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Original article

Evaluation of grip strength in normal and obese Wistar rats submitted to swimming with overload after median nerve compression[☆]



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ABSTRACT

Objective: To verify the functionality through muscle grip strength in animals with obesity induced by monosodium glutamate (MSG) and in control animals, which suffered compression of the right median nerve, and treated with swimming with overload.

Methods: During the first five days of life, neonatal Wistar rats received subcutaneous injections of MSG. The control group received a hypertonic saline solution. Forty-eight rats were divided into six groups: G1 (control); G2 (control + injury); G3 (control + injury + swimming); G4 (obese); G5 (obese + injury); and G6 (obese + injury + swimming). The animals in groups G2, G3, G5 and G6 were submitted to compression of the median nerve and G3 and G6 groups were treated, after injury, with swimming exercise with load for three weeks. The swimming exercise had a progressive duration, according to the week, of 20, 30 and 40 min. Muscle strength was assessed using a grip strength meter preoperatively and on the 3rd, 7th, 14th and 21st days after surgery. The results were expressed and analyzed using descriptive and inferential statistics.

Results: When the grip strength was compared among assessments regardless of group, in the second assessment the animals exhibited lower grip strength. G1 and G4 groups had greater grip strength, compared to G2, G3, G4 and G6.

Conclusion: The swimming exercise with overload has not been effective in promoting improvement in muscle grip strength after compression injury of the right median nerve in control and in obese-MSG rats.

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Avaliação da força de preensão em ratos Wistar, normais e obesos, submetidos à natação com sobrecarga após compressão do nervo mediano

R E S U M O

Palavras-chave:

Força muscular
Compressão nervosa
Obesidade
Natação

Objetivo: Verificar a funcionalidade por meio da força muscular de preensão em animais com obesidade induzida por glutamato monossódico (MSG) e animais controle, que sofreram compressão do nervo mediano direito, tendo como tratamento a natação com carga.

Métodos: Ratos Wistar neonatos durante os primeiros cinco dias de vida receberam injeções subcutâneas de MSG. O grupo controle recebeu solução salina hiperosmótica. Quarenta e oito ratos foram divididos em seis grupos: G1 (controle); G2 (controle com lesão); G3 (controle com lesão + natação); G4 (obesos); G5 (obesos com lesão); G6 (obesos com lesão + natação). Os animais dos grupos G2, G3, G5 e G6 foram submetidos à compressão do nervo mediano e os dos grupos G3 e G6 foram tratados, após a lesão, com exercício de natação com carga durante três semanas. A natação teve duração progressiva conforme as semanas, de 20, 30 e 40 minutos. A força muscular foi avaliada por meio de um medidor de força de preensão no pré-operatório, no terceiro, sétimo, 14^o e 21^o dia pós-operatório. Os resultados foram expressos e analisados por estatística descritiva e inferencial.

Resultados: Quando comparada a força de preensão entre as avaliações, indiferentemente de grupos, na segunda avaliação os animais apresentaram menor força de preensão. Os grupos G1 e G4 apresentaram força de preensão maior, em comparação com os grupos G2, G3, G4 e G6.

Conclusão: O exercício de natação com sobrecarga não foi eficaz em promover melhoria na força muscular de preensão após lesão de compressão do nervo mediano direito em ratos controle e obesos-MSG.

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Introduction

Peripheral nerve lesions are commonly encountered in the clinical practice of physiotherapy, especially traumatic injuries such as crushing, compression or stretching, resulting in functional impairment, caused by the interruption in the proper transmission of nerve impulse.^{1,2} The interruption of the nerve supply leads to a decreased muscle activity, causing muscular atrophy, and the main effect of this atrophy is the reduction of the area and diameter of the muscle fiber and consequent reduction in its strength.¹ Axons of injured peripheral nerves have the capacity to regenerate; however, this process is slow and the functional recovery is usually not complete.³ Studies involving disorders in peripheral nerves and obesity can be found in the literature;^{4,5} however, the approach of conservative treatment for peripheral nerve injury in obese subjects is still scarce.

Physical therapy seeks to repair the consequences of peripheral nerve injury, restoring functionality to the individual. The treatment can be performed by various therapeutic approaches, such as passive and active cinesiotherapy, electrotherapy, functional skills training, specific proprioceptive neuromuscular facilitation techniques and therapeutic exercise.

Animal studies demonstrate the efficacy of exercise on peripheral nerve regeneration.^{6,7} The exercise practice promotes recovery of contractile and metabolic properties of muscle after denervation,⁸ helps removing degenerated myelin and subsequent synthesis,⁹ aids in axonal diameter recovery¹⁰ and axonal sprouting, favors the regeneration of

injured nerves and functional recovery¹¹ and also increases the expression of nerve growth factors such as BDNF and NGF, stimulating the growth and development of new cells.¹² The physiological effects of exercise in the aquatic environment provide benefits to the cardiovascular, skeletal, muscular and nervous systems, increasing the tissue repair process.¹³ However, Oliveira et al.,¹⁰ despite observing improvements in axonal diameter, report that the swimming practice did not affect the maturation of regenerated nerve fibers or their functionality, and when associated with electrical stimulation, delayed functional recovery. These findings disagree with what was observed by Teodori et al.,⁷ who observed a significant effect of swimming exercise, with acceleration of nerve regeneration in post-axotomy of sciatic nerves of rats.

One way to evaluate the functionality of the individual is by the measurement of muscle strength, which enables a functional diagnosis by an evaluation of improvement or worsening during treatment, and as a predictive or prognostic measure.¹⁴ In this context, the aim of this study was to assess the muscle grip strength in MSG-obese and in control animals, which suffered compression of the right median nerve and underwent swimming with load.

Materials and methods

Characterization of the study and sample

This is an experimental research approved by the Ethics Committee on Animal Experimentation and Practical

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