Programming high-speed running and mechanical work in relation to technical contents and match schedule in professional soccer

Martin Buchheit

As previously emphasized (1), the management of high-speed running (HSR) forms a vital training program puzzle piece we need to consider from both a performance and injury mitigation perspective. Regular HSR supplementation helps maintain a stable HSR load (1), which indirectly limits the occurrence of spikes and in turn, may lower injury risk (2). Beyond only performing high-intensity interval training (HIIT, generally run around 18-22 km/h), sprinting maximally (3) or at least reaching velocities close to maximal velocity (4) is also required to cover the full HSR velocity range. In fact, while many fear the implementation of maximal sprinting during practice to avoid acute muscle strain, the reality is that sprinting itself is likely more the solution versus the problem (3). Typical strengthening exercises are unlikely intense enough to replicate sprint demands (i.e., <75% of the EMG activity reached during sprinting (5)). This suggests that sprint-specific neuromuscular demands are unique and can’t be replaced by any other (isolated) muscular actions (3).

While the management of HSR may essentially protect the integrity of the hamstrings, the importance of mechanical work (MW, accelerations, decelerations and changes of direction) programming and supplementation should also not be overlooked with respect to other important muscle groups (i.e., quads, gluts and adductors). Of course, all this is easier said than done, with the actual programming of such specific locomotor loads requiring particular attention in relation to typical soccer training contents, match demands and timing. In this short opinion piece, I offer some guidelines that coaches and practitioners can use to appropriately program HSR and MW sequences in relation to technical training contents and match schedules (i.e., different weekly microcycles).

Within-session puzzle

The first aspect to consider when selecting HIIT types (i.e., physiological targets) and formats (i.e., actual sequences) (Figure 1), is the neuromuscular demands of the tactical and technical sequences programmed within the same day or session (Figure 2). When a tactical session already involves large volumes of HSR, the best option to avoid overload of the posterior chain and especially hamstrings is likely to program either a run-based Type #1 HIIT (with low overall neuromuscular load) or a Type #4 small-sided game with high MW demand but low HSR (in this case, a complimentary load, that loads the gluts, adductors and quads). In contrast, when the goal is to overload the posterior chain (such as when preparing for the worst case scenario of match locomotor demands (7)), a Type #2 HIIT sequence targeting HSR could also be programmed (8). Finally, in the context of a technical/tactical session already involving a high MW load, using a supplementary HIIT sequence involving HSR but low MW is another good option to avoid overload, since it will likely overload different muscles groups than those of the technical / tactical sequence.

Between-match puzzle

This aspect, related to the training dynamics between matches, requires a broader understanding of the entire pro-

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**Fig. 1.** Decision tree for selecting the physiological targets of HIIT (types), which should precede selection of the associated HIIT format. The 6 physiological types include Type #1: aerobic metabolic, with large demands placed on the oxygen (O2) transport and utilization systems (cardiopulmonary system and oxidative muscle fibers); type #2: metabolic as per 1) but with a greater degree of neuromuscular strain; Type #3: metabolic as per 1) with a large anaerobic glycolytic energy contribution but limited neuromuscular strain; Type #4: metabolic as per 3) but with both a large anaerobic glycolytic energy contribution and a high neuromuscular strain; Type #5) a session with limited aerobic demands but with an anaerobic glycolytic energy contribution and high neuromuscular strain and type #6: not considered as HIIT, with a high neuromuscular strain only, which refers to typical speed and strength training for example. Adapted from the book chapter on HIIT in soccer (6).

**Fig. 2.** Typical framework for selecting the neuromuscular targets of a HIIT sequence in relation to the demands of the soccer-specific sequences of the same day/session. If the soccer-specific sequences already include HSR, HIIT may be more oriented towards 1) low or no additional neuromuscular load (Type #1) or 2) MW (Type #4) avoiding overload on the same muscle groups. Conversely, if the soccer-specific content already targets MW, HIIT could include 1) little or no MW (Type #1) or HSR (Type #2). HIIT Types refer to the physiological objectives of the sequences, as shown in Figure 1. From (6).

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1 Performance Department, Paris Saint-Germain Football Club, Saint-Germain-en-Laye, France

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Fig. 3. Decision process when it comes to programming locomotor loads, e.g. high-intensity intermittent training (HIIT) including high-speed running (HSR) and/or mechanical work (MW) and sprint work, with respect to competition participation and match microcycle. Note that only those specific sequences are shown, with most sessions also including technical and tactical components and likely possession games. SSGs: small-sided games. The different HIIT Types are those presented in Figure 1. Note that for all HIIT Types involving a high neuromuscular strain, possible variations exist, i.e. more oriented toward HSR (likely associated with a greater strain on hamstring muscles) or MW (likely associated with a greater strain of quadriceps, adductors and gluteus muscles). Type #1 can be achieved for example using 45°-CODs, which is likely the best option to reduce overall neuromuscular load (decreased absolute running velocity without the need to apply large forces to change direction, resulting in a neuromuscular strain that is lower than straight line or COD-runs with sharper angles (9)). The percentages provided for Short HIIT refer to the % of VIFT used for prescription (10) (VIFT is the speed reached at the end of the 30-15 Intermittent Fitness Test). Note than individual adjustments should be made in terms of HIIT volume prescription with regards to player profile and position (1). Decision tree adapted from (6) and published in (11).

gram, and needs to take into consideration the previous match’s locomotor load. Figure 3 shows the different training scenarios with various levels of HSR and MW loads, which all depend on both the amount of work performed during the preceding match (overall, related to minutes played, player profile and position (1)), and the number of days before the next match. Logically, the more the minutes played the preceding game, and the shorter the between-match microcycle, the less the need for HSR and MW supplementation, and conversely. For starters that played a full match, there is likely no need for any supplementation when matches are separated by less than 5 days. Conversely, at the other end of the spectrum, substitute players having more than 5 days to train before their next match should likely perform the full range of HIIT weapons (Type #4, in the form of run-based HIIT and SSGs targeting both HSR and MW), together with high speed-top ups in the format of progressive sprints (Figure 3).

Conclusion
Managing both HSR and MW are key considerations needed to keep players fit and healthy. The appropriate programming of these specific training sequences, targeting these two important locomotor loads, requires a thorough understanding of both match and technical sequences loads (Figure 2), and should be adjusted as a function of the number of days between matches (Figure 3). In this context, while the monitoring of HSR and MW during matches and training sessions with appropriate technology (i.e., tracking systems (12)) is important, the anticipation and understanding of the HSR and MW demands of the various HIIT Types and formats available (Figure 1) is vital for selecting the most appropriate puzzle piece and its programming.

References


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