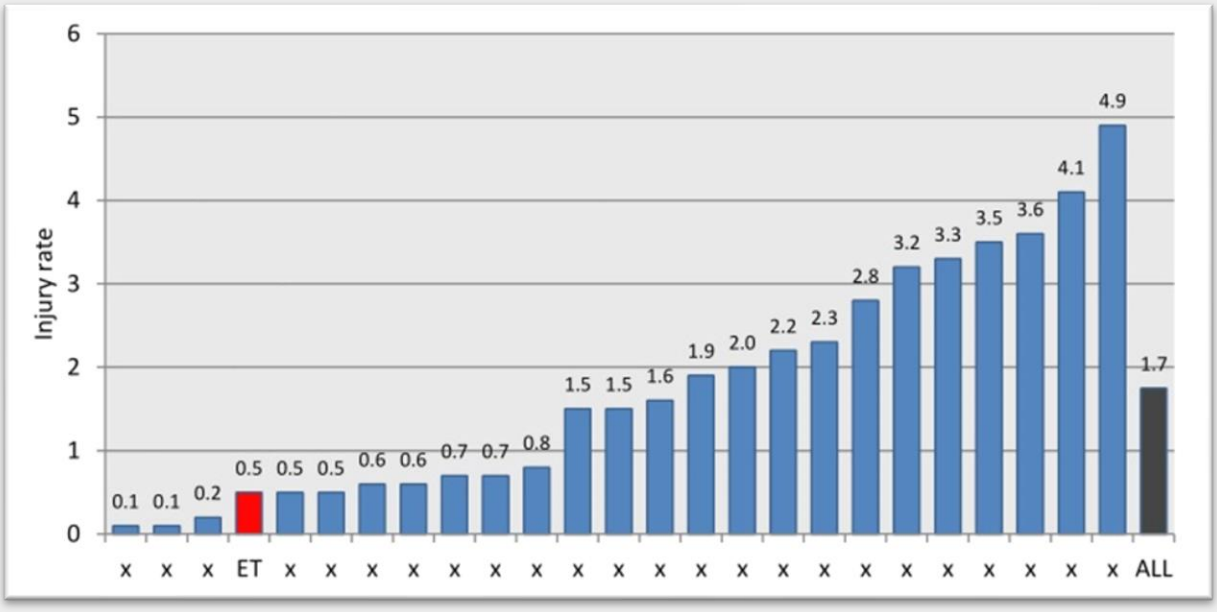
The severity of the injury is related to the nature and duration of the injury, the time of absence from training and competition, possible permanent damage and the financial cost of treatment. Fortunately, sports injuries are rarely serious with lasting consequences but the number of injured athletes requiring surgical treatment of acute and chronic injuries ranges from 5 to 10%. Although the cost of treatment and care for sports injuries is high, it is very difficult to estimate the total costs of sports injuries that include direct (e.g. diagnostic procedures, surgery) and indirect costs, such as: loss of productivity or marketing potential of a popular sport star. The annual cost of sports injuries in Netherlands was about $ 225 million and when the costs of absence from matches were included it rose to $ 350 million (Høy, Lindblad, Terkelsen, Helleland, & Terkelsen, 1992). The direct and indirect costs of ski accidents in Switzerland, according to insurance companies' statistics are about $ 15 billion annually. The US Centres for Disease Control has shown that the minimum rule correction in softball reduced the number of injuries in the sport by 1.7 million injuries per year, which reduced health care costs by $ 2 billion (Janda, Wojtys, Hankin, Benedict, & Hensinger, 1990). These massive costs reinforce the importance of creating adequate strategies for the prevention of sports injuries. The process of developing preventative measures is not straightforward or immediate but investing in injury prevention must be part of long-term sports medicine strategies. Since in football the number of published epidemiological studies is the largest, the definition criteria are consistent and the interest in creating effective prevention strategies is most significant, we will check out 2 analyses of injury incidence in football.

*The **UEFA injury study*** is the annually report made by the UEFA in collaboration with top European clubs (25 in last study). The report contains detailed data about injuries occurred during the observed period and gives feedback to coaches about trends in football and opportunity to compare it with situation in their clubs. On the following pictures, you can see examples of the analysed data (Ekstrand, Hägglund, & Waldén, 2011; Ekstrand, Spreco, Windt, & Khan, 2020).

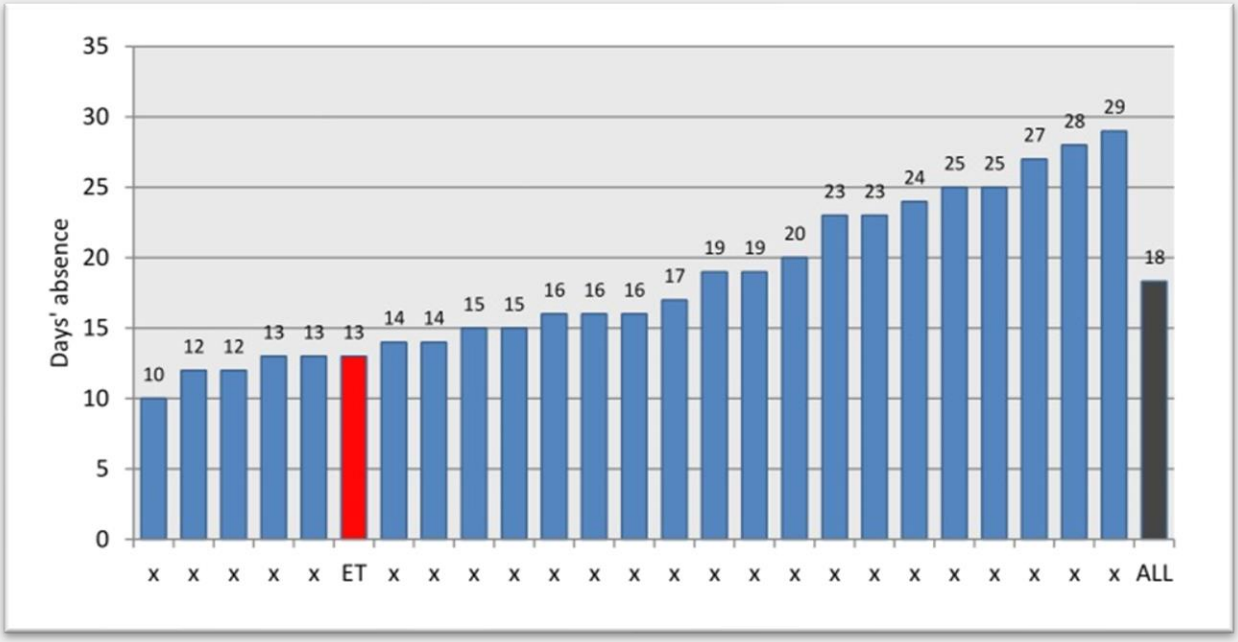
Picture 4. *Distribution of injury types*



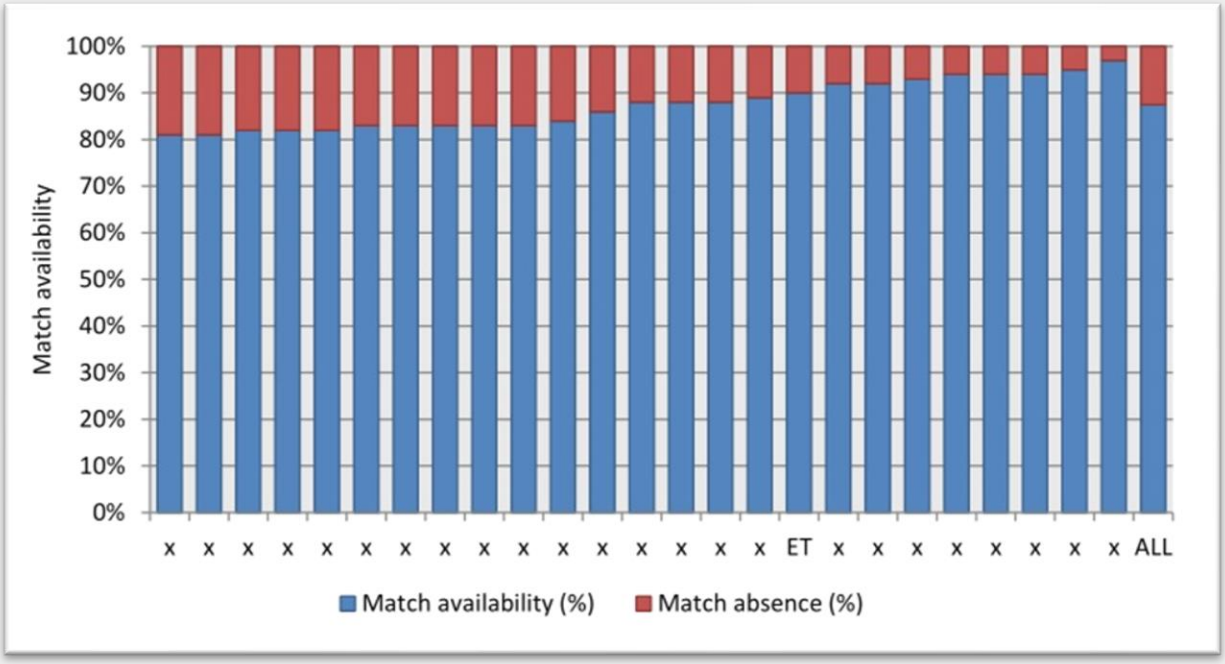
Picture 5. *Training injury rate for every 1 000 training hours*



Picture 6. *Days' absence for muscle injuries*



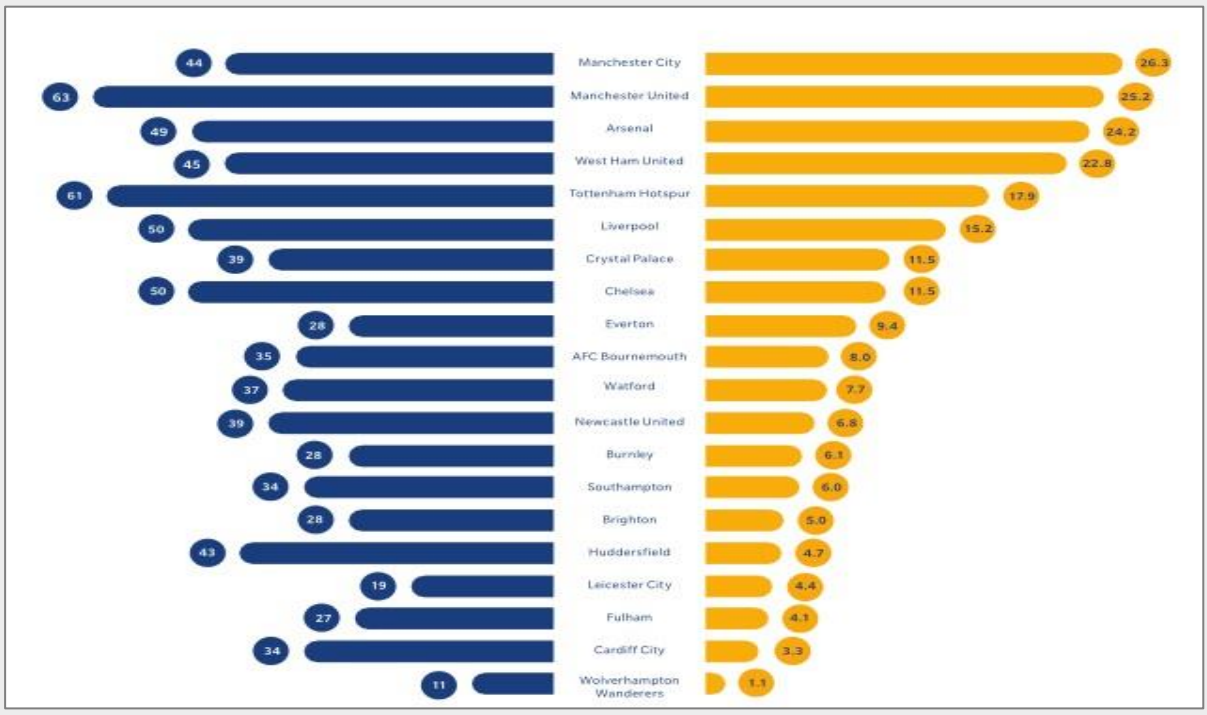
Picture 7. *Squad availability rates for matches*



Football injury index is the annual report which shows how injuries affected 20 football clubs in English Premier League (EPL) over the course of the most recent season. This

information helps clubs understand the financial impact of players' injuries and assess their injury risks.

Picture 8. *Number of injuries and cost of total injuries per club in the EPL season 2018/19*



Since it is clear that injuries debilitate clubs both financially and in terms of results (researches showed that low injury rate strongly correlates with team success), there is an obviously need to emphasize the importance of having a sports-medical system within each club that aims at reducing injuries. It needs to include:

- Head coach is the most responsible person; he is superior in decision-making; he also needs to have adequate information from his staff.

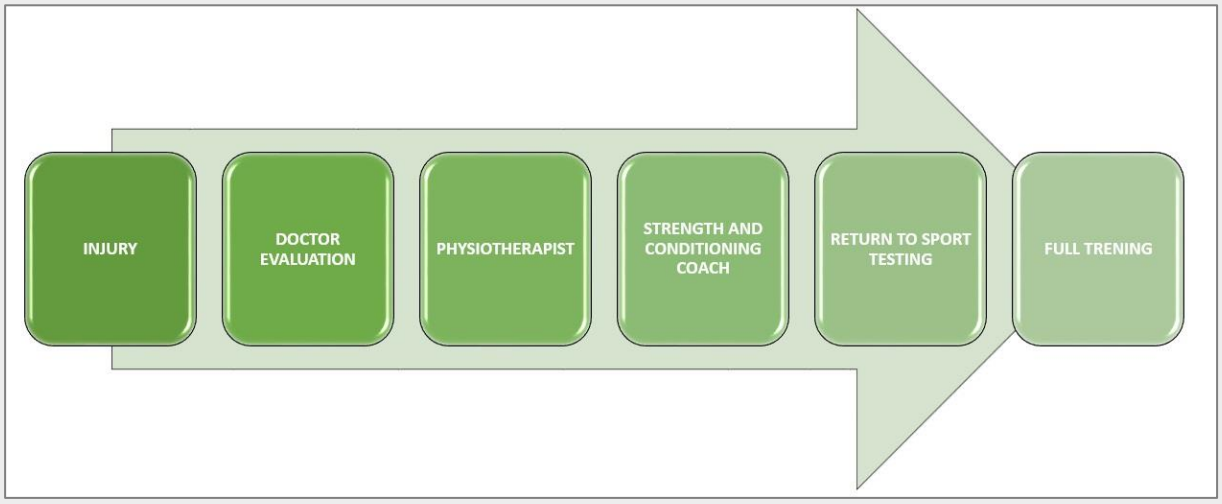
- Strength and conditioning coaches need to monitor training load; they give suggestions to the head coach about planning training process; they create individual corrective program.

- Physiotherapists do all therapies and massages to players.

- Doctors are on the top of the medical pyramid in the club; they are responsible for the evaluation of players' medical status.

When the injury occurs, the doctor needs to check players' status; he needs to make a plan of the rehabilitation and give his guidelines to physiotherapist and strength and conditioning coaches regarding with what to do in each phase of the rehabilitation.

Picture 9. *Rehabilitation protocol*



Each club should have some kind of an injury database with all details about previous injuries which can help treating and reducing them in future.

5.3. INJURY REDUCTION STRATEGIES

From the perspective of strength and conditioning coach, there are several ways of reducing injury rate in team. They are described in the following chapters.

1. Warm up

Expression '*Warm up*' in sports refers to the introductory and preparatory part of the training and has long gone beyond the frames of classic heating up and stretching. Although it will take some time for terminology among coaches to change, it is important to emphasize that warming up or stretching are just the initial parts of training while other segments of preparation are: relaxation, activation or innervation are equally important. Sports science confirmed the effectiveness of numerous training methods and today it is absolutely unacceptable to neglect the proper preparation of an athlete's body for high-intensity activities. The introductory part of the training can consist of the following parts (Jukić, Milanović, Svilar, Dadić, & Očić, 2016):

- Warm-up

- Relaxation

- Mobilization

- Stretching

- Stabilization

- Activation

- Balance

- Innervation

Picture 10. *Pregame warm-up*

All of the aforementioned aspects of the introductory part of the training are not necessarily present in every training as content of the main part of the training and goals, in term of development motor and functional abilities are the guidelines for creating optimal introduction part.

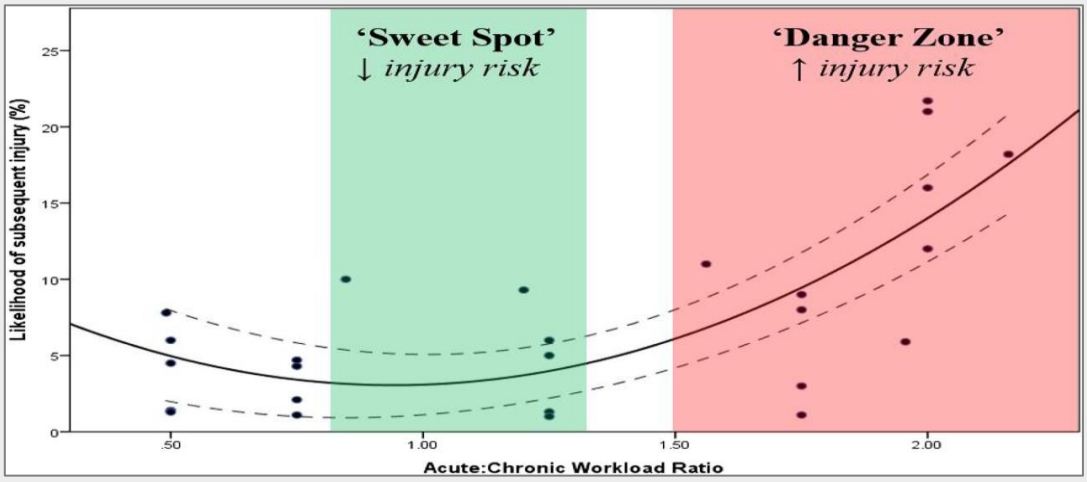
Table 1. *Introductory part of the training*

TYPE OF TRAINING	Warming up	Relaxation	Mobilization	Stretching	Stabilization	Activation	Balance	Innervation
Aerobic	√	√	√	√				
Anaerobic lactic	√	√	√	√	√	√		√
Maximal strength		√	√	√	√	√		
Power and speed strength	√	√	√	√	√	√	√	√
Strength endurance		√	√	√	√			
Speed	√	√	√	√	√	√	√	√
Agility	√	√	√	√	√	√	√	√
Technical		√		√	√	√	√	√
Tactical	√	√	√	√	√	√	√	√

2. Load monitoring

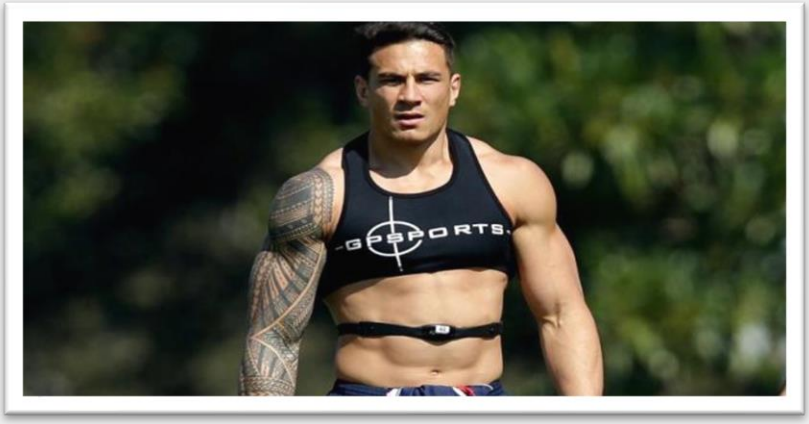
As aformentioned (*Micro cycle planning for team sports games*), coaches need to keep the training process under control. They should also make sure that specific goals for each training or phase have been accomplished. In doing so, they consistently benefit from the athlete's load monitoring. In general, training load represents the total amount of stress (exercises, trainings, games) imposed on a player. If the load is monitored and controlled, it will result in a positive adaptation processes which will, consequently, increase player's specific abilities and performances (Halson, 2014). On the other hand, it will also be used as a protective factor for injuries, illness, overtraining and, in general, in unwanted adaptation processes. Researches showed that both low and high training loads can be associated with the increased risk of injury, while moderate chronic loads can protect athletes from an injury (Hulin, Gabbett, Lawson, Caputi, & Sampson, 2016).

Picture 11. *Likelihood of injury and workload correlation*



Load monitoring represents useful tool for detecting players that can be in the risk zone. These data can help the coach in individualizing load and avoiding future injuries. Training load can be divided on external and internal load. Most common ways for measuring external load is the GPS technology which collects data on players' running performance (e.g. total distance covered, the distance covered at different intensities) and the number of accelerations and decelerations. Heart rate monitoring and the RPE scale are the most commonly used tools for measuring internal load (Rago et al., 2019).

Picture 12. The *GPS and heart rate monitoring*



Picture 13. The *GPS technology in injury prevention (Ehrmann, Duncan, Sindhusake, Franzsen, & Greene, 2016)*

3. Strength and power training

Lack of strength is often recognized as a risk factor for injuries to the musculoskeletal system (de la Motte, Gribbin, Lisman, Murphy, & Deuster, 2017). Strength and power training can affect the protection of athletes from injury due to positive changes that occur on bones, ligaments and tendons on in the muscles after such training. It increases the density, i.e. the bone strength which means the higher the lower body strength level, the lower the incidence of stress fractures is (Westcott, 2012). It also plays an important role in reducing the risk of musculoskeletal injuries related to muscle imbalance. This is achieved by maintaining adequate ratio of agonist to antagonist strength or the strength ratio of the same muscle groups of right and left extremity. During conscious and repetitive movements, strong muscles can act as a joint stabilizer and when a muscle primarily produces motion of a joint, proper conditioning can prevent the muscle from undergoing an unwanted movement.

To improve muscle strength, stress must be progressive and gradually challenged or placed under additional loading since the effects of training are specific to the applied type of stress. The Specific Adaptation to Imposed Demands (SAID) principle states that as the body is placed under stress of varying intensities and durations, it attempts to overcome the stress by adapting specifically to the imposed demands (M. H. Stone, Stone, & Sands, 2007).

Other components of strength conditioning that contribute to injury prevention are the ability of the muscle to contract or exert force at an accelerated speed, and muscular endurance, which allows the athlete to maintain an appropriate strength level over a period of time.

Example of strength and power training for team sports players

In the given example you can see in-season training of strength and power for football players. Training should not be observed outside of the context, i.e. outside of the specific part of the season, gradual adaptation on strength exercise etc.

Table 2. *Strength and power training example*

STRENGTH EXERCISE	POWER EXERCISE	REPETITIONS	SETS
Squat	Jumps over big hurdles	5+3	2
RDL	Skip over small hurdles	5/5 + 2	2
Lunges	Unilateral broad jump	5/5+3/3	2
Hip thrust	Explosive step up	5/5+3/3	2
Step down	Drop jump	5/5+3	2
Nordic hamstrings	Sprint	5+1	2
Adductor pull	Side steps	10/10+3/3	2
Calf raises	Straight leg jumps	10/10 + 3	2

4. Proprioceptive training

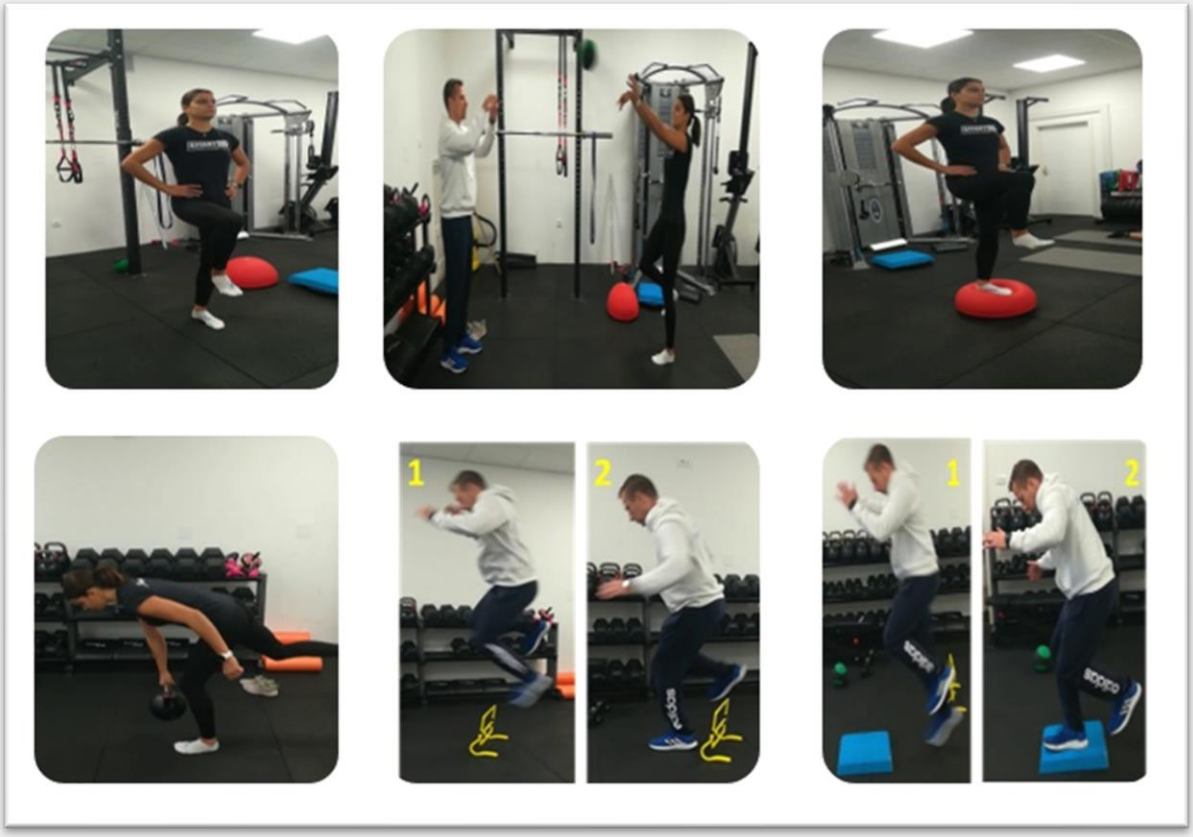
Proprioception generally represents the conscious and unconscious sense of posture in the joint, i.e. it represents the ability to maintain a balanced position in the static and dynamic action (Jerosch & Prymka, 1996). As such, it plays a very important role in reducing the risk of injury to athletes.

Static and dynamic stabilizers are responsible for the stability of joints. Static (passive) joint stabilizers are ligaments, joint capsule, menisci and bone geometry of joints, while dynamic (active) stabilizers include muscles and two control mechanisms - mechanism of anticipation of muscle movements and the reflex feedback mechanism. Proper proprioceptor information from all joint structures ensures proper strength of muscle contraction and correct timing of contractions of the agonist-antagonist muscle pair that work together in the dynamic stabilization of the joint, eventually preventing possible injury. Through these mechanisms, proprioception develops the ability of the nervous system to respond more quickly to changes in the articular surfaces and, thus, assumes that the athlete will respond optimally in emergencies that might cause injury, which is the basic meaning of this type of training (Sarah, Lisman, Gribbin, Murphy, & Deuster, 2019).

Examples of proprioceptive exercises for team sports players

On the following pictures, you can see some examples of proprioceptive balance training with gradual progression.

Picture 14. *Proprioceptive training*

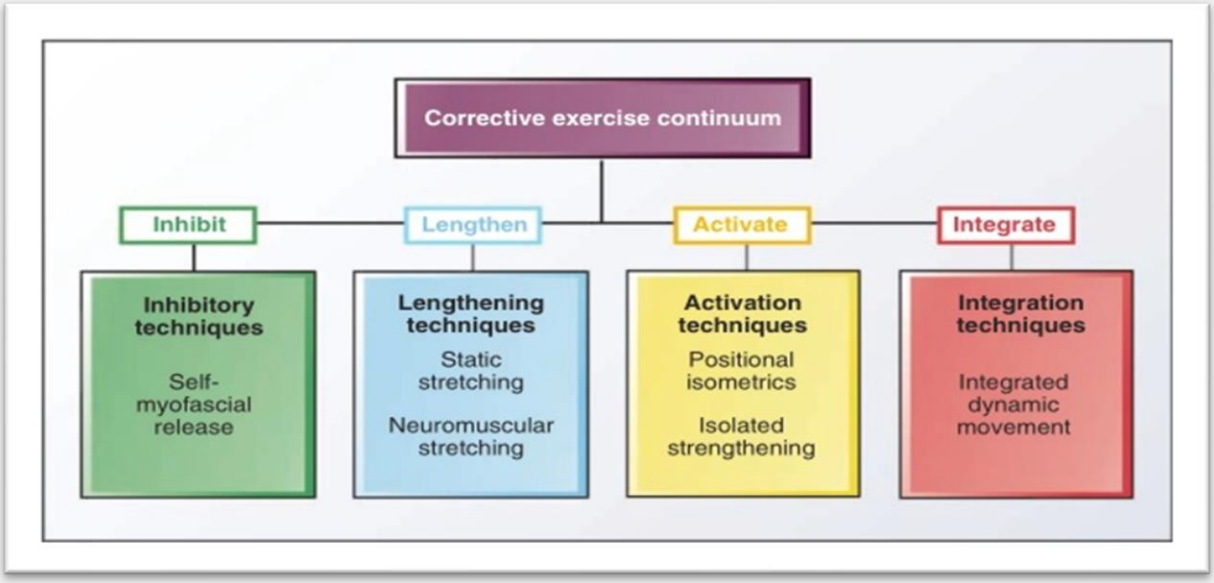


5. Individual corrective training

Corrective training should be a standard part of every training process in team sports games. Strength and conditioning coaches should provide range of motion and movement assessments to detect each player's disabilities. Although there are a lot of assessment models (such as: the FMS or the NASM), coaches should not stick blindly to these established protocols but they should rather create their own which will be specific for the requirements and moving structures in their sport. Ones the testing has finished, coaches need to make individual corrective programs for each player and plan how these trainings should be organized. Players can have option to do their program individually before the team training

with coaches monitoring them, or they should work in smaller groups, for example in the morning hours (if the team training is afternoon). Although, as aforementioned, the introductory part of the training has injury reducing orientation, this can never be substituted for the individual corrective work since each player is an individual with specific characteristics and abilities.

Picture 15. *Corrective exercise continuum (Clark & Lucett, 2010)*



Example of corrective program

Here is the example of assessments chosen for detecting football player's movement disabilities, restrictions and *"weak spots".*

Table 3. *Movement and range of motion assessments*

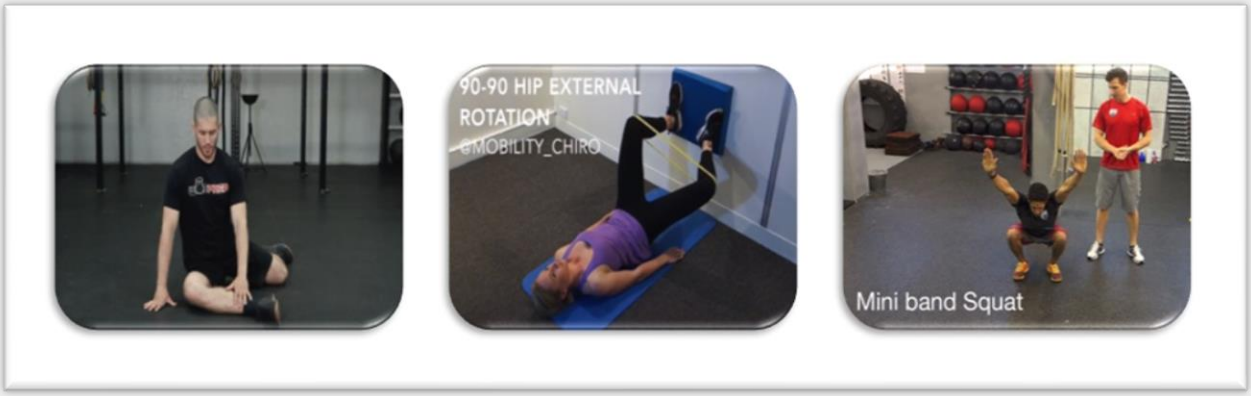
TEST	What to look
Overhead squat	LPHC, knee, feet check points
Drop jump	Knee (valgus), trunk stability
Push up	Trunk stability
Hip flexion	≥120◦
Hip external/internal rotation	≥45◦
Hip abduction	≥45◦
Straight leg raise	≥80◦
Thomas test	Quadriceps, illiopsoas, TFL
Foot ankle mobility	>10cm

Dynamic test should be recorded with video camera as evaluation is more accurate when looking at it couple of times and from several angles. Range of motion assessments should all perform actively which would give clear picture about soft tissue limitations.

After testing, individual programs should be prepared for each player. Also, previous history of players' injuries should be taken into consideration. Here is the example of the corrective individual program for an unnamed football player whose tests have showed:

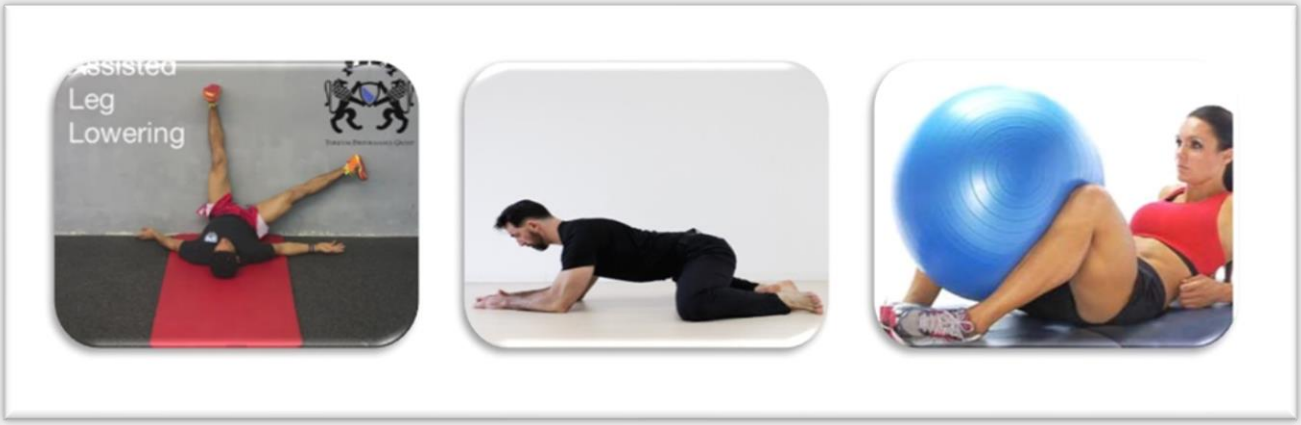
- reduced hip mobility (external and internal rotation)
- poor hamstring flexibility
- often problems with adductor muscles (DOMS)
- poor foot ankle flexibility

Picture 16. *Hips – 3 exercise; 30 seconds each leg/10 repetitions*



Picture 17. *Hamstrings – 3 exercise; 30 seconds each leg/10 repetitions*

Picture 18. *Adductors - 3 exercise; 30 seconds each leg/10 repetitions*



Picture 19. *Foot ankle - 3 exercise; 30 seconds each leg/10 repetitions*

Homework

For homework create a battery of movement and range of motion tests for particular team sports game.

Summary

→ Physical demands to which professional athletes are exposed to are extremely high and a complete avoiding injury is impossible.

→ Injuries can generally be classified as acute and chronic, but there are more classifications regarding injured tissue, mechanic of injury etc.

→ Injuries effect clubs both on sports plan and economically.

→ Sports-medical system, in each club, should be established and consisted of: head coach, strength and conditioning coaches, physiotherapists and doctors.

→ Injury reduction strategies include: proper warm up, load monitoring, strength training, proprioceptive training and individual corrective training.

→ Warm-up should be in accordance with the content of the main part of the training and goals in term of development motor and functional abilities.

→ Load monitoring provides a valuable tool for detecting players at risk of injury and/or illness.

→ Strength and power impacts positive changes whether on the bones, ligaments and tendons or on the muscles.

→ Proprioception develops the ability of the nervous system to respond more quickly to changes in the articular surfaces, which helps an athlete respond optimally in situations that might cause an injury.

→ Corrective training should be standard part of any training process in team sports games and created sport-specifically.

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