Faculdade de Ciências do Desporto e de Educação Física

Universidade do Porto

Crioterapia: efeitos na homeostasia muscular após o exercício

Dissertação apresentada às provas de doutoramento no ramo de Ciência do Desporto, nos termos do Decreto-Lei nº 216/92 13 de Outubro.

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ÍNDICE GERAL

1. Introdução

Todas as funções físicas do corpo implicam actividade muscular. Estas funções incluem movimentos do esqueleto, a contração do coração, a contração dos vasos sanguíneos, o peristaltismo do intestino e muitas outras (91). De um ato explosivo, como um salto, a uma ação mais refinada como a escrita, todas dependem do tecido muscular esquelético, que se constitui como um dos tecidos mais adaptáveis dos seres vivos, devido as suas propriedades intrínsecas.

O tecido muscular esquelético, como qualquer outro tecido humano, está sujeito a agressões de diversas naturezas, mecânicas, metabólicas, térmicas, etc. Destacamos neste estudo o exercício como o agente desta agressão.

Os exercícios intensos ou não habituais produzem no tecido muscular esquelético, um fenômeno designado por comumente por "miopatia do exercício" (68). Esta entidade é, por definição, considerada como um conjunto de alterações transitórias e benignas que ocorrem no tecido muscular quando submetido a níveis elevados de stress. Este acometimento pode ser de ordem morfológica e/ou funcional e o processo patológico ocorre quando um fator, de ordem interna ou externa, degrada ou danifica as células do tecido muscular, impedindo-as de executar suas funções normais. Paralelamente, este quadro é habitualmente acompanhado por um processo inflamatório transitório (citotóxico) (68).

Este tipo de agressão causada pelo exercício, seguida pela quebra de homeostasia nos músculos, tem um caráter biopositivo dentro do processo de treinamento, pois resguarda e faz valer o princípio da sobrecarga no processo de adaptabilidade, já que é necessário que haja a quebra da homeostasia do organismo, para que ele possa se organizar estrutural e funcionalmente a fim de não ser perturbado novamente por estímulos de mesma magnitude. (20, 45, 63, 68, 93).

Sendo assim, o exercício pode ser encarado como uma agressão orgânica particularmente para o tecido muscular, já que perturba, ainda que transitoriamente, a homeostasia das fibras musculares (68). Esta agressão pode

dar-se através de três mecanismos básicos: por via metabólica, mecânica e combinada (14, 68,164).

A miopatia do exercício é caracterizada clinicamente por um processo inflamatório local, dor e perda da função (força e mobilidade articular).

Tradicionalmente são utilizadas diversas estratégias para recuperação ou minimização dos efeitos da miopatia induzida pelo exercício, como por exemplo: massagem, eletroestimulação, ultra-som, infravermelho laser, antiinflamatórios, antioxidantes, crioterapia, alongamento etc. (1, 8, 34, 57, 66, 87, 88, 92, 143, ,144, 171, 174, 182, 217). Ou seja, alguns dos procedimentos utilizados para diminuir a perda da funcionalidade associada a miopatia do exercício, são também os referidos para o tratamento de lesões desportivas. Entre os vários procedimentos, destacamos a forma mais clássica de terapêuticas: Repouso (R), Gelo (I), Fixação (C) e Elevação (E), originando a sigla em língua inglesa RICE (Rest, Ice, Compression, Elevation). Estas condutas têm sido descritas como influenciadoras do edema, dor, e perda de função, desencadeados pelo processo inflamatório (57).

Durante um programa de treinamento fica inviável a aplicação desta eficiente combinação de condutas. Daí surge o desafio de encontrar alternativas, que minimizem o desconforto causado durante o processo inflamatório induzido pelo exercício, sem prejuízo na continuidade dos treinamentos.

Neste estudo foi realizado um corte na terapêutica clássica, selecionando apenas o frio (resfriamento) como forma de tratamento na recuperação da homeostasia muscular. A utilização da crioterapia justifica-se, neste caso, pelo fato de ser aquele procedimento que é mais facilmente utilizável durante um processo de treino intenso. Ou seja, pretendemos, experimentalmente, estudar o efeito do frio na evolução das alterações musculares induzidas por um exercício considerado fisiologicamente intenso e, deste modo, tentar encontrar procedimentos facilmente exeqüíveis de diminuição da funcionalidade orgânica após agressão muscular.

O frio isoladamente ou associado ao calor, são as terapêuticas mais comumente utilizadas, devido ao seu caráter prático em suas diversas formas de

aplicação. Basicamente a aplicação do frio produz uma redução na temperatura da pele e de tecidos mais profundos na região da aplicação (57, 110, 144). Apesar deste procedimento ser largamente utilizado, existe uma carência de estudos científicos, que demonstrem de forma objetiva os mecanismos de ação do frio no processo inflamatório, sendo encontradas apenas observações acerca dos resultados alcançados, na redução do edema, dor e recuperação da mobilidade.

Quando abordamos tecnicamente a aplicação do frio de forma clínica, surge um termo de designação, Crioterapia, consiste na associação do termo frio + terapia, ou seja, qualquer procedimento com intenção de tratamento que utilize gelo, água gelada ou qualquer outra forma de frio, como estratégia de diminuição da temperatura tecidual no local de aplicação (110).

Para concretizar os objetivos deste trabalho, subdividimos, o estudo em três capítulos que abordam: (I) o desenvolvimento de tecnologia para crioterapia, no modelo animal, com metodologia de frio por convecção, sem utilização de temperaturas moderadas (10 a 15 graus Celsius); (II) a aplicação desta metodologia em animais com a avaliação de variáveis bioquímicas e histológicas, indicadoras de lesão tecidual e, finalmente, (III) a reprodução do modelo de crioterapia em humanos, com a utilização de marcadores indirectos.

1.1 Objetivos

- Desenvolver sistema para aplicação de crioterapia moderada em animais de laboratório;
- Analisar as interferências da crioterapia moderada na homeostasia muscular, após a agressão tecidual produzida pelo exercício;
- Analisar alterações histológicas e bioquímicas, induzidas pela crioterapia moderada, exercício e a sua combinação;
- Analisar respostas indiretas da miopatia do exercício em humanos, submetidos a exercício, crioterapia moderada, exercício e sua combinação.

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