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point-of-view

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Muscle creatine kinase as a biomarker of muscle injury in Soccer

Creatina quinase muscular como biomarcador de lesão muscular no futebol

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Abstract – The measurement of muscle creatine kinase (CKm) activity in the bloodstream has been used as a parameter for prospecting muscle injuries in soccer. This approach is based on the proposition that intense muscular activity is often associated with structural micro-injuries in contractile components of skeletal muscle. Once installed, tissue damage favors inflammatory activity, leading to the process of muscle pain. Strikinly, there is still no correlation between increased CKm in the bloodstream and the occurrence of muscle injuries, further complicating the interpretation of CKm as a reliable biomarker. CKm is a protein with a relatively high molecular weight and is primarily drained by the lymphatic system in a slow kinetic process which is, therefore, drained by the lymphatic system in a slow kinetic process. Once it enters the bloodstream, the enzyme can be rapidly degraded, being difficult to determine the protein's actual values. Therefore, the increase in CKm in the bloodstream of athletes may be a reflection of chronic muscle contraction, the intensity of training/games in the current period, and delayed-onset muscle soreness rather than direct incidence of muscle injury. Finally, there remains a lack of evidence supporting a direct relationship between increased CKm levels and performance indices.

Key words: Biomarker; Muscle soreness; Soccer; Sports performance.

Resumo – *A mensuração atividade da creatina quinase muscular (CKm) no sangue tem sido utilizada como parâmetro para prospectar lesões musculares no futebol. Essa abordagem parte do pressuposto de que atividades musculares intensas frequentemente resultam em microlesões estruturais nos componentes contráteis do músculo esquelético. Uma vez instalado, o dano tercidual favorece a atividade inflamatória, levando ao processo de dor muscular. No entanto, não há correlação estabelecida entre o aumento da CKm no sangue e a ocorrência de lesões musculares, tornando sua interpretação como biomarcador pouco confiável. A CKm é uma proteína de alto peso molecular e sua drenagem ocorre predominantemente pelo sistema linfático, em um processo lento. Quando atinge a corrente sanguínea, pode ser rapidamente degradada, dificultando a determinação de seus valores reais. Assim, o aumento da CKm no sangue de atletas pode estar mais relacionado à contração muscular crônica, à intensidade dos treinos e jogos no período atual e à dor muscular tardia, em vez da incidência direta de lesões musculares. Além disso, ainda faltam evidências que sustentem uma relação direta entre níveis elevados de CKm e índices de desempenho.*

Palavras-chave: *Biomarcador; Dor muscular; Futebol; Desempenho esportivo.*

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REPORT

Measuring the activity of the muscle creatine kinase enzyme (CKm) in the bloodstream has frequently been used as a pivotal parameter for prospecting muscle injuries in soccer. Athletes with CKm activity above the recommended values are avoided from games and training, with little or no reflection on the real meaning of the increase in this enzyme[1]. This decision is simply based on the proposition that intense muscular activity is often associated with structural micro-injuries in components of the contractile units of skeletal muscle and it often leads to delayed muscle soreness. Despite the reasoning, there is no evidence that an increase in CKm induced by physical exercise leads to any type of more serious muscle injury in soccer[2].

Although it is a multifactorial phenomenon, the mechanical stress imposed by muscle contraction seems to be the main factor in triggering micro-injuries during physical exercise. Once installed, tissue damage favors inflammatory activity, leading to the process of muscle pain. The phenomenon may also be caused by the generation of reactive oxygen species (ROS), greatly intensified by the increase in energy demand during intense exercise. Overall, the low level of physical conditioning and the performance of eccentric contractile activities are two of the main triggers of this process, indicating that adaptation to physical training can constitute an important strategy of protection against muscular activity induced- micro-injuries. Moreover, there are individuals who are more and others less responsive to the increase in CK[3]. Male individuals are always more susceptible to, compared to female individuals. It is probably due to the effect of the male sex hormone, testosterone, increasing the permeability of the skeletal muscle cell membrane. These findings indicate that there is no clear correlation between increased CKm and muscle injuries in athletes, or even in those who practice regular physical activity. CK is a relatively high molecular weight protein requiring to be drained by the lymphatic system, in a slow kinetic process that can take hours or even days for its complete removal. Once in the bloodstream, the enzyme can be rapidly degraded, making it difficult to determine the protein's real values[1,4,5].

Therefore, the increase in CKm in the bloodstream in athletes may be a reflection of either chronic muscle contraction or the intensity of training/games in the current period, which can be translated into delayed muscle pain. Furthermore, the non-existence of a correlation between the increase in CKm and the rates of muscle micro-injuries clearly signaling that a special care must be taken when interpreting blood CK values, making it difficult to predict the occurrence of a muscle injury. Finally, there is still a lack of evidence of a direct effect of increasing CKm on performance indices, suggesting that both parameters may be correlated. In the other words, it would mean that the athletes could be at the peak of their physical performance!

COMPLIANCE WITH ETHICAL STANDARDS

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Data Availability Statement

No research data was used.

Ethical approval

This research is in accordance with the standards set by the Declaration of Helsinki.

Conflict of interest statement

The authors have no conflict of interests to declare.

Author Contributions

Conceived and designed the article: LRS; Wrote the paper: LRS, BNI.

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