



Influence of pilates method training on the balance of the elderly: a systematic review

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ABSTRACT

Introduction: Getting older is a process characterized by physical changes, which include, among other, the loss of reproductive function and the decline of motor function and it is sometimes associated with chronic diseases. The aging process induces a natural functional decline, and considering this phenomenon, it is primordial research studies that indicate interventions that promote improvements in the health status of the elderly. **Objective:** To analyse, through a sistemic review, the effects of the pilates method on the static and dinamic balance in the elderly. **Method:** This systematic review followed the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) and the searches were carried out in database: IBECs, PubMed, LILACS, EMBASE, SCIELO e PEDro from descriptors “pilates, exercício físico e idosos”, and their names in english and spanish. **Results:** There were analysed 11 original articles about the theme and most of them showed positive results of the pilates method on the static and dinamic balance in the elderly. **Conclusion:** The pilates method showed significant results on the static and dinamic balance in the elderly, but there should be better quality studies to guarantee its effectiveness.

Keywords: elderly, pilates, balance

INTRODUCTION

The phenomenon aging of the world population is a reality found in several countries, including Brazil.⁽¹⁾ Growing old is a process characterized by physical transformations, which include, among other changes, the loss of reproductive function and the decline of motor function,⁽²⁾ being sometimes associated with chronic diseases.^(1,3)

Despite the functional decline generated by aging, regular physical exercises (PE) provide several benefits, such as improved quality of life, cardiorespiratory fitness, increased muscle strength and balance.^(4,5) The PE associated with proper nutrition can prevent or delay the onset of various diseases.⁽⁶⁾

Among the various forms of PE, the Pilates method, developed by Joseph Pilates in the last century, consists of activities that require balance, strength, concentration and body awareness by the practitioners, with a focus on overall development and reduced energy expenditure during this activity.⁽⁷⁾ There are some basic principles for the development of this method, including, control, concentration, precision, focus, relaxation, free movement, strength and diaphragmatic breathing.⁽⁸⁾

The pilates method has often been used to improve balance.^(9,10) The static and dynamic balance are very important variables that must be taken into account in the practice of pilates method, therefore, mainly help the elderly to decrease

the risk of falls and, consequently, causing them to have a better quality of life and functional independence in activities of daily living.⁽¹⁰⁾

Although it is a very common condition in people in advanced age, imbalances and high risk of falls may be altered through physical training. However, there are still doubts about the efficacy of the pilates method in relation to the changes generated on the balance, due to the scarcity of good quality studies and systematic reviews with these types of articles.

Considering the assumptions presented, the present study consisted in a systematic review, which objective was to identify and analyze studies that verified the effects of the pilates method on the balance of the elderly.

The question on which this review was based for the construction of PICO (P - people; I - intervention; C - comparison; O - Outcome) was: Does the pilates method influence the balance of the elderly? Being the P - Elderly; I - Pilates; O - the Balance. The balance is the primary studied outcome.

METHOD

This systematic review followed the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)⁽¹¹⁾ when appropriate.

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Procedure for data collection and analysis

The research was carried out from June to August of 2016 searching for articles in the following databases: IBECs, PubMed, LILACS, EMBASE, SCIELO and PEDro. These databases were chosen for indexing large numbers of area-specific journals. In the article search process, the following descriptors were used: pilates, exercise and elderly, and their respective names in English and Spanish. All descriptors have been entered in the databases according to the official languages required by them.

The research was done by 2 researchers independently and a third researcher was activated when there was some disagreement. The last search was performed on August 20, 2016.

As inclusion criteria to compose this systematic review were considered original articles published in any language, presenting a human sample and information about the treatment on the elderly balance using the pilates method, as well as to report information about exercise use and applied methodology.

The criteria for the articles exclusion were: scientific papers that were published in other formats, configured as case studies, case series, review articles, educational materials, incomplete articles or deficiency in the methodological description, particularly regarding the objective, methods, results and conclusions and articles with multiple interventions and/or only preliminary data submitted. Articles which were indexed in more than one database were also deleted.

The procedures for the search of the articles were organized in the following sequence: in the first stage of the investigation, a search of the articles with the descriptors proposed in the previously mentioned databases was carried

out, initially considering the reading of the titles of articles which were located in the searches, in order to exclude those that clearly did not meet the objectives of the study. In a second stage, this selection was made through the reading of the abstract of the articles and then they were analyzed in full if any doubt persisted.

The comparison between the data obtained from the studies and the decision to insert them in this review was made at the consensus meeting by the researchers. When there was any doubt about the information contained in the articles, it was attempted the contact through email/telephone with the researcher in charge.

After the selection of the articles, they were stored in a database containing information about the sociodemographic characteristics of the study population, country, year, type of study, data collection form, authors and methodological procedures such as: randomization, blinding, intention-to-treat analysis, early stopping (interim analysis), participants, intervention, instruments for analysis, selective description of outcome, and the outcome. The articles were grouped by similarity of population and results, characterizing, thus, the scientific publication which was associated to the theme.

RESULTS

After the search, 238 articles were found, of which 211 were excluded by reading the title. In the subsequent phase, through an analysis of the abstracts of the articles, it was decided to exclude six articles, finally after reading the articles in full, it was decided to exclude 10 articles, remaining

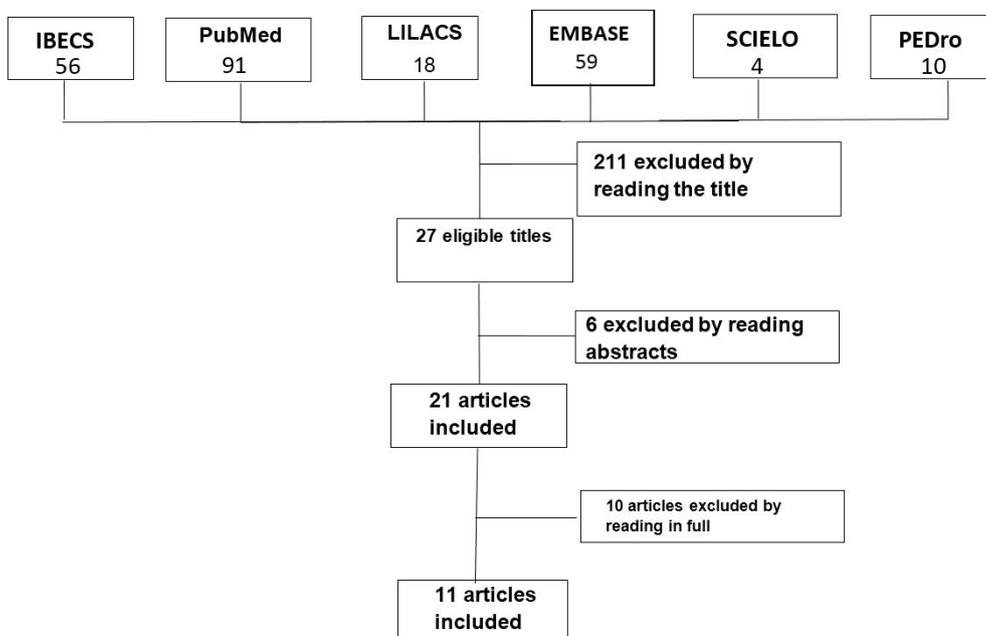


Figure 1. Selection process of articles



11 articles. These results are illustrated in figure 1, which shows the selection process of the articles.

Localized articles were published between the years 2009 and 2015, although publication time was not restricted in the search phase.

The characteristics of the studies that were part of this review are shown in Table 1, which presents a summary of the articles found according to the chronological order of publication.

DISCUSSION

The articles in the present review present methodological bias that may interfere with their results. In addition, it is important to highlight the small number of papers that aim the subject under study. Despite the small number of productions and biased methodological strategies, there are studies which report improvements in pain and quality of life of people who used Pilates as a form of intervention.^(12,13)

Table 1. Summary of articles found, according to chronological order of publication.

REFERENCES	OBJECTIVE	METHOD - Type of research - Subjects - Instruments	RESULTS	CONCLUSION
Evaluation of the static balance of elderly females after training with Pilates method. Siqueira BG, Cader AS, Oliveira EM, Torres NVOB, Dantas EHM. Revista brasileira Ciência e Movimento. 17(4):27-33, 2009.	To verify the effects of the Pilates method on the balance of healthy elderly women.	Quasi-experimental study Pilates Group: 27 elderly women; Control Group: 25 elderly women. They performed 8 sessions, twice a week for 60 min each and the control group maintained the AVD's. There was no randomization, secrecy of allocation, blinding. Pilates group - heterogeneous before the intervention, i.e. the data can not be compared (for the outcome balance). Evaluation through the Tinetti Protocol.	There was a significant improvement after intervention in the intergroup and intragroup analysis.	Pilates may offer benefit to the static balance of the elderly women after 8 consecutive weeks of exercise.
Pilates method in personal autonomy, static balance and quality of life of elderly females Siqueira BG, Ali S, Bento NV, Oliveira EM, Martin EH Journal Bodyw Mov Ther. Apr. 14(2):195-202, 2010.	To evaluate the effects of the Pilates method on personal autonomy, static balance and quality of life in healthy elderly women.	Quasi-experimental study 52 elderly women. Divided into 2 groups. Pilates group (27 elderly) and control group (25 elderly). The pilates group did exercises twice a week for 8 weeks. Evaluation of functional autonomy, Static balance (Tinetti), Quality of life (WHOQOL-OLD).	The pilates group presented post-test improvements in balance (Delta 4.35%), functional autonomy (Delta 13.35%) and quality of life (Delta 1.26%).	The pilates method may offer a significant improvement in personal autonomy, static balance and quality of life.
Effect of the Pilates method on the quality of balance and gait movements in elderly. Carvalho QJ, Silva PA, Isabel SM. Fisioterapia Brasil 12(1): 37-42, 2011.	The objective of this study was to analyze the effect of the treatment with the pilates method on gait movement quality and postural balance in the elderly.	Quasi-experimental study. 12 elderly did 32 pilates sessions for 4 months. POMA Scale.	The results showed an improvement in post-intervention gait balance.	The pilates method improves the motor function of the elderly.
A Randomized Controlled Study Investigating Static and Dynamic Balance in Older Adults After Training With Pilates. Bird M, Hill KD, Fell JW. Arch Phys Med Rehabil Vol 93, January 2012.	To investigate the Pilates effects on the static and dynamic balance of elderly women.	A randomized controlled trial. The exercises were done for 5 weeks 2 times a week. Each group was practicing the Pilates method and the other maintaining the AVD's and after that they reversed (crossover). 14 people in the first group and 13 in the other group. An evaluation was made before the start of interventions (1), immediately after the end of the 5 weeks (2), after 6 weeks there was crossover and data collection (3), and after relay termination (4). There was randomization, secrecy of allocation, blinding. Intention-to-treat analysis was dubious and unclear. No homogeneity or normality tests were performed on the pre-treatment data. There was a small number of participants so that the power of the study was adequate for a level of significance of $p = 0.05$. Dynamic balance was evaluated by Timed up and Go and Four Square Step Test. The static was evaluated by a force platform.	There were improvements in the static and dynamic balance in the group undergoing training with Pilates both the first group and the second (crossover).	Significant improvements were observed in the static and dynamic balance together in the 2 conditions. Between the groups there was no significant difference due to the low power to detect real difference between them.



Table 1. Continued...

REFERENCES	OBJECTIVE	METHOD - Type of research - Subjects - Instruments	RESULTS	CONCLUSION
Changes in gait and balance parameters in elderly subjects attending an 8-week supervised Pilates programme. Newell D, Shead V, Sloane L. Journal Bodyw Mov Ther. Oct;16(4):549-54, 2012.	To investigate the effects of the pilates method on gait parameters in the elderly.	Observational study. 9 elderly people attending pilates classes for more than 8 weeks. The tests used were: gait speed, step cycle, Anteroposterior balance, lower limb strength.	There was a significant improvement in walking speed, step cycle, Anteroposterior balance.	The results suggest that a short pilates program has the potential to improve gait and balance parameters, including those associated with the risk of falls.
The Effects of Pilates Mat Exercise on the Balance Ability of Elderly Females. Hyun J, Hwangbo K, Lee C, J. Phys. Ther. Sci. Vol. 26, No. 2, 2014.	To compare the effects of the mat exercises of the Pilates method and balance exercises for stability of the trunk on the balance ability of the elderly women.	Quasi-experimental study. 40 elderly women divided into 2 groups. Pilates solo group and Exercise group on an unstable surface. Intervention: 3 times a week for 12 weeks for 40 min each. There was no secrecy of allocation, blinding and randomization. No homogeneity or normality tests were performed on pre-treatment data. There was no description of the methods used to assess outcomes.	Dynamic balance improved only in intragroup analysis. The static balance showed improvement in the intra and inter group analysis.	The pilates method and the balance exercise for the trunk, made it possible to improve the static and dynamic balance of the elderly women.
Positive long-term effects of pilates exercise on the aged-related decline in balance and strenght in older community-dwelling men and women. Bird ML, Fell J. Journal Aging Phys Act. Jul;22(3):342-7, 2014.	To investigate the effects of 5 weeks of training with the pilates method in the elderly on risk factors for falls.	Quasi-experimental study. 30 adults had pilates classes for 5 weeks and were assessed before, after and 12 months after intervention. Postural balance, dynamic balance and functional improvement were evaluated.	Significant difference on dynamic balance and strength were observed after 12 months in those who continued to do pilates and in those who stopped.	Improvements in balance after a short period of intervention using the pilates method were maintained after 1 year in all participants.
The effect of Pilates based exercise on mobility, postural stability, and balance in order to decrease fall risk in older adults. Pata RW, Lord K, Lamb J. J Bodyw Mov Ther. Jul;18(3):361-370, 2014.	To verify if a 8-week program using the pilates method interferes with balance, mobility, and postural stability.	Quasi-experimental study. 35 elderlies participated in an 8-week pilates training. Tests: Timed up and Go, Forward reach and Turn 180 test before and after interventions.	Significant improvements were observed in Timed Up and Go, forward reach and turn 180 tests.	A pilates exercise program improves balance, mobility, and postural stability reducing the risk of falls in the elderly.
Effects of two exercise protocols on postural balance of elderly women: a randomized controlled Trial. Mesquita LSA, Carvalho FT, Freire LSA, Neto OP, Zângaro RA BMC Geriatrics 15:61, 2015.	To compare and examine the effects of 2 exercise protocols on the balance of the elderly.	A clinical trial type study. 63 elderly women. Divided into 3 groups: neuromuscular facilitation, Pilates and control. Interventions were done 3 times a week for 4 weeks during 50 min. The tests used were the Berg balance scale, stabilometric parameters, functional range test, Timed Up and Go. All were measured before and 1 month after the interventions.	The neuromuscular facilitation group presented significantly better results in most of the stabilometric parameters, Berg balance scale, functional range test and Timed Up and Go when compared with the control group. The Pilates group showed significant improvements in the functional range test and Timed Up and Go when compared to the control group.	The elderly women in the neuromuscular facilitation group presented significant improvements in the static and dynamic balance in relation to control group and the Pilates group presented improvements in the dynamic balance in relation to control group. There were no differences between the neuromuscular facilitation groups and Pilates.



Table 1. Continued...

REFERENCES	OBJECTIVE	METHOD - Type of research - Subjects - Instruments	RESULTS	CONCLUSION
Comparison of the effects of two selected exercises of Theraband and Pilates on the balance and strength of lower limb in elderly women. Dashti P, Shabani M, Moazami M. Iranian Journal of Obstetrics, Gynecology and Infertility 18(153):1-9, July 2015.	To compare the effects of pilates method and exercises with the use of theraband on the balance and strength of the lower limbs of elderly women.	Quasi-experimental study. 45 elderly women were randomized into 3 groups. Training with theraband, Pilates training and control group. They were evaluated by the Berg Balance Scale and 30 seconds standing on a chair.	The theraband and pilates groups showed significant improvements in balance and strength.	The group which did the training with theraband presented better results in the dynamic balance and the group which did the training with the pilates method presented better results in the strength of lower limbs.
The effects of 12 weeks Pilates-inspired exercise training on functional performance in older women: A randomized clinical trial Vieira ND, Testa D, Ruas PC, Salvini FT, Catai AM, Melo RC. Journal of bodywork and movement therapies, Federal University of São Paulo, December 18, 2015.	To investigate the effects of a 12-week pilates program on the functional performance of elderly women in a community.	A clinical trial type study. 40 elderly women were randomized into 2 groups. Pilates group and control group. The pilates group performed exercises twice a week during 60 min each for a period of 12 weeks. Evaluations were made before and after exercises, through the functional performance one-leg stance, Timed Up and Go (TUG), sitting and standing 5 times, 6-minute walk.	Only the elderlies who participated in the Pilates group presented a decreased time in the TUG test and 6-min walk.	Pilates exercises have improved the dynamic balance, lower limb strength and endurance in the elderly community.

Regarding the bias identified in the studies, the prevalence of low statistical power in most of the articles found is highlighted. Some items not encompassed, for example, randomization,⁽¹⁴⁻²¹⁾ analysis by intention to treat,⁽¹⁴⁾ allocation concealment or blinding,⁽¹⁴⁻²¹⁾ compromising the quality and representativeness of the studies.

In relation to the balance variable, an aspect analyzed in the present review, it showed significant improvements, according to the articles, explained by the increase in muscular resistance and greater proprioceptive stimulation, besides the postural stability, reached by the harmony of opposing muscle groups during the activity, generating a better functional capacity.⁽¹⁴⁻¹⁶⁾ Further, during the learning PE when done with the principles of the method, increases activation of the stabilizing muscles of the trunk⁽²²⁾ and the vestibular system⁽²³⁾ improving the static and dynamic balance.

It was possible to identify in the articles included in the research, the improvement of the static and dynamic balance after the intervention of the Pilates method, which can be justified by the increase of muscle strength, proprioception and gait.⁽²⁴⁻²⁶⁾ Furthermore, it is stated that the training of peripheral, abdominal and spinal muscles influences the improvement of posture and consequently the body balance.⁽²⁷⁾

Clinical trials present in this review^(28,29) found significant improvements on the balance in the group which conducted

the training with Pilates method, after the interventions. Muscle resistance training for the upper limbs and flexibility of the hamstring muscles justify these results.⁽³⁰⁾

The duration of interventions was similar in most studies, but practice, number of series and repetitions varied, furthermore, the description of activities generally left questions about what was done, making comparison and analysis difficult between studies.

CONCLUSION

The pilates method is considered a good method for the improvement of the static and dynamic balance in elderly, but better methodological quality studies are still necessary so that there is a scientific basis to ensure its effectiveness.

CONFLICTS OF INTEREST

None.

AUTHOR DETAILS

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REFERENCES

- Garrido R, Menezes P. O Brasil está envelhecendo: boas e más notícias por uma perspectiva epidemiológica. Revista Brasileira de Psiquiatria. 2002;24(1):3-6.



- 2 Miller DB, O'Callaghan JP. Effects of aging and stress on hippocampal structure and function. *Metabolism*. 2003;52(10):17-21.
- 3 Chaimovicz F. A saúde dos idosos brasileiros às vésperas do século XXI: problemas, projeções e alternativas. *Revista Saúde Pública*. 1997;31(2):184-200.
- 4 Marandi SM, Nejad VS, Shanazari Z, Zolaktaf V. A Comparison of 12 Weeks of Pilates and Aquatic Training on the Dynamic Balance of Women with Multiple Sclerosis. *Int J Prev Med*. 2013;4(1):110-117.
- 5 Lalande S, Luoma CE, Miller AD, Johnson BD. Effect of changes in intrathoracic pressure on cardiac function at rest and during moderate exercise in health and heart failure. *Exp Physiol*. 2011;97(2):248-256.
- 6 Crist LA, Catherine M, Corsino L, Lien LF, Zhang G, Young DR. Influence of Change in Aerobic Fitness and Weight on Prevalence of Metabolic Syndrome. *CDC - Preventing Chronic Disease*. 2012;9:110-171.
- 7 Pires DC, Couto de Sá CK. Pilates: notas sobre aspectos históricos, princípios, técnicas e aplicações. *Revista Digital*. 2005;91:1-7.
- 8 Da Silva A, Mannrich G. Pilates na reabilitação: uma revisão sistemática. *Fisioter Mov*. 2009;22:449-455.
- 9 Freeman J, Fox E, Gear M, Hough A. Pilates based core stability training in ambulant individuals with multiple sclerosis: protocol for a multi-centre randomised controlled trial. *BMC Neurology*. 2012;12:12-19.
- 10 Hita F, Martínez A, Cruz D, Pérez FR. Fall prevention in postmenopausal women: the role of Pilates exercise training. *Climacteric*. 2016;19(3):229-233.
- 11 Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Ann Intern Med*. 2009;151(4):264-269.
- 12 Marandi SM, Neja VS, Shanazari Z, Zolaktaf VA. Comparison of 12 Weeks of Pilates and Aquatic Training on the Dynamic Balance of Women with Multiple Sclerosis. *Int J Prev Med*. 2013;4(1):110-117.
- 13 Lim ECW, Poh RLC, Low AY, Wong WP. Effects of Pilates-Based Exercises on Pain and Disability in Individuals With Persistent Nonspecific Low Back Pain: A Systematic Review With Meta-analysis. *Journal of orthopaedic sports physical therapy*. 2011;41(2):70-80.
- 14 Siqueira BG, Cader AS, Oliveira EM, Torres NVOB, Dantas EHM. Evaluation of the static balance of elderly females after training with Pilates method. *R. bras. Ci. e Mov*. 2009;17(4):27-33.
- 15 Hyun J, Hwangbo K, Lee C. The Effects of Pilates Mat Exercise on the Balance Ability of Elderly Females. *J. Phys. Ther. Sci*. 2014;26:291-293.
- 16 Siqueira BG, Cader AS, Oliveira EM, Torres NVOB, Dantas EHM. Pilates method in personal autonomy, static balance and quality of life of elderly females. *Journal of Bodywork & Movement Therapies*. 2010;14:195-202.
- 17 Carvalho QJ, Silva PA, Isabel SM. Efeito do método Pilates na qualidade dos movimentos da marcha e no equilíbrio de idosos. *Fisioterapia Brasil*. 2011;12(1):37-42.
- 18 Bird ML, Fell J. Positive long-term effects of pilates exercise on the aged-related decline in balance and strenght in older community-dwelling men and women. *Journal Aging Phys Act*. 2014;22(3):342-347.
- 19 Pata RW, Lord K, Lamb J. The effect of Pilates based exercise on mobility, postural stability, and balance in order to decrease fall risk in older adults. *J Bodyw Mov Ther*. 2014;18(3):361-367.
- 20 Dashti P, Shabani M, Moazami M. Comparison of the effects of two selected exercises of Theraband and Pilates on the balance and strength of lower limb in elderly women. *Iranian Journal of Obstetrics, Gynecology and Infertility*. 2015;18(153):1-9.
- 21 Newell D, Shead V, Sloane L. Changes in gait and balance parameters in elderly subjects attending an 8-week supervised Pilates programme. *Journal Bodyw Mov Ther*. 2012;16(4):549-554.
- 22 Bird M, Hill KD, Fell JW. A Randomized Controlled Study Investigating Static and Dynamic Balance in Older Adults After Training With Pilates. *Arch Phys Med Rehabil*. 2012;93(1):43-49.
- 23 Carr JH, Shepherd RB. *Stroke rehabilitation: guideline for exercise and training to optimize motor skill*. London: Butterworth-Heinemann. 2003;1:1-650.
- 24 Aveiro MC, Granito RN, Navega MT, Driusso P, Oishi J. Influência de um Programa de Treinamento na Força Muscular, no Equilíbrio e na Velocidade da Marcha de Mulheres Portadoras de Osteoporose. *Rev Bra Fisiot*. 2006;10(4):441-448.
- 25 Trancoso ESF, Farinatti, PTV. Efeitos de 12 semanas de treinamento com pesos sobre a força muscular de mulheres com mais de 60 anos de idade. *Rev Paul de Ed Fís*. 2002; 16(2):20-29.
- 26 Carvalho J, Oliveira J, Magalhães J, Ascensão A, Mota J, Soares JMC. Efeito de um Programa de Treino em Idosos: comparação da avaliação isocinética e isotônica. *Rev Paul de Ed Fís*. 2003;17(1):74-84.
- 27 Gallagher SP, Kryzanowska R. *The complete writings of Joseph H. Pilates: Return to life through controllogy and your health*. Philadelphia: Bain Bridge Books; 2000.
- 28 Vieira ND, Testa D, Ruas PC, Salvini FT, Catai AM, Melo RC. The effects of 12 weeks Pilates-inspired exercise training on functional performance in older women: A randomized clinical trial. *Journal of bodywork and movement therapies*. 2016;20:1-8.
- 29 Mesquita LSA, Carvalho FT, Freire LSA, Neto OP, Zângaro RA. Effects of two exercise protocols on postural balance of elderly women: a randomized controlled Trial. *BMC Geriatrics*. 2015;15:61-70.
- 30 Kloubec JA. Pilates for improvement of muscle endurance, flexibility, balance, and posture. *J Strength Cond Res*. 2010;24(3):661-667.