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Effects of the Pilates method on neck pain: a systematic review

Efeitos do método Pilates nas dores cervicais: uma revisão sistemática

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Abstract

Introduction: The Pilates method has been used for neck pain reduction. **Objective:** To systematically review randomized and non-randomized controlled trials that assessed the effects of Pilates on neck pain when compared to other groups (CRD42015025987). **Methods:** This study involved a systematic review directed by the PRISMA Statement based on the recommendations of the Cochrane Colaboration, registered in PROSPERO under the code CRD42015025987. The following databases were searched: Cochrane CENTRAL, EMBASE, PubMed, Science Direct, Scopus and Web of Science, using the terms "Pilates" AND "Neck pain", without language and date restrictions. **Results:** Of a total of 73 identified studies, two were included herein since they fulfilled the eligibility criteria (at least one intervention group applying Pilates), where we evaluated the methodological quality by the Downs and Black scale and evidence strength with the Best Evidence Synthesis. Pain and disability decreased from the sixth session, with gradual improvement in up to 24 sessions. **Conclusion:** Few studies are available using Pilates to decrease pain, and moderate evidence exists of positive Pilates effects on pain and function in patients with neck pain.

Keywords: Neck Pain. Pilates. Exercise Therapy. Systematic Review.

Resumo

Introdução: *O Método Pilates vem sendo utilizado para redução álgica cervical.* ***Objetivo:*** *revisar sistematicamente os ensaios clínicos aleatorizados e não aleatorizados que avaliaram os efeitos do Método Pilates na dor cervical,*

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quando comparados a outro grupo (CRD42015025987). ***Métodos:*** *O presente estudo compreendeu uma revisão sistemática direcionada pelo PRISMA Statement com base nas recomendações da Colaboração Cochrane, registrada no PROSPERO sob o código CRD42015025987. Foram conduzidas buscas nas bases de dados Cochrane CENTRAL, EMBASE, PubMed, Science Direct, SCOPUS e Web of Science, com os termos "Pilates" AND "Neck pain", sem restrição de idioma e data.* ***Resultados:*** *Dos 73 estudos identificados, dois foram incluídos por cumprir o critério de elegibilidade (ao menos um grupo com intervenção com Pilates), sendo a qualidade metodológica avaliada pela escala Downs e Black e a força de evidência pela Melhor Síntese de Evidência. A dor e a incapacidade diminuem a partir da sexta sessão, com melhora gradativa até 24 sessões.* ***Conclusão:*** *Há poucos estudos e moderada evidência sobre os efeitos positivos do Pilates na dor e funcionalidade em indivíduos com dor cervical.*

Palavras-chave: *Dor Cervical. Pilates. Terapia por Exercício. Revisão Sistemática.*

Introduction

Chronic neck pain is characterized by pain and limited movement, from small discomforts to severe and disabling pain [1, 2]. This condition causes reduction in quality of life [3], leading to drug dependence, emotional changes and difficulties at work [4, 5]. Approximately 14 to 71% of adults will present an episode of neck pain at some point in their life, with annual prevalence varying from 16 to 75% [6] and a recurrence rate of 75% in the following five years [7]. According to Ferreira et al. [8], in a study conducted with 972 Brazilians aged 20 to 69, 24% of the individuals presented neck pain at least once in the last year, with a prevalence of chronic pain at 18.9% and acute pain at 34.1%. Similar results are observed in other countries. For example, in a Finnish study [9], chronic neck pain was observed in 13.5% of women and 9.5% of men, and in a Norwegian study [10], 13.8% of the participants reported pain lasting over six months, while in individuals over the age of 43 this rate rose to 20%.

Currently, several types of interventions have been performed in order to reduce chronic neck pain [11 - 13], from conventional physiotherapy to more specific exercises [14, 15], among them the Pilates method [16, 17]. Pilates can be considered as an alternative to improve flexibility, motor coordination, muscular strength and stability, as well as postural alignment, which are essential factors for postural functionality and reeducation [18 - 20] in general.

In addition, strengthening and resistance exercises, specific for the cervico-scapulothoracic and shoulder region, have been highlighted as a beneficial part of the intervention routine of patients with chronic neck pain, presenting moderate evidence levels regarding pain relief and functional improvement [13]. The Pilates method comprises the accomplishment of global muscular activations [18 - 20] in its repertoire of exercises, although it is possible to isolate muscular focus and prioritize regions of interest according to the presented pathology, and can, thus, be recommended for interventions in individuals with neck pain.

However, there is no evidence so far for Pilates prescription for neck pain and functional improvement. Thus, the aim of the present study was to systematically review randomized and non-randomized clinical trials that evaluated the effects of the Pilates method on neck pain when compared to a control group or to another type of intervention.

Methods

Study type

The present study comprised a systematic review [21] guided by the PRISMA Statement [22] based on the recommendations of the Cochrane Collaboration [23], registered in PROSPERO under the code CRD42015025987 (http://www.crd.york.ac.uk/PROSPERO/display_record.asp?ID=CRD42015025987).

Search strategies

In order to achieve the proposed goal, the following Cochrane databases were searched: CENTRAL, EMBASE, PubMed, Science Direct, SCOPUS and Web of Science, between September 4 and 9, 2015. The terms and boolean operator searched for were "Pilates" AND "Neck pain". No restriction regarding language

or year of publication was applied, and the search ranged from the beginning of the establishment of the databases until the search year, 2015. An example of the search strategy is presented in Table 1. Studies should be clinical trials published in peer-reviewed journals or papers published in annals of events. Manual searches were also performed based on the references of the included studies.

Table 1 -Search strategy - *PubMed*

#1	"Pilates"
#2	"Neck Pain"[Mesh] OR "Neck Pain"
#3	#1 AND #2

Elegibility criteria

Two evaluators, independently selected the potentially relevant studies from the search results titles and abstracts. When these sections did not provide enough information to be included, the full text was verified. Subsequently, the same reviewers independently evaluated the complete studies and performed the selection according to the eligibility criteria: a methodology that involved a Pilates method intervention in at least one group. Discordant cases were resolved by consensus [24]. Authors, year of publication, participants (total and group - age), type of intervention and results of the variables of interest (pain and functionality) were independently obtained by the two reviewers, using a standardized form.

Evaluation of the selected studies

The two reviewers independently assessed the methodological quality and risk of bias through the Downs and Black scale [25], which is composed of 27 items distributed in five sub-scales (report, external validity, risk of bias, confusion factors and power of study). The answers were scored as zero (item not included) or one (item included), with the exception of one item of the sub-scale report, that scores from zero to two and the item referring to the power of the study, which scores from zero to five. However, it should be pointed out that, in studies involving oriented physical activity as a form of intervention, as in the case of this review, items 14 and 24 were not be considered, since it is not possible to blind individuals and therapists. Thus, the maximum score obtained for the studies was 30, with a cut-off point of 18 points chosen to discriminate between low and high quality studies.

Evidence strength

The strength of the scientific evidence was analyzed through the Best Evidence Synthesis [26], based on the following criteria: strong evidence, obtained through several high-quality studies; moderate evidence obtained through a high quality study and one or more low quality studies, limited evidence obtained through a high quality study or several low quality studies; and no evidence, obtained through a poor quality study or contradictory results.

Results

The initial search identified 73 studies, of which 12 were duplicates, thus leaving 61, although 59 were excluded based on the titles and abstracts. Thus, only two were eligible for a detailed analysis and were included in this review. Figure 1 displays the flowchart of the search and Table 2 summarizes the characteristics of the included studies.

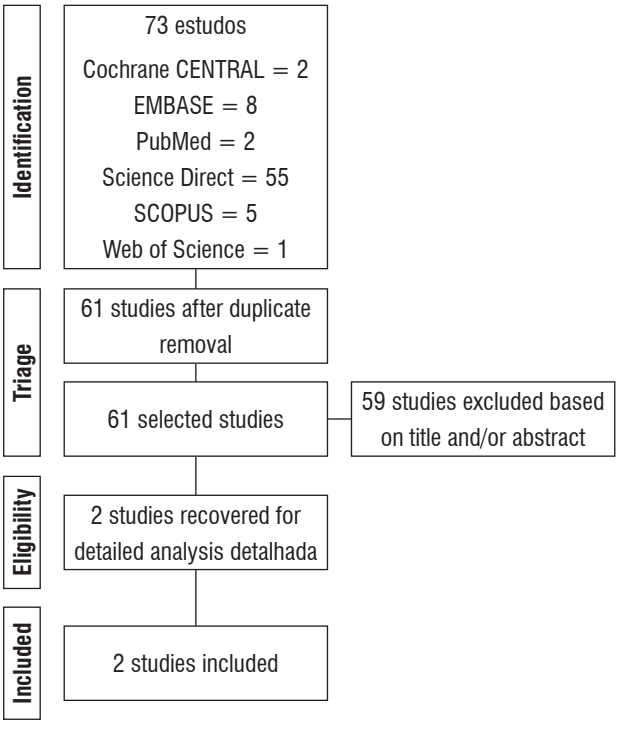

Figure 1 - Search flowchart

Table 2 - Characteristics of the included studies

Study, Year	Study type	Sample data	Intervention	Evaluation	Results
Dunleavy et al. [17]	NRCT	Chronic neck pain N = 56 (49 women and 7 men; age 55.6 ± 9) Pilates group: n = 20 Yoga group: n = 19 Control group: n = 17	Duration and Frequency: 12 weeks, once a week (60 min) Pilates group: Pilates exercises on the ground Yoga group: Adapted Yoga exercises Control group: no intervention	- Evaluations: weeks 0, 6, 12 and 18 - Functional incapacity (NDI - *Neck Disability Index*) - Pain Intensity Evaluation (NRS - *Numeric pain rating scale*)	- NDI: ↓ in the Pilates and Yoga groups at week 12; - NRS: ↓ in average pain in the 12th week compared to the 6th week in the Pilates group; ↔ pain in the upper limb; and ↓ pain in sustained activity from the 6th week in the Pilates and Yoga groups; - No difference comparing results from weeks 12 and 18.
Cazotti et al. [27]	RCT	Chronic neck pain n = 64 (age 18-65) Pilates group: n = 32 Control group: n = 32	Duration and Frequency: 12 weeks, twice a week Pilates group: Pilates exercises and drug maintenance Control group: drug maintenance only	- Evaluations: pre-intervention, and after 45, 90 and 180 days - Functional incapacity (NDI - *Neck Disability Index*) - Pain Intensity Evaluation (AVS - Analogic visual scale)	- The Pilates group, in comparison to the control group, presented improvement of pain and functionality.

Note: Caption: ECNR: Non-Randomized Clinical Trial; ECR: Randomized Clinical Trial.

Based on the evaluation of the methodological quality and risk of bias, taking into account the obtained scores and the type of included studies (Tables 2 and 3), the present systematic review presents moderate evidence. Since one of the studies comprised only an expanded abstract version [27] in its entirety, its score was lower, and its evaluation and interpretation were impaired.

Table 3 – Score of the studies on the Downs and Black scale [25]

	SCALE ITEM	INCLUDED STUDIES	
		Dunleavy et al. [17]	Cazotti et al. [27]
1	Clear hypothesis/objective	1	1
2	Measured Outcomes	1	1
3	Characteristics of the individuals included	1	1
4	Interventions	1	1
5	Distribution of the confusion factors	1	1
6	Findings and conclusions	1	0
7	Variability estimates	1	0
8	Adverse effects	0	0
9	Characteristics of lost individuals	1	0
10	Confidence intervals and p values	1	1
11	Individuals representative of the population	0	0
12	Representative % of individuals	0	0
13	Representative team and location	1	0
15	Evaluator blinding	0	1
16	Data dredging	1	1
17	Analyses adjusted over time	1	1
18	Adequate statistical tests	1	1
19	Adherence to the intervention	1	1
20	Accurate outcome measurement	1	0
21	Individuals from groups recruited from the same population	1	0
22	Individuals recruited during the same period	1	0
23	Randomized individuals	0	1
25	Adjustment of the confusion factors	0	0
26	Losses taken into account	1	0
27	Power of the study	5	0
	Total	**23**	**12**

(To be continued)

(Conclusion)

Discussion

Scientific research on the effects of the Pilates method on neck pain present methodological differences, but do not make comparisons unfeasible. Regarding the studies included herein, one was predominantly performed with adults [17] and the other with young and old individuals, characterizing a broader age group [27]. The divergences and particularities of each age group make it difficult to extrapolate and compare the results, since the elderly population presents associated health problems and poorer health self-perception [28, 29]. It should be pointed out that neck pain has become a public health problem, which directly affects individuals of the economically active population, in other words, adults, which is consistent with the sample design adopted in both studies included in this review, and in the studies included in the systematic review conducted by the Cervical Overview Group of the Cochrane Collaboration [12].

Most studies conducted to investigate the effect of Pilates exercise intervention include female participants, due to the profile of people that search and conduct the practice [30, 31]. In addition, the incidence of neck pain is higher in women compared to men [6, 32, 33], corroborating the sampling adopted in the studies [17, 34].

In the study conducted by Dunleavy et al. [17] the final sample, considering intention to treat the presented pain, was composed of 56 individuals. However, 90 individuals had been estimated to detect clinical differences through the Neck Disability Index [35]. On the other hand, in the study performed by Cazotti et al. [27], conducted with 64 individuals, individuals were not described per sex and the sample calculation was not reported, despite the fact that the adopted sample size was considerable. It should be noted that studies encompassing exercises as therapy for the treatment of neck pain, in turn, show a small sample size [12], which can lead to biases and generate type II errors.

Although the included studies were clinical trials, only one seems to have been methodologically conducted in a randomized fashion [27], and divergences in the number of listed groups were observed. Dunleavy et al. [17] conducted a controlled, almost randomized, parallel study and chose to split the sample into three groups, one control and two undergoing interventions, one with Pilates exercises and the other with Yoga. Cazotti et al. [27] conducted their study with an intervention group with Pilates and drug maintenance and a control group with drug maintenance only, which may have masked information related to pain results, since the medication had an active principle focused on pain relief. The results of the comparisons between groups were presented in both included studies [17, 27], while in the study performed by Dunleavy et al. [17] the results isolated by group over time were also provided, facilitating extrapolation of the findings and understanding of the effects of the practice.

Regarding the type of intervention, Dunleavy et al. [17] adopted solo Pilates exercises guided by physiotherapists trained in the method, focusing on stabilization, mobilization and strengthening of the extensor muscles of the spine, with greater focus on the shoulder girdle, in classes performed with groups composed of four to eight individuals. This protocol was similar to that adopted in the study conducted by Mallin & Murphy [34], with individuals with chronic neck pain, although these authors prioritized the pelvic girdle in their approach. However, it is not clear what exercise protocol was adopted in the study conducted by Cazotti et al. [27]. The preference for ground exercises may be due to low costs and ease of execution regarding physical space and the fact that they can be taught to larger groups, as well as the fact that exercise resistance is only generated by the action of gravity and not exacerbated by the use of accessories, such as occurs when using equipment springs.

The frequency of the sessions in the study performed by Dunleavy et al. [17] consisted of a weekly intervention lasting 60 minutes, also adopted by Mallin & Murphy [34], although these authors still recommend complementary home practice. On the other hand, Cazotti et al. [27] preferred to adopt a frequency of twice a week, which has been observed in other studies conducted with Pilates [26, 36]. In both studies, the duration of the intervention consisted of 12 weeks [17, 27], accounting for a total of 12 sessions in the report by Dunleavy et al. [17] and 24 in the study by Cazotti et al. [27]. It should be noted that, in a recent systematic review with meta-analysis on the effects of exercise on neck pain [37], authors observed that an intervention frequency of three times a week was the most adopted and, therefore, indicated, since this frequency results in pain improvement, strength, quality of life and functional capacity [38, 39].

We emphasize the importance of performing exercises under the guidance and supervision of a trained professional, mainly by individuals seeking the practice for pain relief, for, although home exercise programs are important for maintenance, they can be performed incorrectly, reinforcing the adoption of inadequate movement strategies [17]. In addition, it is extremely important that the exercise protocols in the studies be evidenced, in order to allow for replication in research and clinical practice.

Investigative approaches regarding pain and functionality were conducted in the included studies [17, 27], since these variables are directly related to each other. Pain was measured in the study performed by Dunleavy et al. [17] by means of the Numerical Pain Classification Scale, which quantifies the intensity of the pain through a numerical categorization from zero to 10, through questions regarding pain during the last week (in order to characterize the pre-intervention groups), pain caused by activities related to upper limb movements and pain caused by sustained tasks. Cazotti et al. [27] opted to use the Visual Analogue Scale, which consists of a 10 centimeter horizontal line, designed to quantitatively assess pain in both clinical and research situations [40], approached comprehensively.

Functionality was evaluated in both studies using the Neck Disability Index [17, 27], which consists of 10 questions related to pain and daily living activities (pain intensity, personal care, concentration, work, driving, sleeping and recreation), with responses in the Likert scale format (0 - 5). A maximum score of 50 can be obtained, where higher values indicate greater disability [35]. It should be noted that all the adopted evaluation instruments are valid and reproducible, leading to more robust and reliable results.

In the study conducted by Dunleavy et al. [17] the evaluations were performed before the beginning of the study, in the 6th, 12th and 18th weeks, the latter referring to the follow-up, performed after six weeks of the end of the practice. In the study performed by Cazotti et al. [27] pre-intervention evaluations were carried out after 45, 90 and 180 days, or, in weekly approaches, at week zero, six, 13 and 26, and the follow-up was conducted at an interval of 13 weeks. It is important to point out the importance of conducting evaluations after an intervention pause period, which allows for the verification of the preservation of the obtained benefits.

Significant functionality improvement with Pilates exercises was observed in the included studies [17, 27]. Dunleavy et al. [17] observed better results in the groups submitted to the intervention in the 12th week compared to the 6th, after the end of 12 sessions, which was not observed in the control group. This corroborates the report by Mallin & Murphy [34], who also observed improvement in this variable after six sessions. However, evidence is still of low quality regarding the benefits related to functionality arising from interventions with exercises in long-term follow-ups [12]. Moreover, in the study performed by Dunleavy et al. [17], Pilates had greater effect than Yoga when compared to the control group, and only Pilates promoted improvement from the 6th week onwards. However, in the study conducted by Mallin & Murphy [34], a preservation in the improvement of the functionality after six weeks of the end of the intervention was observed, while in the study conducted by Dunleavy et al. [17] no difference was observed comparing the 12th and 18th weeks.

The decrease of pain with the Pilates intervention was unanimous in the included studies [17, 27]. In the study performed by Dunleavy et al. [17], pain caused by sustained tasks decreased from the 6th week of intervention, with lower values and near-remission after 12 weeks in the groups submitted to the intervention. Meanwhile, the average pain in the Pilates group was lower in the 12th week compared to the 6th, and the same when compared to the control group, with Pilates displaying a significant effect. However, no significant difference was observed in relation to pain caused by upper limb movements in all analyzed groups, as well as in the follow-up evaluation after six weeks of the end of the intervention. In the same study, the group submitted to the Yoga intervention also presented pain decreases in comparison to the control group, but with moderate effect size. Cazotti et al. [27] also observed significant pain improvement, however, they did not make it clear from which week. These results are in line with what has been observed in other systematic literature reviews, which demonstrate the benefits of exercise therapies in the decrease and remission of pain [12, 41].

Based on the above, despite the small number of studies carried out to investigate the effects of Pilates on individuals with neck pain, we emphasize

their considerable quality and methodological rigor, which provides basis for the reproduction of the described protocols in the clinical practice, adding to the guidance of the prescription of exercises by instructors with training in the Method.

Conclusion

The present systematic review presents moderate evidence to support the indication and practice of Pilates exercises by individuals with chronic neck pain, since this method promotes functional and functional improvement after a short period of time. It is suggested that studies with higher quality and methodological rigor, such as randomized clinical trials, be conducted, so that evidence of this practice recommendation can be confirmed.

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