

# EFFECTS OF RUNNING ON RECOVERY OF FUNCTION IN ATHLETES WITH KNEE OSTEOARTHRITIS



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EFEITOS DA CORRIDA NA RECUPERAÇÃO DE FUNÇÃO EM ATLETAS COM OSTEOARTRITE DE JOELHO

EFFECTOS DE LA CORRIDA EN LA RECUPERACIÓN DE FUNCIÓN EN DEPORTISTAS CON OSTEOARTRITIS DE RODILLA

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## ABSTRACT

**Introduction:** Running can promote health prevent obesity, cardiovascular, and cerebrovascular diseases, among other chronic diseases. Much research reports the benefits of this aerobic resistance exercise, but little is known about the impacts of running on knee osteoarthritis. **Objective:** To observe and study the clinical effect of running on pain and function improvement in patients with knee osteoarthritis. **Methods:** Seventy cases that met the inclusion criteria were selected and randomly divided into control and observation groups. Patients in the observation group received eight weeks of neuromuscular exercise (NEMEX) and eight weeks of quadriceps muscle strength training while the control group was subjected to a running protocol. Patients were assessed using the Western Ontario and McMaster Universities Pain Scale and Osteoarthritis Index (WOMAC) after 1, 2, 4 and 8 weeks of treatment. **Results:** After 1, 2, 4, and 8 weeks of treatment, the WOMAC function scores of the two groups significantly improved compared to that found before treatment ( $P < 0.05$ ); There was no difference between the two groups before treatment and after 1, 2 weeks of treatment. After 4 and 8 weeks of treatment, the function of the observation group was better than that of the control group; the difference was statistically significant ( $t = -4.287, -6.355, P < 0.05$ ). **Conclusions:** NEMEX training methods and quadriceps muscle strength training can effectively improve patients' functional level, but NEMEX improves more significantly than quadriceps muscle strength training. **Evidence level II; Therapeutic Studies - Investigating the results.**

**Keywords:** Running; Athletic Injuries; Accident Prevention.

## RESUMO

**Introdução:** A corrida pode promover a saúde, prevenir a obesidade, doenças cardiovasculares e cerebrovasculares entre outras doenças crônicas. Muitas pesquisas relatam os benefícios desse exercício de resistência aeróbica, mas pouco conhecimento há sobre os impactos da corrida na osteoartrite do joelho. **Objetivo:** Observar e estudar o efeito clínico da corrida na melhora da dor e da função em pacientes com osteoartrite de joelho. **Métodos:** Setenta casos que preencheram os critérios de inclusão foram selecionados e divididos aleatoriamente em grupos controle e observação. Os pacientes do grupo de observação receberam 8 semanas de exercício neuromuscular (NEMEX) e 8 semanas de treinamento de força muscular do quadríceps enquanto o grupo controle foi submetido a um protocolo de corrida. Os pacientes foram avaliados usando a Escala de Dor e o Índice de Osteoartrite das Universidades Western Ontario and McMaster (WOMAC) após 1, 2, 4 e 8 semanas de tratamento. **Resultados:** Após 1, 2, 4 e 8 semanas de tratamento, os escores de função WOMAC dos dois grupos melhoraram significativamente comparados ao encontrado antes do tratamento ( $P < 0,05$ ). Não houve diferença entre os dois grupos antes do tratamento e após 1, 2 semanas de tratamento. Após 4 e 8 semanas de tratamento, a função do grupo de observação foi melhor que a do grupo controle, a diferença foi estatisticamente significativa ( $t = -4,287, -6,355, P < 0,05$ ). **Conclusões:** Ambos os métodos de treinamento NEMEX e o treinamento de força muscular do quadríceps podem efetivamente melhorar o nível funcional dos pacientes, e o NEMEX melhora mais significativamente do que o treinamento de força muscular do quadríceps. **Nível de evidência II; Estudos terapêuticos - Investigação de resultados.**

**Descritores:** Corrida; Traumatismos em Atletas; Prevenção de Acidentes.

## RESUMEN

**Introducción:** La corrida puede promover la salud, prevenir la obesidad, enfermedades cardiovasculares y cerebrovasculares, entre otras enfermedades crónicas. Muchas investigaciones informan los beneficios de este ejercicio de resistencia aeróbica, pero se sabe poco sobre los impactos de correr en la osteoartritis de rodilla. **Objetivo:** Observar y estudiar el efecto clínico de la corrida sobre el dolor y la mejora funcional en pacientes con artrosis de rodilla. **Métodos:** Setenta casos que cumplieron con los criterios de inclusión fueron seleccionados y divididos aleatoriamente en grupos de control y observación. Los pacientes del grupo de observación recibieron 8 semanas de ejercicio neuromuscular (NEMEX) y 8 semanas de entrenamiento de fuerza de los cuádriceps, mientras que el grupo de control se sometió a un protocolo de corrida. Los pacientes fueron evaluados utilizando la escala de dolor y el índice de osteoartritis de las universidades de Western Ontario y McMaster (WOMAC) después de 1, 2, 4 y 8 semanas de tratamiento. **Resultados:**



Después de 1, 2, 4 y 8 semanas de tratamiento, las puntuaciones de función WOMAC de los dos grupos mejoraron significativamente en comparación con las encontradas antes del tratamiento ( $P < 0,05$ ). No hubo diferencia entre los dos grupos antes del tratamiento y después de 1, 2 semanas de tratamiento. Después de 4 y 8 semanas de tratamiento, la función del grupo de observación fue mejor que la del grupo control, la diferencia fue estadísticamente significativa ( $t = -4.287, -6.355, P < 0.05$ ). Conclusiones: Tanto los métodos de entrenamiento NEMEX como el entrenamiento de la fuerza muscular del cuádriceps pueden mejorar eficazmente el nivel funcional de los pacientes, y NEMEX mejora de forma más significativa que el entrenamiento de la fuerza muscular del cuádriceps. **Nivel de evidencia II; Estudios terapéuticos - Investigación de resultados.**

**Descriptor:** Corrida; Traumatismos en Atletas; Prevención de Accidentes.

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## INTRODUCTION

Running as a kind of aerobic endurance exercise, can promote health, prevent obesity, cardiovascular and cerebrovascular diseases and other chronic diseases, and because of its simplicity, convenience, low cost, and ease of development, at home and abroad, running sports and running events have sprung up.<sup>1</sup> Since Beijing's first international marathon was held in 1981, the Chinese city marathon continues to flourish, for runners, it is an active lifestyle that pursues physical and mental health, for host cities, it is a way to spread culture and promote economic development. Bittencourt, N. et al. found that it was only 5 years from 2013 to 2017, China's annual marathon and related events increased from 39 to 1,102, the number of participants increased from 750,000 to 4.98 million. As far as 2017 is concerned, on average, there are 3 marathons every day, among the 1.3 billion people in the country, for every 1,000 people, 4 people participate in the city marathon.<sup>2</sup> Briem, K. and others proposed that sports have two sides, although running is a non-confrontational event, the injury rate remains high, especially for amateur runners.<sup>3</sup>

## METHOD

In this survey, the time for runners to warm up before running, and statistical analysis of relaxation time after running, as shown in Table 1, 75.86% of runners spent less than 10 minutes warming up before running, 53.6% of runners relax for less than 10 minutes after running.<sup>4,5</sup> Runners spend relaxing time after running, which is slightly longer than warming up before running, 37.3% of runners have a relaxing time of 10-20 minutes after running, it may be that more attention is paid to recovery after exercise. In this survey, the way runners warm up before running is investigated, because some runners use one or more warm-up methods, therefore, according to the number of people who choose different warm-up methods, statistics are made separately, as shown in Table 2, the number of people choosing stretching exercises is the largest, the proportion of people reached 38.25%, followed by the proportion of jogging options at 29.4%.

**Table 1.** Statistic table of the length of warm-up and relaxation time for runners before and after running.

Index	Index sub-items	total people	Number of men	Number of women
Warm-up time before running	Less than 10 min	200	120	80
	10~ 20 min	45	30	15
	20 min or more	3	2	1
	without	20	15	5
Relax time after running	Less than 10 min	140	90	50
	10~ 20 min	99	60	39
	20 min or more	18	8	10
	without	7	5	2

In the survey, the places where runners usually run are surveyed as shown in Table 3, since it can be based on factors such as weather and environment, choose different locations for running, therefore, the statistics are based on the number of people who choose to run, the report shows a total of 510 people, among them, the proportions of people who choose to run in parks and roads are similar, 33.53% and 32.53%, running in the gym is only 7.65%. 38.11% of runners suffer from sports injury pain after exercise, secondly, 21.89% of runners have pain during running. 45.28% of runners had better pain in the area of sports injury, no runners experienced increased pain at the injury site. Knee osteoarthritis (Knee osteoarthritis, KOA) is a common chronic and progressive joint disease characterized by articular cartilage degeneration, destruction and bone hyperplasia, its clinical manifestations are knee pain, stiffness, joint swelling, and limited mobility, seriously affect the patient's ability of daily living and quality of life, not only lead to physical and psychological dysfunction of the patient, it also brings a heavy burden to the family and society.<sup>6,7</sup>

Use elastic bands for quadriceps muscle strength training. Training method: Patient sitting position, the rouge nest against the edge of the chair, put a towel under the end of the thigh.<sup>8</sup> Elastic band (magenta, green, blue, black, silver, gold in increasing order, choose different colors of elastic bands according to the patient's muscle strength, that is, under the resistance of the elastic band, 10 resistance exercises of knee extension can be completed continuously. The elastic band is fixed at the patient's ankle joint, the starting position of the training is 90° natural knee flexion, here the elastic band should be kept in a just stretched position. Then complete the knee extension until the knee joint is fully straightened. Keep 5 s, in the straight position and repeat 10 repetitions as 1 set, and complete 3 sets each time. Train 2 times a day for a total of 8 weeks, in 8 weeks, according to the patient's muscle strength changes and pain tolerance, replace the elastic band with a higher elasticity.

**Table 2.** Statistics of warm-up methods for runners.

Index	Index sub-items	total people	Number of men	Number of women
Warm-up method	speed-walking	45	20	25
	jogging	150	100	50
	Stretching exercises	198	120	78
	High leg up	100	65	35
	other	20	12	8

**Table 3.** Statistics of the usual running locations of runners.

Index	Index sub-items	total people	Number of men	Number of women
Usually running location	Track field	125	77	48
	Roadside	165	108	57
	garden	170	108	62
	Gym	40	24	16
	other	10	4	6

## RESULTS

The distribution of the number of runners in all age groups is middle-high, the trend of low ends, mainly concentrated in 31-50 years old, accounted for 71.7% of the total number of people, the number of people aged 18-25 and over 60 who participated in running is relatively small, as shown in Figure 1. The main symptoms of KOA are pain in the knee joint and limited function in daily life and sports. Health education, exercise training and weight loss are among many KOA treatment guidelines, the recommended treatment with a higher level of evidence-based. Among them, sports training includes muscle strength training, aerobic exercise, balance training and so on. Different sports training methods have different goals, muscle training is to improve the muscle strength around the knee joint, aerobic exercise is to improve cardiorespiratory endurance, and balance training is to improve balance and prevent falls, NEMEX is to improve the sensory motor control ability and rebuild the functional stability of the joints.<sup>9</sup>

According to the results of this research, we found that whether it is the observation group or the control group, the pain after 2, weeks of treatment is significantly relieved than before treatment, after the first week of treatment, the pain was not significantly relieved compared with before treatment, this may be related to the shorter exercise time, and the amount of exercise is relatively low at the beginning, muscle strength and joint stability have not been significantly improved. After 2 weeks of training, the muscle strength and stability around the knee joint have improved, therefore, the pain was significantly relieved than before treatment. In addition, we found that after 1, 2, 4 weeks of treatment, the pain scores of the two groups of patients were not significantly different, after 8 weeks of treatment, the pain score of the control group was lower than that of the observation group, this is different from what we expected before the test. We believe that this situation may have the following 2 reasons: When the test is in the later stage, since the

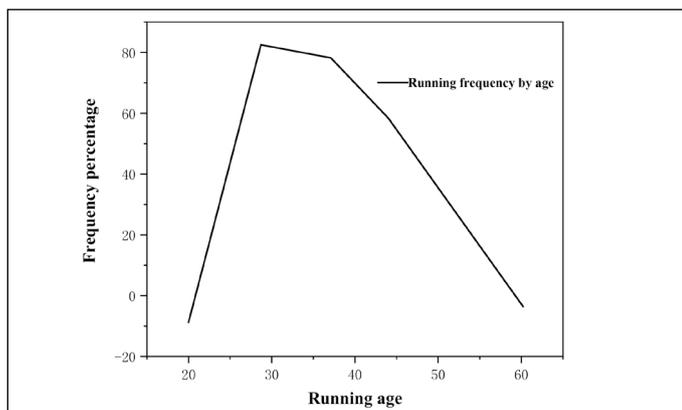


Figure 1. Running frequency by age.

observation group adopted a training method with greater resistance and difficulty, the training is carried out under the weight-bearing situation, which increases the burden on the knee joint, as a result, some patients with severe KOA experienced increased pain in the final stage of the trial. Although before the test, we told the patient in great detail that the knee joint should maintain the correct alignment and alignment in NEMEX, but as the difficulty increases, based on the feedback from the subjects, we learned that some subjects in the observation group were exercising, the movement is not completely standardized, and it also affects the effect of training. The control subjects had almost no similar feedback. It can be seen that, when NEMEX is used in patients with severe KOA, the difficulty of exercise should be strictly controlled, and observe the quality of the exercise completed during the exercise, ensure correct alignment and alignment of the knee joint.<sup>10</sup>

## DISCUSSION

In terms of functional improvement, the research results are consistent with our expectations. Both training methods can effectively improve function, and NEMEX is more effective in improving function than quadriceps muscle training. This may be related to NEMEX is a kind of functional weight training. The quadriceps muscle strength training mainly adopts resistance training without weight bearing. Although both methods can increase the stability of the knee joint, but NEMEX can improve when completing functional exercises, sensorimotor control and dynamic stability of joints, this is consistent with the actual completion of the functional task. On the other hand, NEMEX may help improve the proteoglycan content in articular cartilage. Roos et al. found that after 4 months of NEMEX intervention, the content of cartilage proteoglycans in the joints increases. The content of cartilage proteoglycan increases, it can improve the rigidity and load bearing capacity of cartilage, thereby alleviating KOA symptoms and improving function. Otherwise, NEMEX can significantly improve the cause of functional activities, it may also increase the patient's confidence in completing some weight-bearing functional activities.

## CONCLUSION

This questionnaire is mainly aimed at the basic running situation and sports injury characteristics of runners. And both training methods can effectively improve the patient's functional level, NEMEX improves more significantly than quadriceps muscle strength training. Although NEMEX can relieve the pain of KOA patients and improve the level of function, but we found that it may aggravate pain in patients with severe KOA, therefore, patients with severe KOA need to use it with caution. In general, we recommend NEMEX for KOA patients.

All authors declare no potential conflict of interest related to this article

**AUTHORS' CONTRIBUTIONS:** Each author made significant individual contributions to this manuscript. JH: writing and performing surgeries. JY: data analysis and performing surgeries, article review and intellectual concept of the article.

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