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Effects of TRX Suspensions Training on Functionality, Body Pain and Static Posture of an Elderly Woman: a Case Report

Efeitos do Treinamento Suspenso TRX Sobre a Funcionalidade, Dor no Corpo e a Postura Estática de uma Mulher Idosa: um Relato de Caso

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Abstract

Considering that suspended training (TRX® ST) refers to the idea of a full training, it is believed that its practice can bring great benefits. Thus, it was [aimed to verify the effect of suspended training TRX® ST on the functionality, the static posture of the spine and general body pain in an elderly woman. The following were evaluated :(1) funcionality using Senior Fitness Test (SFT) protocol; (2) body pain using a validated questionnaire; and (3) spine static posture using Flexicurve before the training (1st evaluation) and after the last training session (2nd evaluation). The suspended training TRX® ST, that consists of exercises for strength and flexibility, was performed for twelve weeks, in such ways that each week consisted of two sessions, lasting 50 minutes each. The participant presented: (1) an improvement of the functionality (increasing from 12 to 19 repetitions the number of repetitions of sitting and standing up; decreasing from 5.9s to 4.5s the number of sitting and walking ; and decreasing from 6cm to 0cm the result of sitting and reaching up, in STF), except in upper limbs; (2) a reduction of pain in the dorsal, lumbar and gluteal regions; and (3) postural modifications in the lumbar spine, passing from a correction (24°) to a physiological lordosis. (41°). In contrast, the results also showed that the posture of the thoracic spine was not affected by the suspended training in twelve weeks. Since these are initial results, it is necessary to conduct further studies in order to verify the effects of training with TRX® ST on the variables pain, static posture and functionality, as well as on the dynamic posture and the quality of life of its practitioners.

Keywords: Physical Education and Training. Aged. Posture. Pain.

Resumo

Considerando que o treinamento suspenso (TRX® ST) remete à ideia de um treinamento completo, trabalhando o corpo como uma unidade, acredita-se que sua prática pode trazer grandes benefícios. Nessa perspectiva, objetivou-se identificar o efeito do treinamento suspenso TRX® ST sobre a funcionalidade, a postura estática da coluna vertebral e as dores corporais em geral em uma mulher idosa, a qual foi submetida à avaliação (1) da funcionalidade por meio do protocolo proposto pelo Senior Fitness Test (SFT); (2) das dores corporais utilizando-se o instrumento Informações sobre Dor nas Costas (IDC); e (3) da postura estática da coluna vertebral utilizando o Flexicurva antes do início do treinamento (1ª avaliação) e após a última sessão do treinamento (2ª avaliação). O treinamento suspenso (TRX® ST), composto de exercícios para força e flexibilidade, foi realizado durante 12 semanas, sendo cada semana composta de duas sessões, com duração de até 50 minutos cada. A participante apresentou: (1) melhora da funcionalidade (aumentando de 12 para 19 o número de repetições de sentar e levantar; diminuindo de 5,9s para 4,5s o tempo de sentar e caminhar; e diminuindo de 6cm para 0cm o resultado de sentar e alcançar, no STF), exceto nos membros superiores; (2) diminuição da dor nas regiões dorsal (de EVA intensidade 1 para intensidade 0), lombar (de EVA intensidade 1 para intensidade 0) e de glúteos (de EVA intensidade 2 para intensidade 1); e (3) mudança da postura da coluna lombar, passando de uma retificação (24°) para uma lordose fisiológica (41°). Em contrapartida, os resultados também demonstraram que a postura da coluna torácica não foi alterada pelo treinamento. Tendo em vista que esses são resultados iniciais, se faz necessária a condução de novos estudos a fim de verificar os efeitos do treinamento com TRX® ST sobre as variáveis dor, postura estática e funcionalidade, bem como sobre a postura dinâmica e a qualidade de vida de seus praticantes.

Palavras-chave: Educação Física e Treinamento. Idoso. Postura. Dor.

1 Introduction

The practice of physical activities in gyms is, traditionally, motivated by aesthetic purposes. However, this concept has changed considerably with the increase in demand for exercises that contribute to the improvement of health conditions, quality of life and functionality or even increasing sports performance[1,2]. In order to meet the new demands expected from the practice of physical exercises, the Functional Training emerges as something innovative, which aims to improve the functional body capabilities with exercises that stimulate the proprioceptive receptors present in the body, resulting in the increment of kinesthetic awareness, body control and static and dynamic balance[3], assisting in the reduction of injuries resulting from the activities of daily life and increase the efficiency of movements[4,5].

According to the literature, functional training is a diversified offer of training which, by means of specific exercises for all types of body movements, the individual

leads to improved performance in tasks performed, are in the sport, at work, in the domestic tasks on a day to day basis and in moments of leisure, among others[6]. It is believed that the functional training may constitute itself as a basis for other training methodologies, such as the *TRX® Suspension Training* (ST) (TRX®, California, USA), which is currently spread in the United States of America and in other countries. ST advocates the maintenance of optimal physical conditioning, even without access to a gym, conventional gym equipment or an ample space for exercises. *TRX® ST* is based on three major principles of training: principles of vector of resistance, of the pendulum and stability. The principle of the vector of resistance is defined as a way to increase or decrease the rolling resistance on a target muscle in accordance with the angle formed between the performer and the ground. The principle of the pendulum increases the resistance according to the initial position in relation to the anchor point. Finally, the principle of stability concerns the support base of the performer, where the lower the support base, the greater the instability will be and, consequently, the difficulty of exercise implementation[7,8].

It is believed that the TRX Suspension Training (® ST) refers to the idea of a complete training. It works the body as a unit all the time, since all of the exercises recruit the complex formed by the abdominal muscles more the stabilizers of the spine, known as *CORE* (English: *Centro*), in order to maintain a proper posture for the execution of the same[9,10]. Thus, both the drafters of the methodology *TRX® ST,* as well as instructors of this type of training, who are trained and certified by the company itself, believe and spread the idea that the training could be used to develop the body in a general way, emphasizing the physical conditioning, or in a specific way. The latter, in general, aims at some sports modality, either from the manipulation of the above principles (of the vector of resistance, pendulum and instability) and/or of the other variables of physical training (mainly: the volume, density, the frequency and the total load of training).

Due to being believed that this training, which has potentially been used in many gyms and sports clubs in several countries, can bring great body benefits [3,5,9], but that still lacks scientific evidence, it is understood that it is necessary to conduct studies aimed to identify the effect of training on the functionality, the static posture and pain in the back of the practitioners. In this context, a case study seems appropriate for an initial evaluation of the importance of *TRX®* ST, because it allows the monitoring of the evolution of the practitioner over a short period of time. Thus, the objective of this study was to verify the effect of TRX Suspension Training ® ST on the functionality, the static posture of the spine and pain in general in the body in an elderly woman.

2 Case report

A 64-year-old student was intentionally invited to participate in this case study of exploratory-descriptive, who did not practice physical activity for more than 12 months at the time of her enrollment in a gym of Porto Alegre city. The participant had 67 kg of body mass, 162cm height, without reports of previous diseases evaluation, however reported presence of back pain in the 3 months prior to the study. She undertook not to be absent in more than four training sessions interspersed or in two consecutive training sessions, in addition to being present in the evaluative meetings. The participant signed an Informed Consent Form before the beginning of the present study, which, in turn, was approved by the Research Ethics Committee of the UFRGS, under the number CAAE 18509613.2.0000.5347.

The TRX Suspension Training ® ST, composed of exercises for strength and flexibility, lasted 12 weeks, being performed with a frequency of two times per week (24 in all) sessions, during 50 minutes per training session, being led by a professional of Physical Education, trained in the method. In Table 1 the planning of the TRX Suspension Training ® ST is presented, based on the principles of the periodization of physical training proposed by Bompa[11].

Table 1 - Planning of the periodization of training with *TRX® ST*.

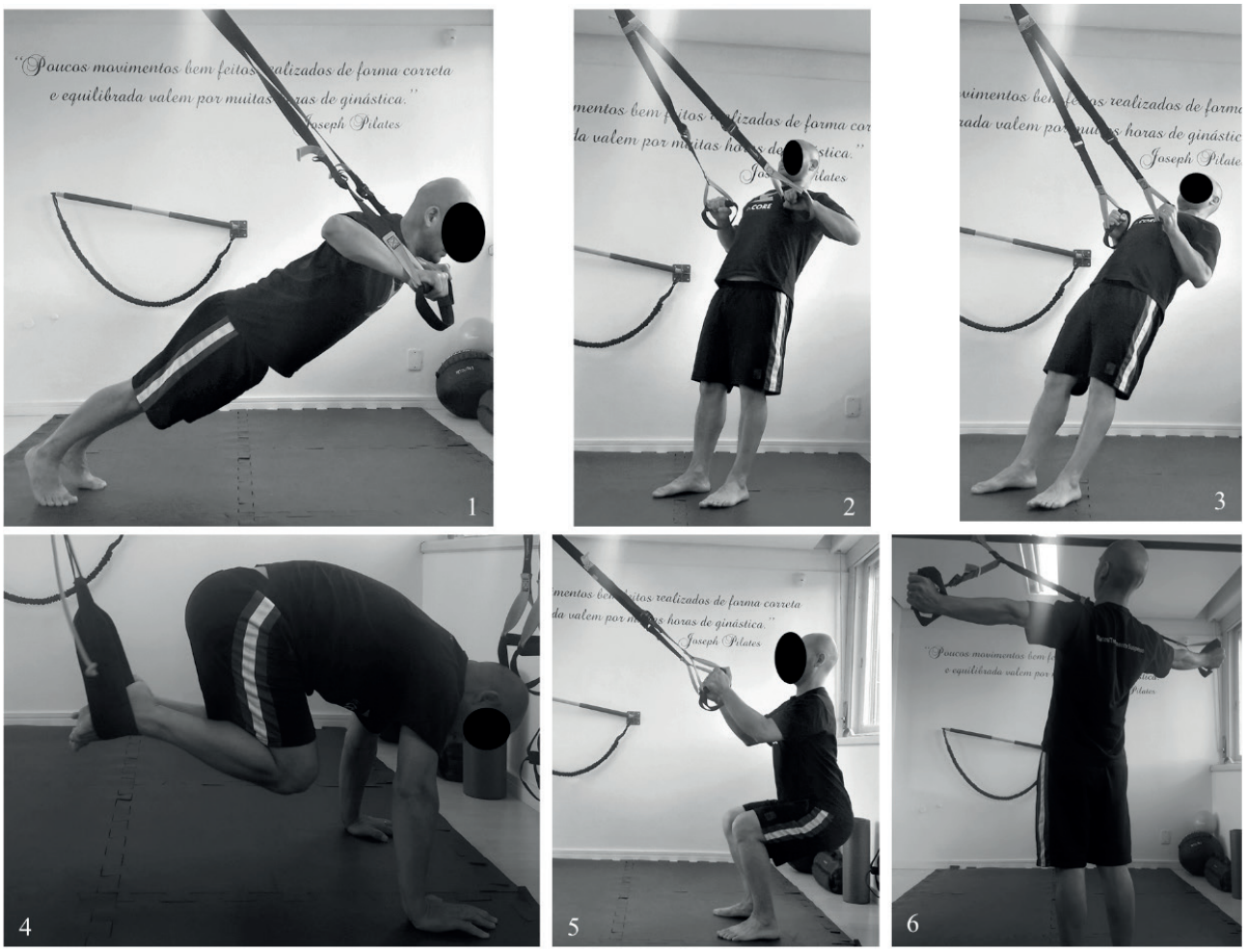
	Month 1				**Month 2**				**Month 3**			
Week	1	2	3	4	5	6	7	8	9	10	11	12
Adaptation	X											
Resistance		X	X									
Overall Strength				X	X	X						
Specific Strength							X	X	X			
Shock										X	X	
Regenerative												X
Flexibility	X	X	X	X	X	X	X	X	X	X	X	X

Source: Research data.

The TRX Suspension Training ® *ST* developed for this case study was composed by the exercises: (1) chest press, a similar exercise to supine; rower; (2) open and (3) closed; (4) *crunch*, exercise that focuses on the activation of the

infra umbilical abdominal musculature; (5) squat without additional load; (6) horizontal extension of shoulders; (7) curl biceps; (8) curl triceps; and (9) shoulders extension exercise. All the exercises (Figure 1) occurred in all sessions and were performed using only the body weight, with the greatest possible incline, so that the participant could successfully perform all the requested repetitions. The repetitions were requested in accordance with the time of the periodization (adaptation, resistance, overall strength, specific strength). In the adaptation period training was performed 1 series of 12 repetitions of each exercise; in resistance 2 series of 15 to 20 repetitions were performed ; in strength, 2 sets from 10 to 12 repetitions; in specific strength 3 sets of 8 repetitions were performed ; in the period of shock, 3 sets from 4 to 6 repetitions; and in the regenerative period 2 sets of 15 repetitions of each exercise were performed.

Figure 1 - Six of the nine exercises performed during the TRX Suspension Training® ST: (1) chest press; rowers (2) open and (3) closed; (4) crunch; (5) squat; (6) horizontal extension of shoulders



Source: The authors.

Five days before the beginning of the training (test 1) and five days after the last session of training (test 2) batteries of tests were performed which are validated in the literature to evaluate the posture of the spine, functionality, and the body pain. As a way of assessing the functionality, |the following tests were used that composes the *Senior Fitness Test*proposed by Rikli & Jones (2008(12): (1) standing and sitting on the chair, in order to assess strength and resistance of lower limbs; (2) Sitting and reaching, to assess the flexibility of lower limbs, performed from the seated position; (3) sitting and walking, to assess the physical mobility; and (4) reach behind their backs.

The test standing and sitting on the Chair (1) is to stimulate the participant to complete many actions to be possible in a period of thirty seconds, having as final score the total number of executions supplemented by the same. In the sitting and reaching test (2), the participant should try to reach with one of his hands the ipsilateral foot without flexing the knee. Measured the distance between the middle finger of the hand and the middle toe of the foot, being given the score in the test from this measure. The test sitting, walking 2.44m and sitting back (3), the participant began sitting down, and upon the sign of the evaluator, stood up and began the path in a straight line until a cone far 1.22 m from the chair, where she performed

a lap around the cone and returned to her initial position in the shortest period of time possible. The score of this test is performed from the time of execution, which was measured by a digital chronometer (Mormaii®, 2013, Garopaba, Brazil). The test of reaching behind their backs (4), consists of the participant put his or her hand of preference on the ipsilateral shoulder and the other hand behind his back, trying to flatten or overlap the middle fingers of both hands. The classification of functionality from these four tests was performed according to the references provided by Rikli and Jones[12], ranging from very poor, poor, fair, good and very good.

The self-administered questionnaire was used Information about Back Pain (IDC) proposed by Krieger and Souza[13] to assess general body pains. This questionnaire contains only questions about pain (location, frequency and intensity) and analysis of their results was performed by comparison of the responses obtained in the two ratings proposals throughout the study (pre and post 12 weeks of training).

The evaluation of the thoracic and lumbar curvature of the spine was performed in the sagittal plane with the instrument Flexicurva. Flexicurva (flexible ruler of the Trident brand®, São Paulo, Brazil) is a malleable metal strip, plastic-coated, with 85 cm of length, which allows the mold of rounded structures. The procedure for evaluation of the vertebral column with the Flexicurva was proposed by Oliveira *et al*.[14] and begins with palpation and marking on the skin of the following spinous processes C7, T1, T12, L1, L5 and S1. In the sequence, the evaluator performs the mold on the dorsum of the individual, being the Flexicurva positioned the spinous process of C7 until the spinous process of the vertebra S1.

During the realization of the mold of the vertebral column the location of the spinous processes of C7, T1, T12, L1, L5 and S1 were checked and recorded in the own Flexicurva After the mold on the back of the individual, Flexicurva was removed and its internal contour (Flexicurva side in contact with the skin) was drawn on a graph paper, representing the thoracic and lumbar spine sagittal curvatures. In this drawing, the spinous processes of interest were identified[14].

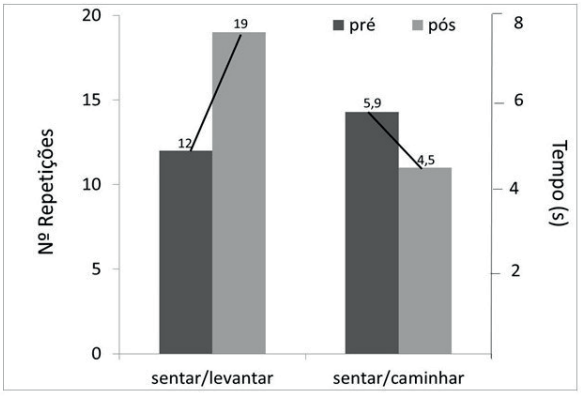
From the Drawing obtained by the contour of Flexicurva a system of coordinates (SC) on two-dimensional graph paper was established, in which the x-axis represents the superior-inferior direction and the y-axis the anteroposterior direction[14]. Based on this SC ordered pairs were extracted (x;y) of points of interest and typed in *Software Biomec-FLEX* (http://www.ufrgs.br/biomec/materiais.html), which provided the angles of the thoracic and lumbar curvatures, among the points representing the spinous processes of T1 and T12 and L1 and L5, respectively. These angle values were used for the classification of the curvature of the spine. The thoracic curvature was considered normal when it presented its values between 20º and 50º Cobb; below 20º was considered decreased; and above 50º was considered increased[15.16]. The lumbar curvature was considered normal when it presented its values between 26º and 58º Cobb; below 26º was considered decreased; and above 58º was considered increased[16]. In addition, the thoracic spine was also evaluated by the Index of kyphosis (equation 1), proposed by Hinmann[17], where values above 10 represent the thoracic curvature increased.

$$IC = l/h \times 100 \qquad \text{Equation 1}$$

Where:
IC = index of kyphosis
l = width of the apex of the thoracic curvature
h = height of the thoracic curvature between T1 and T12

The results of the assessment of functionality, from Senior Fitness Test, demonstrated that the functional variables evaluated showed improvement when compared with the periods of pre and post-intervention, indicating the participant's functional improvement after the implementation of the training protocol in suspension, except for the upper limbs. In Figure 2 it can be observed that the test of sitting down and standing up from the chair passed from 12 to 19 repetitions and that the test sitting and walking passed from 5.9 to 4.5 seconds, i.e., according to the classification of functionality[12], in the first test (Sitting and lifting), the participant improved her function, passing from "very weak" for the classification "good" and, in the second test (Sitting and Walking), the classification was from "weak" to "good".

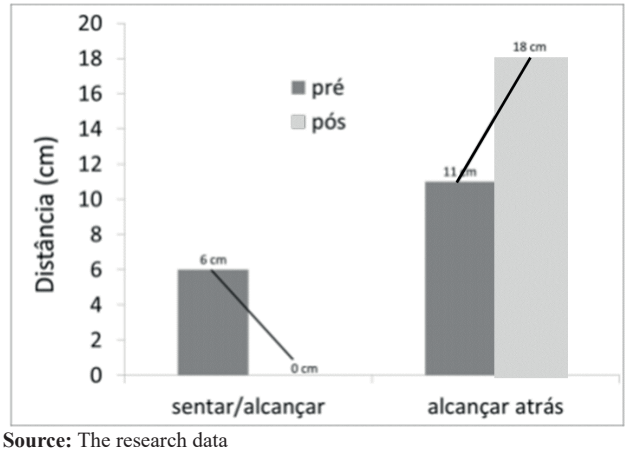
Figure 2 - Result of the tests "sitting and raising" and "sitting and walking" of *Senior Fitness Test* before and after the 12 weeks of training suspended (TRX® ST).



Source: The research data

In Figure 3, it is possible to observe that the sitting and reaching test went from 6 cm to 0.1 cm, which represents a gain in the functionality of the participant, who passed from classification "very weak" to "weak"[12], evidencing the gain of flexibility of the lower limbs. However, int the test of reaching behind, the participant presented a worsening of functionality, going from 11 to 18cm distance among the middle fingers of both hands, representing a rating "very weak"[12].

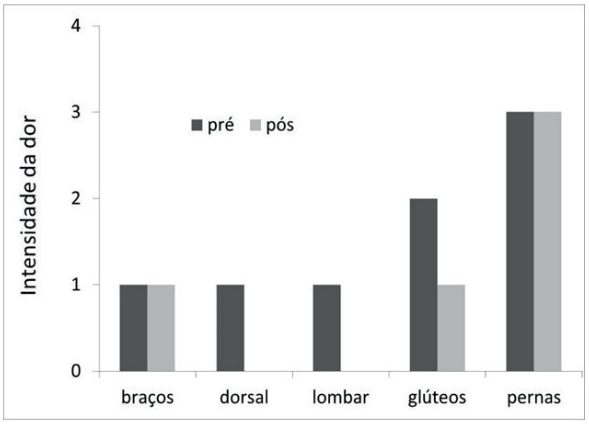
Figure 3 - Senior Fitness Test Result for the sitting and reaching test and the test reaching behind before and after the 12 weeks of training suspended (TRX® ST).



Source: The research data

Figure 4 presents the results of pain for each body region, in periods of pre and post-intervention, showing a decrease in the intensity of pain in the region of the dorsal and lumbar spine, as well as in the buttocks.

Figure 4 - Result of the intensity of the pain evaluated by IDC questionnaire before and after the 12 weeks of training suspended (TRX® ST). Intensity of pain: number four means unbearable pain and the number zero no pain



Source: The research data

Regarding the evaluation of the Curvatures of the vertebral column, in the period of pre-intervention, the participant had 58° and 24° to the dorsal and lumbar curvatures, respectively. After the period of post-intervention, the dorsal and lumbar curvatures were reevaluated and presented 60° and 41°, respectively. Referring to the classification of curvatures[15], the participant presents thoracic hyperkyphosis in both moments of evaluation. In relation to the lumbar region, the participant went from the classification of rectified lumbar spine in the pre-intervention period for allocation in the classification refers to a lumbar curvature within the limits of normality[18] in the post-intervention period. The results of the thoracic spine are also reinforced by the Index of kyphosis, which was, in the pre-intervention period, equal to 30.1 and 31.8, in the post-intervention period.

The main limitations of the present study relate to the fact of being a case study, which prevents the inference or extrapolation of results for the elderly population and the fact that the training period having been relatively short (12 weeks), to promote postural changes, especially in an elderly individual. In addition, it is known that the participant had no previous diseases at the beginning of the training. However, no information was collected about medications used during the intervention, which can be characterized as a limitation of this study, since it is a confounding factor on the results found. Another limitation of this study is the use of the sitting and reaching test as evaluation of flexibility of the lower limbs, since it is a test that assesses the flexibility of the entire posterior chain.

In relation to the results of the evaluation of functionality (Figure 1), an improvement was observed in the functionality of the participant after the implementation of the training protocol in suspension, showing a decrease in speed in performing of the test sitting and walking of the SFT, as well as an increase in the number of repetitions of the test sitting and raising of the STF, suggesting improvement in reaction speed, agility and strength of lower limbs. Nevertheless, these variables were not measured, consisting of an issue matter still to be investigated, however, these results have already been identified in the literature with the same type of population[3,8]. It is believed that training in suspension, due to working with a resistance against the target muscles (due to the body mass of the practitioner)[19] may generate muscle responses, either at a neural level, recruiting more motor units, or even in the composition of the muscle tissue, such as hypertrophy of the same, which may explain the improvement observed in these two tests presented.

In Figure 3 it is possible to notice a significant improvement in the flexibility of the lower limbs. Even taking into account that the training period was short, this gain already represents an improvement in the quality of life of the participant, because it results in facilitating the realization of her daily life activities[20]. However, for test reaching behind, there was a worsening in the functionality of the upper limbs. However, it should be emphasized that this test may have been affected by an acute injury, a muscular contracture in the scapular region, referred to by the participant. The lesion occurred in the 11th week of training, resulting from the daily life, which considerably reduced the range of motion of the lower limbs.

Regarding the evaluation of pain in the pre-intervention period, the participant stated that he felt "pain in general at the moment of evaluation, while in the post-intervention period, the participant stated that "pain in general" was non-existent at the time of evaluation. The results in Figure 3, which shows the intensity of the pain referred to by the participant, suggest that the training program in suspension may have favored the decrease or maintenance of the intensity of pain. Such results

have already been identified in other studies using the same type of training[3]. It is believed, therefore, that training with resistance, using the body mass of the participant, favored an increase of muscular strength and endurance, which contributes to the maintenance of a posture with less effort, reducing the intensity of the pain referred to[20].

Still, the results concerning the curvature of the spine, suggest that the training of *TRX® ST* did not generate influences on the posture of the participant's spine regarding the thoracic region (which continued with hyperkyphosis). This can be explained by the fact that the training period was very short to generate some improvement in the hyperkyphosis presented by the participant, since this type of postural change requires more time for the intervention to become visible. Other studies only found results after at least six months of intervention[21]. In addition, the thoracic hyperkyphosis is commonly structural in elderly people, as a result of the displacement of the center of gravity, which makes the intervention in this region of the vertebral column difficult[22]. Therefore, it is suggested that future research, with longer periods of training, be carried out to ensure that this influence is tested. Whereas regarding the lumbar spine, the training seems to have contributed to a significant improvement in its curvature, because the participant has a rectification from 24° to a physiological lordosis of 41°. This may have occurred due to the strengthening of the whole musculature that protects the lumbar region, located both anteriorly and posteriorly to the vertebral column[9.10], at the same time that may have increased the flexibility of the posterior muscles of the lower limbs, which was shortened due to the fact that the participant spends much of her day sitting in the position of flexion of the spine, which can be observed in the decrease of distance in the sitting and reaching test at STF. Nevertheless, the literature already demonstrates the significant increase of activation of the muscles of the core, among them the column erectors (multifidi)[19.23], which are usually weakened in older people, since the main postural manifestation during the third age is the increase of the thoracic kyphosis and lumbar rectification[24.25]. In addition, working with the *TRX® ST* seems to stimulate the increase of articular mobility, resulting from exercises that involve movements of squat, for example, in addition to rotations of the trunk and others, reinforcing the improvement of lumbar rectification observed. Moreover, the method of training used advocates, through verbal stimuli, postural correction during the execution of movements.

In conclusion, despite its limitations, this preliminary study on the effects of training *TRX® ST* showed improvement in the flexibility of lower limbs, in motor valences as the reaction speed and agility, and also in the curvature of the lumbar region of the vertebral column, which went from a state of rectification to a state of normal curvature, which is in agreement with a previous study[26]. Furthermore, although it has not been assessed directly the quality of life of the participant, the literature shows that the practice of physical activity is associated with improved quality of life and promotion of independence in daily life activities[27.28].

3 Conclusion

The results showed that the participant presented an improvement of the functionality from the tests "sitting and standing", "Sitting and walking" and "sitting and reaching"; reduction of pain in the dorsal, lumbar and buttocks regions; and changing the posture of the lumbar spine, which went from a rectification to a physiological lordosis. In contrast, the results also demonstrated that the posture of the thoracic spine was not altered by the training in suspension with a duration of 12 weeks, in addition to having been observed a worsening in the functionality of the upper limbs, from the test "reaching back".

It is necessary to perform further studies with a larger sample "n" and/or with a longer training period, to be able to answer the research questions without the bias of the interpretation of a case study. Nevertheless, it is worth mentioning that this was the first study that sought to relate the training in suspension with the *TRX® ST* with the improvement of variables that may influence the quality of life of the elderly, serving as a basis for future studies that seek better results with this type of training.

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