and the exhaustive nature of the training program, we cannot rule out these changes as indicative of potential maladaptation to this model of training.
Grants: PI14/01509; ProID2017010106, and in part by METAPREDICT.

12:00 - 14:00

PS-PL02 SPRINT PERFORMANCE: BEATING THE LIMITS

THE PHYSIOLOGICAL DETERMINANTS OF SPRINT PERFORMANCE: AN INTEGRATIVE APPROACH

CALBET, J.

UNIVERSITY OF LAS PALMAS DE GRAN CANARIA

Sprint performance is critical for success in many sports. A high-level sprint
performance requires the optimal application of force to produce the highest power output possible. In many athletic events, the time available to generate force is very short (<75 ms), and therefore the capacity to produce high power since the very beginning of contractions is crucial for performance. Neural, muscular and mechanical factors influence the ability to generate outstanding levels of power. Several approaches trying to isolate the role played by each factor have been undertaken. However, there is lack of experimental evidence on how the three components interact to limit performance and how they respond to changes in stimulation (training/detraining) under varying circumstances (duration of contractions, temperature, fatigue, etc.). The force exerted at any given time depends on the number of cross-bridges generating tension. On the other hand, the shortening velocity depends mostly on the speed at which myosin detaches and re-attaches to actin, whose primary determinant is the myosin ATPase activity. The neural component should produce synchronised activation of all motor units at the highest frequency possible during explosive muscle contractions, with timely activation of the agonist and
antagonist/synergist muscles. A higher proportion of myosin heavy chain (MCH) IIX is associated with greater force and shortening velocity, a distinctive quality of the faster mammals in nature. The quicker and larger Ca 2+ transients of type II fibers are also contributing factors, which may become more critical as fatigue develops. Calcium transients are sensed by the calcium decoding proteins, namely Ca 2+ /calmodulin-dependent protein kinase II (CaMKII) and calcineurin. Increased CaMKII phosphorylation may induce muscle hypertrophy and reduce muscle breakdown by downregulation of the ubiquitin E3 ligases. Paradoxically, MCH IIX increase with immobilization and decrease with exercise training. Although the most effective strategy to improve muscle power is by loaded contractions performed at the highest speed possible (explosive-type strength training), the level of fatigue reached during each set has a major impact on muscle adaptations. Reducing the level of fatigue allowed during the training session helps to preserve MCH IIX and is associated with greater improvement in jumping and sprinting performance. In vitro experiments
indicate that muscle contractions to failure are associated with increased reactive
oxygen species production, which reduces Ca 2+ release and Ca 2+ sensitivity, thus hampering peak power output. During prolonged sprints, as well during repeated short
sprints, the mechanisms limiting performance become more complex and will be
analysed with some detail. The inclusion of ergogenic aids and adequate training may help to overcome some of the limitations.

NEW THOUGHTS ON DEHYDRATION, ADAPTATION AND PERFORMANCE: HOW SHOULD ATHLETES ADDRESS FLUID NEEDS DURING SPORT?

BURKE, L.

AUSTRALIAN INSTITUTE OF SPORT

Early research on the effect of dehydration on performance concluded that a fluid deficit above a threshold equivalent to ~2% BM was sufficient to impair performance, particularly in hot conditions. However, there have been recent challenges to this notion. Issues speaking to the overestimation of the effect of dehydration include the failure of laboratory based studies to account for real world conditions or the “placebo” effect of drinking, as well as the observation that many athletes incur substantial fluid deficits during “winning” performances. On the other hand, the small margins between winning and losing, the effect of dehydration on the “mental cost” of performance in events requiring repeated efforts, and the central nervous system benefits associated with oral sensation of fluid intake or cooling provide an incentive for a proactive fluid plan. Novel research protocols are attempting to remove some of these previous biases in their investigation of the effects of dehydration on sports performance, while other investigations are comparing “planned drinking” versus “drinking to thirst” as the underpinning theme of fluid practices. Whether repeated exposure to exercising in a dehydrated state “trains the body” to tolerate a fluid deficit or leads to a reduction in training quality and adaptation is a relevant question for athletes who are deliberately preparing for hot weather competition.