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# Immune inflammation markers and physical fitness during a congested match play period in elite male soccer players

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## Résumé

**Introduction :** Cellular immune markers of inflammation such as neutrophil-to-lymphocyte ratio (NLR), platelet-to-lymphocyte ratio (PLR) and systemic immune inflammation index (SII) are frequently used in patient care. The adoption of these markers to elite sports, e.g. soccer could be beneficial when monitoring training and aiming to maximize physical fitness. This study investigated cellular immune inflammation markers and physical fitness in elite male soccer players in relation to changes in training and match exposure during a congested match play period.

**Methods :** Fifteen elite male soccer players were evaluated three times (T1, T2, and T3) over 12 weeks (T1–T2: six weeks uncongested period of match play and T2–T3: six weeks congested period of match play). Players performed vertical jump tests (squat jumps (SJ), countermovement jumps (CMJ)), the 20-meter sprint test, and the Yo-Yo intermittent recovery test (YYIRL1) at T1, T2 and T3. Measurements included counts of leucocytes and its subtypes, as well as platelets. Cellular immune inflammation markers (NLR, PLR and SII) were calculated at T1, T2, and T3. Training session rating of perceived exertion was also recorded on a daily basis.

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\*Intervenant

**Results :** Significant increases in leucocyte, neutrophil, eosinophil, basophil and monocyte counts occurred at T3 compared with T2 ( $0.002 < p < 0.04$ ,  $-0.56 < ES < -0.40$ ) and T1 ( $-0.78 < ES < -0.49$ ). Lymphocyte counts were lower at T3 as compared to T2 and T1 ( $p = 0.038$ ,  $-0.48 < ES < -0.25$ ), while NLR, PLR and SII were greater at T3 compared to T2 ( $0.001 < p < 0.015$ ,  $-1.01 < ES < -0.44$ ) and T1 ( $-0.99 < ES < -0.21$ ). There was a negative correlation between YYIRL1 performance with NLR ( $r = -0.56$ ;  $p = 0.02$ ), PLR ( $r = -0.44$ ,  $p = 0.015$ ), and SII ( $r = -0.63$ ;  $p = 0.01$ ) after the congested period of match play (i.e., T3). Values for maximal oxygen uptake (VO<sub>2</sub>max), negatively correlated with NLR ( $r = -0.56$ ;  $p = 0.02$ ), PLR ( $r = -0.44$ ,  $p = 0.015$ ), and SII ( $p = 0.01$ ;  $r = -0.63$ ). There was a positive correlation between NLR, and SII with workload parameters. In addition, a clear positive correlation was observed between NLR and SII with competitive load instead ( $r = 0.59-0.64$ ;  $p < 0.001$ ), training load (TL) ( $r = 0.65-0.68$ ;  $p < 0.001$ ), session rating of perceived exertion (S-RPE) ( $r = 0.65-0.68$ ;  $p = 0.001$ ), and training volume ( $r = 0.60-0.61$ ;  $p = 0.001$ ).

**Discussion** The present findings reveal changes in immune cell counts after a congested soccer period when the innate immune cell (i.e., neutrophils, eosinophils, basophils, monocytes) increased and adaptive immune cells (i.e., lymphocytes) decreased. The decrease in performance combined with altered markers of inflammation after the congested playing period could also be explained by the chronic effects of the 12-week competitive period as well as the acute effect of the previous congested week of match play and/or the last match played during this period. This is supported by studies reporting impaired immune cell counts in soccer players during intense match programs either due to competitive matches or vigorous training periods (**1**). In addition, NLR, PLR, and SII levels increased after a congested match play period, when total load and competitive loads were increased as reported elsewhere—**2**). A clear correlation between leucocyte counts, NLR, SII with workload parameters during the competitive periods were found, suggesting that these markers can be used to monitor the intensity of training and/or competition. In contrast, PLR was not associated with workload parameters, suggesting that it may be more useful to monitor variation in NLR and SII. We found NLR, and SII were negatively correlated with aerobic fitness performance. Furthermore, decreases in VO<sub>2</sub>max and the distance covered during YYIRL1 tests were related to higher NLR and SII values. Unlike NLR and SII, PLR was not associated with other physical fitness measures (20-meter sprint, SJ, and CMJ), suggesting that it may be more useful to monitor variations in NLR, PLR and SII to assess aerobic fitness in elite soccer players, similarly to Zacher et al.'s findings in Olympic athletes (**3**).

**Conclusion :** An intensive period of congested match play significantly altered immune cell counts and cellular markers of inflammation (NLR, PLR and SII). Changes in NLR and SII were related to workload parameters, suggesting the usefulness of these markers in regulating training intensity and competitive load. An association between physical fitness (YYIRL1, VO<sub>2</sub>max) and NLR, PLR and SII suggests that these biomarkers are promising tools to monitor aerobic physical fitness of elite soccer players during congested periods of match play.

## References

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