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Original article

CONCURRENT TRAINING IN THE CONDITIONAL PLANNING OF ELITE RUGBY PLAYER

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Abstract

The alternation of resistance and endurance training, known as Concurrent Training (CT), has been gaining increasing interest in the scientific community for some years now. Different studies have suggested combining endurance with resistance training because if the training of these two capacities is designed appropriately, the functional and performance level rises positively. Sports like rugby it is essential to train these two conditional skills, since the rugby player is required to run for short distances and repeatedly. The match lasts a lot and run for 80 minutes on a field, opposing rivals requires appropriate training, not all aerobic capacity, but also very high levels of strength and power. Despite the countless studies done to best combine the training of these two capacities without creating interference, we still do not have clear guidelines to avoid it altogether. This work is a practical proposal of how the CT can be employed through an intra-session and inter-session training in an elite rugby team.

Key Words*:* conditional planning, rugby player.

Introduction

Rugby was classified as a multi-sprint and a multi-activity sport. During the training, according to the parameters of the session as intensity, volume, recovery, frequency, it stimulates in different ways all of the three energetic systems and therefore the physiologic condition of the player, who beyond to have a good aerobic endurance, it will need to work differently connected with the specific roles and positions. In fact the forwards will have to work mostly on lactic acid system to produce energy and the backs more on the alactic one.

The rugby player has to be trained as he would be a complete athlete and his physical preparation will have to be focus on the demands of this sport, especially the endurance and the resistance.

About "building of the player" it is not necessary to train specifically single conditional capacities but to increase them in the same moment. When it is trained the endurance and resistance together during the same session or in the following days – with a maximum recovery of 24h – it is called concurrent training (CT).

This methodology could be useful just through an annual program, in which the necessity to apply two different stimuli is the aim to have the highest result. In 1980 Dr. Hickson was the first one who studied the effect of overlap between the resistance and endurance during the training and he called this phenomenon Interference. Different consecutive stimuli could induce the organism a kind of overtraining that reduce the gains of strength and hypertrophy, they are the reason of the Interference. Both of trainings produce peripheral adaptations, with an high glycolitic needs, it looks that the grade of adaptation incompatibility is high because antagonistic muscular adaptations compete with metabolic, structural and molecular aspects. Normally elite athletes train twice a day, for this reason it will be crucial to consider the order of exercises to whom they have been subjected and the aims of the training session to achieve maximum possible adaptations, simultaneously avoid generate the least possible interference between the stimuli. So the best strategy to reduce the negative effects of CT although scientific literature have not yet clear certainty about guidelines to get the improvements both of strength/hypertrophy and endurance, are based on these 5 strategic factors: order, weekly frequency and volume, training intensity, detailed arrangements for the exercise of endurance training, duration of recovery between training sessions. However, studies have shown that the best way to avoid interference is to train the two conditional capacities waiting for a time of 8 hours, even better it would be to wait 24 hours to eliminate it altogether. Studies have suggested that the accumulation of metabolites may partly explain the phenomenon of acute interference during concurrent training. Firstly

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it is reported some of the parts that they have been more notable for the thesis, in which is focused the theme of the game and its roles, the energy systems that act according to the type of work proposed, the concurrent training and the principle of the phenomenon of interference; secondly they are analyzed some examples about how to use this type of training in rugby without creating interference between adaptations of resistance and endurance training.

Concurrent training and Interference

In team sports, such as rugby, it has already proved that concurrent training can be useful to improve specific performances, since conditional abilities, such as resistance and endurance, form the foundations of rugby player allowing it to address better the competition on physical aspects.

However if it compares different studies related on training competitor, the results are often contradictory. This depends on the different variables and factors such as the characteristics of the subjects of study, length of study, the characteristics of strength training and endurance, the study design, methods of evaluation, etc. etc.

In fact the first studies on training competitor (Hickson, 1980) showed that improving the strength, but not of endurance (VO2max), could be compromised when they were carried out, during the same day, concurrent training sessions included running and strength, high intensity and high attendance. On the contrary strength training looked to improve the performance of the endurance. According to Murach and Bagley (2016), concurrent training wouldn't interfere with strength training that induces hypertrophy. When the volume and recovery of both sessions are adequate, an increase in muscle mass could occur. Most of researchers identify the interference as a problem at the level of molecular signals, which triggers the adaptation more to a type of stimulus rather than to another one (Souza et all., 2012). This explains why resistance training exercises increase the phosphorylation of selected proteins of the AKt / mTOR pathway, which is strictly related to the increase in the rate of synthesis of muscle proteins. The increase of mTOR1 activity derives from an increase of protein synthesis through a cascade of intracellular transduction pathways activated by an infinite number of stimuli, including tension or mechanical overload (Philp, Hamilton & Baar, 2011). However, endurance exercises generate a reduction in cell energy reserves and ATP / AMP proportions. This reduction induces AMPK phosphorylation, as a consequence the AMPK phosphorylated inhibits anabolic processes that requires the degradation of ATP, as protein synthesis, while encouraging protein degradation (Bolster, Crozier, Kimball & Jefferson 2002; Coffey & Hawley, 2007; Nader, 2006). Thus, the activation of the AMPK signal pathway, induced by endurance exercise, would activate the TSC2 / Rheb complex, which would produce an inhibitory effect on the activity of the mTOR and the net protein synthesis rate, which could theoretically ultimately reducing the effect of resistance training on improving hypertrophy, unbalancing the system towards a catabolic condition. However, CT in some cases develops compatible adaptations between them that do not create significant interferences, as in the following training cases (Leveritt M. et al.,1999): Compatibility is maximum and interference is nil when moderate-low intensity endurance training (near the aerobic threshold) is combined with that of force at high intensities with greater neuro-muscular stimulation (few repetitions per series, without generating high metabolic stress), are of intermediate compatibility and with low interference or when the training of the endurance to moderate-low intensity (close to the aerobic threshold) is combined with that of resistance with its own characteristics of a more structural training and with significant metabolic stress, or in the case where high intensity endurance training (near the maximum aerobic power) is combined with that of force at high intensities with greater neuro-muscular stimulation (few repetitions per series, without generating high metabolic stress). Starting from these observations on adaptations, Docherty and Sporer (2000) built a model based on the so-called "Interference Zone". The maximum interference is found when endurance work carried out at high intensity is combined with low intensity resistance load as they both provide for adaptations at the peripheral level. Vice versa, endurance work performed below the anaerobic threshold (<85/90% of the maximum aerobic power) combined with high intensity resistance work (<6 RM) minimizes the phenomenon of interference. When both workouts cause adaptation at the peripheral level, and there is a high glycolytic demand to produce energy during the efforts, it seems that the degree of adaptive incompatibility is high because the muscular antagonist adaptations at the metabolic, structural and molecular levels compete with each other. The model proposed by Docherty and Sporer (2000) focuses mainly on the intensity of the training, being an habitual strategy to decrease the volume when the intensity increases.

Concurrent training causes excess muscle fatigue, increased catabolic status and a possible change in fiber types, counting on the fact that both physical abilities have a different motor unit recruitment model (Docherty and Sporer, 2000, García- Pallarés et al., 2011).

The possible causes of interference and how to program to avoid them

The following factors could explain the possible causes of these interferences in improving strength through concurrent training:

• accumulation of residual fatigue produced by previous workouts on the neuromuscular system;
• depletion of muscle glycogen stores;
• transformation of the type of muscle fiber, from IIb to IIa and from IIa to I;
• overtraining produced by the imbalances between the training and recovery processes of the athlete;
• inhibition of protein synthesis through resistance training, with the consequent reduction of the transverse section of the muscle fibers and a reduction of the muscle's ability to generate tension.

In the study conducted by García-Pallarés et al. (2011) it was concluded that with short and high intensity training periods (high load in 5 weeks) aimed at improving more physical components over the same period of time, much higher results are achieved in high level athletes compared to a traditional training. Regarding the sequence of the sessions, García-Pallarés et al. (2011) recommend carrying out the resistance session before the endurance session, leaving a minimum recovery interval of 8 hours between the two, due to the residual fatigue caused, which decreases the quality of the subsequent training because the system has been compromised neuromuscular. On the other hand, the frequency of training affects the quantity and quality of adaptations products during the training period, the degree of interference is related to the total number of the weeks that athletes undergo during training. The García-Pallarés study (2011) shows that the frequency of training sessions per week should be 3, because more sessions would cause a high stress to the body due to the accumulation of stimuli, and on the other side a smaller number of sessions would not provide the necessary stimuli to improve the athlete's performance. Regarding the training volume, the number of exercises per session, the serial number per exercise and the number of repetitions per series must be taken into account, so that a good regulation of all the parameters can have a greater or lesser interference in adaptations, although not the most determining factor (Jansen et al., 2007; Izquierdo et al., 2010; García-Pallarés et al., 2011). Izquierdo et al. (2010) showed that during an 8-week training period in which 4 multiarticular exercises were performed, performing 3-5 sets of each, there were significant increases in 1RM, in the power and in the specific performance of elite rowers . Also contributing as extra data, that the training of strength with repetitions until fatigue (muscular failure) muscle does not produce significant improvements in strength, while a workout with moderate repetitions and without achieving muscle breakdown instead produce significant improvements in strength. In this way, for the subjects of his study, García-Pallarés et al. (2011) established that the optimal training volume for such athletes would be: cycles of 10 to 12 weeks, 3 sessions a week of 4 to 6 multi-joint exercises of 3 to 5 series each. Among all the strategic factors, the most important and determining role is played by the intensity of the training, as a bad conjugation of the intensity of both physical abilities can lead to a clear interference in the adaptations produced and consequently a reduction in the performance of the athlete. (Docherty and Sporer, 2000; García-Pallarés et al., 2011; Izquierdo et al., 2010). By observing the physical needs that are risky from the game, the strongest and most powerful players are those who start off with different actions, and therefore the strength improvement must be focused on the development of RFD combined with endurance training, focused on development of the specific endurance in rugby, as suggested by Gorostiaga et al. (2005) and Granados et al. (2007), a VO2max is sufficient (about 50-60 ml / kg / min), and is not a limitation for the development of elite rugby.

Workout proposal

Combine training with different physiological profiles, as strength and endurance in the same session or in close sessions is a requirement for elite rugby players but at the same time it is a risk because the sense of fatigue may arise early due to the restricted recovery interval between sessions and the adaptations would not be created. Individualisation of the training programme in an elite team according to position is absolutely essential to sufficiently raise up the special physical abilities that enables a player to

reach his full potential and play at the highest levels of the game. Therefore, during particular periods of annual planning, you should avoid training players with a generic program valid for everyone. The exercises to be proposed should be as similar as possible to field activities, including the range of motion, where force is applied in the range of motion, the direction in which force is applied, the speed of movement, the type of muscle contraction and the muscular work regime. For example, within the Forwards, the Front Row has as a movement skill the scrimmaging so they should work maximal and isometric strength with squats variations, isometric scrum engage, fight, horizontal pressing variations. Within the Backs, the Centres have to tackling, breaking the gain line, support running so they should require good speed and reactive strength to get into position, but good speed strength and strength speed to execute the tackle. Below are reported two examples of inter and intra-training, designed for the forwards and the backs.

Inter-sessio CT

The training is divided into two sessions, one in the morning and one in the afternoon.

The first part of the training includes the session in the gym to work the maximum dynamic strength with percentages around about 80% with basic exercises, for a total duration of 1 hour.

The second session will be performed in the field and provides for the improvement of the specific endurance for roles (lactic acid work).

Forwards

Run shuttles on 22m in pairs or in groups of three. The exercise consist of 20 seconds of shuttle and 10 seconds of 1vs1 of scrum or 2vs3 of scrum or touche or ground fight. Repeat 4 times with incomplete recovery between repetitions and complete recovery of 3 minutes between sets. Repeat 4 times.

Backs

Run 20 seconds of shuttle and at the end run 10 seconds of 4vs4 with reduced field or 15/20 seconds of shuttle and 15/20 seconds of specific game. Repeat 4 times with incomplete recovery between repetitions and complete recovery of 3 minutes between sets. Repeat 4 times.

Intra-session CT

A workout that could be done during the same session, therefore following all the indications not to interfere between the adaptations, could be to train the general strenght / AA with circuits alternating with short lactate works. By modulating the recovery times that reflect the phases of the game and the various roles, because in the game there are intense moments alternated with moments of relative recovery, which are the various phases of play.

The session could be structured in this way: 3 basic exercises are performed with low repetitions and high load and between one exercise and the other rest 30 seconds. At the end of the 30 seconds after the last exercise, perform 60/90 seconds of fighting on the ground and then start again with the exercises in the gym. Repeat the whole circuit until we see that the player loses speed and intensity of execution.

This example of a session could be proposed in the competitive phase or in the period of maximum intensity, where we can modulate the muscular, fight and technical work by managing the recoveries to work on the lactic part. While in the initial preparatory phase, and therefore of adaptation one, it could propose the same intense muscular work followed by a work that recalls the aerobic components, such as running, understood as the ability to recover between the intense phases.

Forwards

Deadlift
Bench press + 1 '/ 1'30 "of fight
Barbell row

Backs

Squat
Bench press + 1 '/ 1'30 "of fight
Pull-up

This workout could also be seen as an individual exercise to see how many rounds each player can finish, so it can also be proposed in the form of a competition. Considering that in CT you are training two opposite capacities either in the same session or separated, you can also use the High / Low method then alternating sessions based on the intensity with which you want to work. All modulated in relation to the periodization, the championship stages, the recovery and game phases.

High level overview

These indications have also been underlined by specialists of the aforementioned sport as the Strength and Conditioning Coach of the Italian National Rugby Giovanni Sanguin, who has also experienced the CT with the team, just to comfort our explained ideas on CT. In his experience Sanguin normally prefers not to work on the same day both strength and endurance. In the opposite case he will distance the two sessions for a minimum of 4/5 hours to allow recovery to his athletes, even if not optimally, and inserting a meal. Moreover, again due to lack of time or for reasons of planning the microcycle, when he has to work in the same session

the two skills, he recommends training the resistance in small sessions at the end of training, but no more than 15 minutes, maybe through a Circuit Training. However, in his opinion, Sanguin sees the CT first of all as a training method useful in the "player formation phase", to allow young players to learn to calibrate firstly the work of strength and then the endurance one, or the training of endurance and then that of strength of the upper limbs. It is important to get them used to starting a workout and being able to carry it out, delaying the sense of fatigue as much as possible. Moreover, "reduced CT" could be considered a session that foresees the development of the Explosive Force together with a lactic acid work.

Conclusion

It would be interesting to propose the same training protocol to both an Under 20 and a first team that face elite championships. The results obtained from the two sample groups should then be compared to observe:

• how energy systems react;
• how recovery times vary between efforts.

This study proposal would also be investigated in depth because in the specific literature there is a lack of a well explained and defined CT method.

Based on the results of the match-analysis that compared the actual high intensity playing times, New Zealand, for example, can hold a high pace of play for 43 minutes, and Italy only 28-30 minutes.

You should go to investigate and clarify if this gap between the Italian and the Anglo-Saxon teams and the entire southern hemisphere, is just a problem due to the small base of number of players registered and therefore to a lesser culture of rugby, or is actually a problem of a different training methodology.

Surely it could also be verified whether through the competitor's training the quality of the game and therefore the individual technique of the player as well as the physical qualities improve.

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