Original Article

The effects of global active stretching on classical ballet dancers

Os efeitos do stretching global ativo em bailarinas clássicas

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ABSTRACT | INTRODUCTION: Global Active Stretching (GAS) can be a good strategy for improving posture and quality of life, as well as reducing pain. It works by stretching muscle chains and can improve ballet practice without major physical stress. **OBJECTIVE:** To verify the effects of GAS on posture, pain and quality of life of classical ballet dancers. **MATERIALS AND METHODS:** It was a randomized clinical trial from November 2020 to October 2021, consisting of 20 dancers (aged between 12 and 22 years), without orthopedic or recovering lesions, and without physical therapy treatment. They were divided into two groups. The control group, in which there was no intervention and the SGA group, which performed three postures twice a week for 15 minutes each, for total of 10 sessions. The Athlete's Quality of Life Questionnaire, The Nordic Musculoskeletal Questionnaire, and the Postural Assessment Software were evaluated using the t tests (independence), the t test (paired), the G test (contingency) and the Chi-square. **RESULTS:** There was no statistical difference in quality of life and pain, but in the control group there was an increase in body extension (0.003) and ankle dorsiflexion (0.01); and in the SGA group, there was an increase in left knee valgus (0.05), reduction of internal rotation of the femoral head (0.01) and left knee extension. CONCLUSION: There SGA affected only on posture of the dancers, but not their pain and quality of life. Brazilian Registry of Clinical Trials (ReBEC) protocol RBR-10wckkk7.

KEYWORDS: Dancing. Muscle Stretching Exercises. Physical Therapy.

RESUMO | INTRODUÇÃO: O Stretching Global Ativo (SGA) pode ser uma boa estratégia para a melhora da postura e qualidade de vida e para a redução da dor. Ele atua com alongamentos de cadeias musculares podendo proporcionar melhora da prática do balé sem grandes estresses físicos. **OBJETIVO:** Verificar os efeitos do SGA na postura, dor e qualidade de vida de bailarinas clássicas. **MATERIAIS E MÉTODOS:** Foi um ensaio clínico randomizado no período de novembro de 2020 a outubro de 2021. Constituiu-se de 20 bailarinas (idade entre 12 e 22 anos), sem lesões ortopédicas ou em recuperação, e sem tratamento fisioterapêutico. Estas foram divididas em dois grupos. O grupo controle em que não houve nenhuma intervenção e o grupo SGA, o qual realizou três posturas durante 15 minutos para cada, duas vezes por semana, totalizando 10 sessões. Avaliou-se por meio do Questionário de Qualidade de Vida do Atleta, Questionário Nórdico Musculoesquelético e pelo Software para Avaliação Postural, empregando os testes t (independência), teste t (pareado), teste G (contingência) e o Qui-quadrado. **RESULTADOS:** Não houve diferença estatística na qualidade de vida e dor, porém no grupo controle houve aumento da extensão do corpo (0,003) e dorsiflexão do tornozelo (0,01); e no grupo SGA, houve aumento do valgo de joelho esquerdo (0,05), redução da rotação interna da cabeça do fêmur (0,01) e extensão do joelho esquerdo. **CONCLUSÃO:** Houve efeitos do SGA apenas na postura das bailarinas, fato não encontrado na dor e qualidade de vida das mesmas. Registro Brasileiro de Ensaios Clínicos (ReBEC) de protocolo RBR-10wckkk7.

PALAVRAS-CHAVE: Dança. Exercícios de alongamento muscular. Fisioterapia.

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Introduction

Classical dancers, for the most part, have a body composition of lean characteristic, with good flexibility, a wide external rotation of the hip and a good dorsal region of the foot to achieve an ideal body necessary for dedication to this type of dance.[1]

The practice of classical ballet requires excessive training and repetitive movements aimed at increasing the range of motion, which requires good preparation of the body, both to achieve permanence in the world of dance and the prevention of pain and injuries.[2] In turn, this training increases the presence of pain and, consequently, can lead to postural changes as compensatory mechanisms that directly affect the quality of life of dancers, especially the adolescents.[3]

For this reason, with the passage of time, postural changes occur in the alignment of the head, trunk, pelvis, and, more often, a greater curvature in the spine.[4] In addition, jumping requires training to increase muscle strength, and get effective muscle relaxation and contraction cycle.[5]

To ensure good posture, muscle flexibility is essential. Flexibility is an important factor in performing positions of this dance style. This is based on good muscle stretching, range of motion and general preparation of the body for the performance and maintenance of movements, to achieve success in the result that is sought to achieve.[6]

Based on this, the Global Active Stretching (GAS), which is a precursor of Global Postural Reeducation, aims to optimize the property of recovery of the elastic strength of muscles and also their flexibility, especially in sports practicea.[7] With it, it seeks beyond the knowledge of the sports gesture of each athlete, the prevention of injuries and the improvement of their performance.[8]

The GAS is performed by means of self-postures of muscle chains and can be performed, in sports, in a group of athletes of the same modality. This goal is achieved by working on the lost stretch in the muscles that hinder or brake movement, those that perform movement, as well as in those that carry the compensations and allow the global relaxation.[8]

Studies by Oliveira and Nogueira[9] prove that the GAS has a positivo contribution for volleyball players, by increasing the flexibility of the posterior chain and the analytical flexibility of the hamstrings, in addition to collaborating with vertical drive, a very important aspect for the practice of the sport.

Therefore, it is important to evaluate the effects of GAS on dancers, since they suffer to maintain a good posture for the practice of ballet. The posture learned in ballet is not always ideal for daily life, especially during the growth phase. As a result, many dancers live most of the time with musculoskeletal pain, which can affect their quality of life. It is also often assumed that they, in general, have good flexibility. The flexibility gained is essential for the style of the dance and not for maintaining posture in daily life. GAS can be a strategy to improve overall flexibility, increasing the longevity of ballet practice and consequent improvement for daily life, because GAS uses stretches in muscle chains that may differ from the stretching that the dancers perform, which can often be segmented.

In addition, it is important to study the effects of GAS in individuals who practice sports as well as in all other public, since there is little in the literature on this topic. Raising questions about the practice of GAS in dancers brings information not yet explored, that can provide new information for the scientific and technical environment. With this in mind, the present study aimed to verify the effects of Global Active Stretching on posture, pain and quality of life in classical dancers.

Materials and methods

Study design

This was a randomized clinical trial conducted at the Dance Studio by Lucinha Azeredo, in Belém-Pará, from November 2020 to October 2021.

Sample

Twenty classical dancers were selected to the study by simple probabilistic random sampling. Participants were divided into two groups: the Control Group (CG) and the GAS Group (GASG). Randomization was performed by means of a simple draw, in which all participants were allocated in a table with their respective numbers from 1 to 20. Thus, in the draw, the first 10 were assigned to the control group and the others to the GAS group.

As inclusion criteria, dancers aged 12 to 22 years were chosen and enrolled in the dance studio. Those with orthopedic injuries, who were in recovery, who were undergroing physical therapy, or who had cognitive impairments (assessed by means of the Mini Mental State Exame) were excluded.

Evaluation procedures

The data collection instruments used in the research were an identification form elaborated by the authors themselves, containing sociodemographic, clinical and/or dance history information. In addition to the Athlete's Quality of Life Questionnaire (QQVA), Nordic Musculoskeletal Questionnaire (QNME) and photo registration for further analysis in the Postural Assessment Software (SAPO).[10-12]

To assess quality of life, the QQVA was used, which consists of 14 questions covering 5 factors that affect the quality of life of athletes in the training and competition environment: signs and symptoms of overtraining, basic health conditions, social relationships in the sports environment, the athlete's emotional state and the planning and periodization of sports training.[10] In 2019, this questionnaire was adapted for dancers, replacing terms such as dancer and technical team for teacher.[13] The higher the score in each dimension, the greater interference there is in the quality of life.[14] For the analysis of the dimensions were used: social, biological and psychological.[13]

For pain, the NMQ was used, which consists of 3 questions about problems such as pain, discomfort, or numbness in the following anatomical regions: neck, shoulders, elbow, wrist/hands, thoracic region, lumbar region, hips/thighs, knees and ankle/feet. The first part is "In the past 12 months, have you had some problems (such as pain, discomfort or numbness) in the following regions"; the second is "In the past 12 months, have you had to avoid your normal activities (work, housework, hobbies) because of problems in the following regions"; and the third is "Have you had some problem in the last 7 days, in the following regions". The answer to the questions can be yes or no and you can grade the pain from 1 to 10 in each region.[11]

Finally, for posture assessment, the SAPO was used, which aims to analyze the static posture of adults, young people, and the elderly through a subjective method of posture assessment. The analysis is done by taking a photograph of the participant in the positions that one wants to evaluate, near a clear surface wall, with a distance of 3 meters from the camera, which must be on a tripod with a height of one meter, the feet should be 7.5 cm apart and with a angulation of 10º passing medially to the feet, with anatomical points marked to know the articulations present between joints or bony prominences of the body.[12] The points established for the analysis are preferably bone and joint accidents, always carefully aligning the position on both sides of the body[15,16] (Figure 1). For the analysis of the SAPO method, a calibration is performed in the program for the conversion of distances in the image into pixels for the actual distance of the object in meters, the tabled values are generated by the measurement between three points, where the middle point is the intersection point.[12]

Figure 1. Points demarcated for further evaluation, right side position. The following points can be seen right earlobe, right achromial, spinous processes of the C7 and T3 vertebrae, lower angle of the right scapula, right anterosuperior iliac spine, right inferior iliac spine, major trochanter of the right femur, right suprapatellar region, right knee joint line, and right lateral maleolo

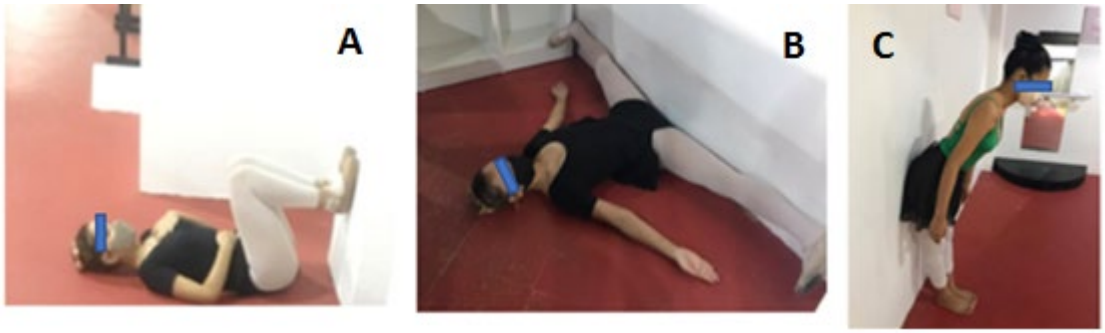
After analysis, positive and negative values were obtained, with positive values corresponding to the right side or valgus in the previous view (PV); extension, posteriorization of the head and knee extension in the lateral view (LV); right scapular asymmetry in the posterior view (PV); negative values corresponding to the opposition of these positions.[3]

Stretching

Only the GASG performed 10 stretches twice a week sessions through Global Active Stretching and was reassessed at the end. In the GC, dancers did not perform the GAS, were only subjected to the initial assessment, and traveled 5 weeks (at the same time as the GASG) to be reassessed.

Three postures were performed, maintained for 15 minutes each, in a total time of 45 minutes, with a frequency of twice a week, before the classes of each dancer, seeking the stretching of the back and posterior muscle chains, emphasizing the lower limbs. The postures performed were "N1d for the pelvis lying on the back on the wall with arms apart" (Posture 1), "N2d for the adductors lying on their backs on the wall" (Posture 2) and "N5 standing and leaning forward" (Posture 3)[8] (Figure 2). These postures were chosen precisely according to the muscle chains most used by the dancers. Since there is little literature on GAS, and one of the main publications in the area is precisely a book, it brings suggestions of the main postures to be worked on in each sport. Thus, a study was conducted to find which postures are most used by dancers.

Figure 2. GAS postures; A- N1d for the pelvis lying on its back on the wall with arms apart, B-N2d for the adductors lying on their backs on the wall; C-N5 standing tilted forward



For posture 1, the participant began in the supine position with hips flexed, knees together, sacrum supported on the floor, and buttocks near the wall; during deep exhalation, the chest went down towards the ground, lengthened the nape and with the arms extended with the palms of the hand upwards (Figure 2A). The work consisted of bracing the feet together against the wall and gradually sliding over the wall, keeping the sacrum in contact with the floor. He could also add upper limb abduction as exercise progression and maintain the posture during the time described.[8]

Posture 2 began in supine position on the ground with knees flexed, hips abducted and plantar region together. During expiration, the thorax was lowered towards the ground and elongation of the nape. When stability was achieved, the development of posture was achieved through the extension of the knees with the abduction of the hips together with the ankle dorsiflexion (Figure 2B) the respiratory exercise was maintained and remained in the posture for the time described.[8]

Finally, posture 3 began standing with the toes extended, with the glutes in contact with the wall, heels 4 or 5cm from the wall and the body leaned forward maintaining the alignment of the head, scapula and sacrum with the arms along the body. The exercise aimed to increase the flexion of the trunk over the lower limbs, maintaining the alignment of three points, with a knee flexion of 10º and remained in the posture for the time described (Figure 2C).[8]

Ethical aspects

The research began after approval by the Research Ethics Committee of the Universidade do Estado do Pará (UEPA) (CAAE: 32267820.8.0000.5174, Opinion no. 4,102,212), following the norms of Resolution 466/12 of the National Health Council, on research with human beings and in the Brazilian Registry of Clinical Trials (ReBEC) of protocol RBR-10wckkk7.

Statistical analysis

The Excel® 2010 software was adopted for data entry and preparation of tables, as well as BioEstat 5.0 in statistical analysis. Categorical variables were presented as frequencies (relative and absolute) and numerical variables by means of measures of central tendency and dispersion (median and interquartile interval). The t tests (independence), t test (paired), G test (contingency) and chi-square test were used to verify the significance of the data. The alpha significance level of 5% ($p \leq 0.05$) was adopted.

Results

The sample consisted of 20 dancers, 9 in the CG and 11 in the GSGA as shown in Figure 3.

Figure 3. Sample flowchart

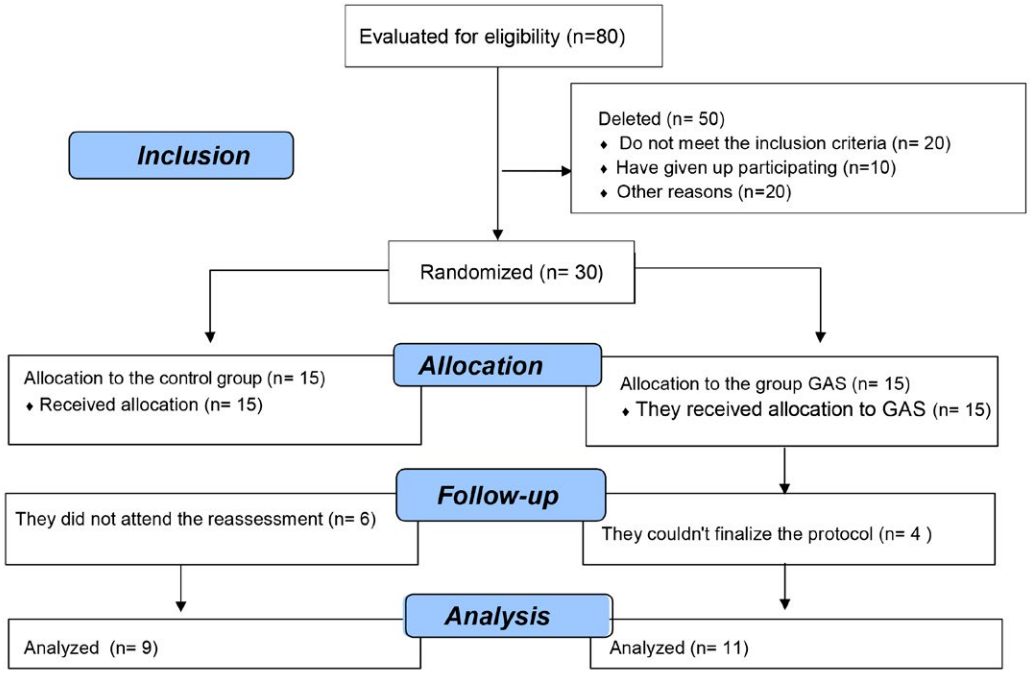


Table 1 shows that there was no statistical difference between the variables age, weight, height, and ballet practice in years, showing homogeneity in the variables. However, when analyzing the average time of dance hours per week, the GC showed to be higher (13.94 ± 9.29 years) than the GASG (6.54 ± 3.32 years).

Table 1. Average age, weight, height, practice, and hours of ballet, of the dancers participating in the study

Variables	Control group (N=9)		GAS Group (N=11)		p-value
	Median	Interquartile range	Median	Interquartile range	
Age (years)	16,0	16,0 – 17,0	14,0	12,5 – 16,0	0,09
Weight (Kg)	54,0	49,0 – 54,0	52,0	49,5 – 58,7	0,78
Height (Cm)	161,0	153,0 – 166,0	163,0	156,5 – 166,0	0,65
Ballet Practice (Years)	9,0	5,0 – 11,0	9,0	4,0 – 10,0	0,34
Hours/Ballet	12,5	5,0 – 21,0	5,0	**5,0 – 8,0**	**0,04***

*Statistically significant result, test t (independence), p≤0.05. GAS (Global Active Stretching).

Regarding the sociodemographic data, the marital status and occupation predominant in the two groups were all single dancers and students, most had no injuries, did not undergo physiotherapy and are right-handed. In the GC, there was a prevalence of students still in high school and family income at more than 4 minimum wages. In the GASG, most of the participants are in elementary school; family income of one minimum wage, one to two salaries and more than four equally (Table 2).

Table 2. Sociodemographic data of the dancers participating in the study

Variables	Control group (N=9)		GAS Group (N=11)	
	N	%	N	%
Marital status				
Single	9	100%	11	100%
Occupation				
Student	9	100%	11	100%
Schooling				
Incomplete Elementary School	1	11%	5	45%
Complete Elementary School	-	-	1	9%
Incomplete High School	6	67%	3	27%
Complete High School	1	11%	-	-
Incomplete Higher Education	1	11%	2	18%
Complete Higher Education	-	-	-	-
Household income				
A salary	1	11%	3	27%
One to two salaries	3	33%	3	27%
Three to four salaries	1	11%	2	18%
More than four salaries	4	44%	3	27%
Injury				
Yes	3	33%	4	36%
No	6	67%	7	64%
Physiotherapy				
Yes	1	11%	0	-
No	8	89%	11	100%
Dominance				
Right	8	89%	11	100%
Lefty	0	-	-	-
Both	1	11%	-	-

(-) Numeric data equal to zero. GAS (Global Active Stretching).

Regarding QQVA, it was observed that there was no statistical difference in both groups in the dimensions studied, as shown in table 3.

Table 3. Quality of life of dancers participating in the study

Quality of life	Control group (N=9)	GAS Group (N=11)
	Median (Interquartile range)	Median (Interquartile range)
Social dimension		
Before	7,0 (5,0 – 11,0)	6,0 (4,5 – 7,5)
After	8,0 (5,0 – 9,0)	7,0 (6,0 – 8,0)
Cohen's d	0,00	0,50
p-value	1,00	0,06
Biological dimension		
Before	23,0 (18,0 – 26,0)	19,0 (14,0 – 22,0)
After	21,0 (20,0 – 28,0)	20,0 (13,5 – 24,0)
Cohen's d	-0,06	0,15
p-value	0,64	0,31
Psychological dimension		
Before	6,0 (2,0 – 6,0)	4,0 (3,0 – 5,0)
After	5,0 (1,0 – 6,0)	3,0 (2,0 – 4,0)
Cohen's d	-0,17	-0,51
p-value	0,22	0,27

Test t (Paired), p≤0.05. GAS (Global Active Stretching).

Around the NMSQ, when analyzing the presence of pain in the last 12 months of all dancers, when comparing the groups there was no statistical difference. However, in both groups there was a prevalence of pain in the lumbar region (7 dancers in the GC and 8 in the GASG) in table 4.

Table 4. Statistical analysis of the Nordic Musculoskeletal Questionnaire of the dancers in the last 12 months of the evaluation of the study participants

QNME 12 months	Control group (N=9)		GAS Group (N=11)		p-value
	Yes	No	Yes	No	
Neck	2(22%)	7(78%)	4(36%)	7(64%)	0,84
Shoulder	2(22%)	7(78%)	3(27%)	8(73%)	0,79
Elbow	1(11%)	8(89%)	1(9%)	10(91%)	0,53
Fist and hand	3(33%)	6(67%)	1(9%)	10(91%)	0,43
Thoracic region	1(11%)	8(89%)	2(18%)	9(82%)	0,85
Lumbar region	7(78%)	2(22%)	8(73%)	3(27%)	0,79
Thighs	1(11%)	8(89%)	4(36%)	5(45%)	0,28
Knees	4(44%)	5(56%)	5(45%)	4(36%)	-
Ankle and foot	5(56%)	4(44%)	4(36%)	5(45%)	-

Test G (Contingency), p≤0.05. GAS (Global Active Stretching). (-) The statistic could not be performed.

When analyzing pain in the last 7 days from the NMQ, there was no statistical difference in the within-group analysis, but it was evidenced that in the GC there was a reduction in one participant's pain in the shoulder and ankle and foot joints. In the GASG, there was a reduction of insomuch in the neck of two dancers (Table 5).

Table 5. Statistical analysis of the QNME of the dancers in the last 7 days before the evaluation and reassessment of the study participants

QNME 7days	Control group (N=9)				p-value	GAS Group (N=11)				p-value
	Initial		Final			Initial		Final		
	Yes	No	Yes	Yes		Yes	No	Sim	Não	
Neck	1 (11%)	8 (89%)	1 (11%)	8 (89%)	-	4 (36%)	7 (64%)	2 (18%)	9 (82%)	0,63
Shoulder	2 (22%)	7 (78%)	1 (11%)	8 (89%)	1,00	1 (9%)	10 (91%)	2 (18%)	9 (82%)	1,00
Elbow	0	9 (100%)	0	9 (100%)	-	0	11 (100%)	0	11 (100%)	1,00
Fist and hand	1 (11%)	8 (89%)	1 (11%)	8 (89%)	-	0	11 (100%)	1 (9%)	10 (91%)	1,00
Thoracic region	0	9 (100%)	1 (11%)	8 (89%)	1,00	3 (27%)	8 (73%)	3 (27%)	8 (89%)	1,00
Lumbar region	3 (33%)	6 (67%)	3 (33%)	6 (67%)	-	4 (36%)	7 (64%)	6 (55%)	5 (45%)	0,43
Thighs	1 (11%)	8 (89%)	2 (22%)	7 (78%)	1,00	4 (36%)	7 (64%)	4 (36%)	7 (64%)	1,00
Knees	1 (11%)	8 (89%)	1 (11%)	8 (89%)	-	5 (45%)	6 (55%)	7 (64%)	4 (36%)	0,66
Ankle and foot	5 (56%)	4 (44%)	4 (44%)	5 (56%)	-	3 (27%)	8 (73%)	5 (45%)	6 (55%)	0,65

Chi-square test, p≤0.05. GAS (Global Active Stretching). (-) The statistic could not be performed.

Regarding posture assessment, only posture alignments were observed. Since the GAS was applied before ballet classes, its influence on the practice of exercise was not analyzed in this study. Thus, in the CG, there was a statistical difference in the left lateral view in relation to the vertical alignment of the body (0.003) which means an increase in body extension and left ankle angle (0.01) that demonstrates increased ankle dorsiflexion in static posture. In the GAS group, there was a statistical difference in the anterior view of the frontal angle of the left lower limb (0.05) evidencing an increase the knee valgus; in the left lateral view at the hip angle (0.01) showing a decrease in the internal rotation of the femoral head compared to the trunk and angle of the left knee (0.02) demonstrating that in static posture the left knee went from a flexion to an extension (Table 6).

Table 6. Posture analysis of the dancers of each group in the evaluation and reassessment

Variables	Control group (N=9) Median (Interquartile range)		P-value	GAS Group (N=11) Median (Interquartile range)		P-value
	Initial	Final		Initial	Final	
VA - AHCab	1,5 (-2,6 - 1,6)	-2,7 (-4,0 - -1,2)	0,34	-1,0 (-2,0 - 0,0)	-1,0 (-2,5 - 1,0)	0,79
VA - AHAcr	-0,9 (-1,5 - 0,0)	-0,7 (-3,9 - 2,1)	0,57	-0,0 (-2,0 - 0,5)	-0,0 (-1,0 - 1,0)	0,80
VA- AHEIAS	-1,1 (-1,4 - 0,0)	-2,9 (-3,6 - 0,0)	0,58	0,0 (-2,0 - 2,0)	0,0 (-2,5 - 1,5)	0,61
VA- AAc2EIAS	-0,3 (-2,7 - 0,7)	-2,7 (-3,9 - 0,3)	0,92	1,0 (-0,5 - 3,0)	0,0 (-2,0 - 2,5)	0,50
VA- ÂFMID	-3,7 (-5,9 - -0,7)	-6,2 (-6,8 - -4,6)	0,08	-2,0 (-4,0 - -0,5)	-4,0 (-7,5 - -1,5)	0,09
VA- ÂFMIE	-6,0 (-6,5 - -4,2)	-6,3 (-7,3 - -5,3)	0,65	0,0 (-2,5 - 0,0)	-6,0 (-6,5 - -0,5)	**0,05***
VA - Comp D-E	0,8 (-0,7 - 1,5)	2,5 (1,3 - 3,7)	0,34	0,0 (-1,0 - 1,0)	0,0 (0,0 - 1,5)	0,38
VA- AHTati	-1,2 (-2,6 - 1,0)	0,0 (-2,3 -2,0)	0,48	-1,0 (-1,0 - 2,5)	0,0 (-2,0 - 2,0)	080
VA- ÂQD	-8,4 (-251,2 - 10,2)	64,3 (20,0 - 71,6)	0,06	23,0 (7,5 - 71,0)	31,0 (12,0 -46,5)	0,53
VA- ÂQE	75,2 (15,4 -91,4)	56,7 (39,4 -74,1)	0,45	56,0 (15,5 - 80,5)	30,0 (12,5 - 63,0)	0,08
VP - AssEsc	0,0 (-14,3 - 17,4)	13,3 (2,5 -21,1)	0,23	6,0 (3,0 - 17,0)	6,0 (-4,5 - 13,0)	0,57
VLD - AHCab-C7	54,6 (50,0 - 57,7)	51,9 (48,5 - 56,7)	0,69	49,0 (47,5 - 52,0)	51,0 (49,0 - 55,0)	0,25
VLD – AVCab-Acr	1,7 (-4,4 - 2,7)	0,0 (-8,9 - 8,3)	0,66	14,0 (5,0 - 24,5)	7,0 (5,0 - 14,0)	0,10
VLD- AvTron	0,0 (-1,9 - 1,4)	0,0 (-1,7 - 4,4)	0,64	0,0 (-2,5 - 0,5)	-1,0 (-2,5 - 0,0)	0,74
VLD- ÂQ	-1,7 (-6,1 - 1,4)	-5,5 (-6,2 - 5,6)	0,76	-6,0 (-7,0 - -0,5)	-5,0 (-7,0 - 1,0)	0,67
VLD - AVCorpo	2,2 (1,8 - 2,3)	2,8 (1,5 - 4,1)	0,29	1,0 (0,0 - 3,5)	1,0 (0,0 - 4,0)	0,46
VLD-AHPel	-14,4 (-16,8 - -12,3)	-10,0 (-14,8 - -8,7)	0,80	-13,0 (-17,0 - -8,5)	-12,0 (-15,5 - -8,5)	0,99
VLD- ÂJ	0,8 (0,4 - 9,7)	7,4 (-3,4 - 12,6)	0,31	1,0 (-2,0 - 8,0)	3,0 (0,0 - 9,5)	0,40
VLD-Âtorn	84,6 (82,6 - 86,1)	81,5 (79,8 - 85,1)	0,10	83,0 (82,0 - 85,0)	83,0 (82,5 - 84,0)	0,58
VLE - AHCab	55,1 (52,6 - 57,0)	51,3 (48,1 - 59,0)	0,27	55,0 (52,5 - 57,0)	51,0 (45,0 - 54,5)	0,42
VLE- AVCab	0,0 (-1,8 - 6,9)	-3,5 (-8,8 - 5,5)	0,76	10,0 (0,0 - 14,5)	5,0 (2,0 - 20,0)	0,91
VLE- AVTron	-1,4 (-2,0 - 0,0)	-0,3 (-1,6 - 3,6)	0,07	-2,0 (-5,0 - -0,5)	-1,0 (-3,0 - 0,5)	0,07
VLE-ÂQ	-3,6 (-4,4 - -3,1)	-4,9 (-6,7 - 4,2)	0,44	-8,0 (-9,0 - -5,5)	-3,0(-5,5 - 0,5)	**0,01***
VLE-AvCorpo	0,8 (0,2 - 2,3)	2,5 (2,4 - 3,8)	**0,003***	1,0 (0,0 - 1,0)	2,0 (0,5 - 2,0)	0,53
VLE-Ahpelve	-10,1 (-12,2 - -7,3)	-11,9 (-19,6 - -10,3)	0,40	-14,0 (-18,0 - -4,0)	-13,0 (-13,0 - -10,0)	0,67
VLE - ÂJ	1,7 (-1,1 -2,8)	4,4 (-1,6 - 11,0)	0,42	-2,0 (-4,5 - 3,0)	7,0 (1,0 - 8,5)	**0,02***
VLE- Âtorn	87,8 (84,9 - 88,7)	82,6 (80,5 - 86,5)	**0,01***	86,0 (83,0 - 88,5)	82,0 (80,5 - 85,0)	0,07

*Statistically significant result, test t (paired), p≤0.05.

Caption: VA: Previous View; VP: Back View; VLD: Right Side View; VLE: Left Side View; AHCab: horizontal alignment of the head; AHAcr: Horizontal alignment of achromials; AHEIAS: Horizontal alignment of anterosuperior iliac spines; Aac2EIAS: Alignment between the two achromials and the two anterosuperior iliac spines; ÂFMID: Front angle of the right lower limb; ÂFMIE: Front Angle of the Lower Left Limb; Comp D-E: Difference in the length of the lower limbs R-L; AHTati: Horizontal alignment of tibias tuberosities; ÂQD: Right Quadricipital Angle; ÂQE: Left Quadricipital Angle; AssEsc: Horizontal asymmetry of the scapula in relation to T3; AHCab-C7: Horizontal head alignment with respect to C7; AVCab-Acr: Vertical alignment of the head with respect to the achromy; AvTron: Vertical trunk alignment; ÂQ: Hip angle (trunk and thigh); AvCorpo: Vertical alignment of the body; AHPel: Horizontal alignment of the pelvis; ÂQ: Knee angle; ÂTorn: Ankle Angle.

Discussion

It was observed in this study that there was no difference in the quality of life and pain variables between the studied groups. However, in the control group it was observed that there was an improvement in posture alignment in relation to greater body extension and greater angle of ankle dorsoflexion. The acquisition of this posture may lead to the alignment of the center of gravity of the dancer, may favor the increase in the response of body balance necessary the practice of ballet, while in the GAS group, a decrease in the internal rotation of the left femur was observed, an increase in the left knee's right-footed knee and no longer has a flexknee for an extension. For this result the decrease in internal rotation attenuates the descending postural imbalance, since with the internal rotation of the femur, the knee tends to present a valgism and consequently a flexknee, With the alignment of the femur, all these changes can be adjusted favoring the body alignment, improving the balance of the dancer and favoring the gesture of the dance.

The reason why there was this difference observed between the groups was that in the control group, this posture behavior was already expected due to the practice of ballet itself, since no intervention was performed in this group. For the GAS group it was beneficial because it reduced postural changes that can facilitate the practice of ballet and may reduce the risks of injuries, as observed in some literature that the GAS may be beneficial for sportsmen in gaining muscle flexibility.

The GAS for working in muscle chains, its results are directly related to flexibility and improvement of postural alignment. The variables pain and quality of life, can not have been influenced by the GAS by other factors inherent to each dancer.

The body of the classical dancer demands great flexibility, range of motion, muscle strength and appropriate posture to her practice, being necessary techniques that favor the improvement of these aspects and reduce the possibility of injuries.[17] The dancers in general do not lose the flexibility to practice dance, but the flexibility exercises that most of them use are segmented. And the GAS comes with the proposal of working muscle stretching in the form of muscle chains, very close to the dance style they practice. Stretching in the form of muscle chains has been shown, in the scientific literature, to be more effective than segmented stretching.

In addition, the intense practice of classical ballet contributes to an increase in the number of injuries and the presence of pain mainly in the lower limbs, such as the ankles, knees and especially feet, since for this modality, the tip sneakers are used that are characterized by lead to deformities, the half-tip, the major cause of musculoskeletal pain and, landings of heels in a defective way.[18,19]

Regarding the causes, several studies describe overtraining, which is the repetitive practice of the same movement, as the main motivation for injuries and pain in adolescent dancers, with a higher incidence in the knees and feet, corroborating the data found in this research that in the QNME half of the dancers presented pain in these regions in the last 12 months.[3,20]

In the analysis of weekly ballet practice, although the evaluation, the participants of the CG presented longer time, with statistical difference, there was no relationship with the higher frequency of pain in the lower limbs, and the GASG was the one with the highest prevalence of injuries, these data do not confirm the study of Schweich et al., in which there was a relationship between exposure and installation of joint injuries in the lower limbs, for the most part.[21]

As a strategy to reduce the number of injuries, pain and postural changes that affect the practice of dance, Global Active Stretching is an alternative used in sports environment using muscle stretching through muscle chains, which also affects flexibility, posture, muscular endurance, and range of motion of the lower limbs.[8,22,23]

Quality of life is influenced by the presence of pain and injuries, mainly related to posture, since the performance of the sports gesture becomes more limited. In this study, the practice of three postures of the SGA method did not demonstrate improvement in the dimensions of the questionnaire.[20]

A study conducted by Fernandes et al. performed the Pilates method in 6 professional dancers during

10 weeks, evaluating the center stability, postural alignment of the knee by the Q angle and pain through the QNME; it was found that there was only statistical difference in the two knees of the dancers, considered normal. In fact, in the present study, there was also statistical difference in the GASG at the left Q angle, but the pain was not altered, so they corroborate that stretching exercises act in the alignment of the knee and do not act in the reduction of pain.[24]

The limitations of the study were the low acceptance of dancers to participate in the study due to the long daily period of dance training in the studio, the fact that the survey period coincided with the peak of the Covid-19 pandemic, the question of whether the chosen postures were the ideas of the participants, researching about overtraining to be able to understand the results obtained, the fact that dancers did not stop practicing ballet during data collection and the considerable sample loss.

Conclusion

Research shows that the GAS does not interfere with the quality of life and pain of classical dancers, however, it may interfere in the posture in relation to the improvement of postural alignment by decreasing the internal rotation of the left femur, alteration of the left flexknee for extension and increased the vaver of this same knee.

Authors' contributions

Pinto ALC participated of conception, design, data collection, interpretation of results and writing of scientific article. Costa CFP e Santos PLM participated in the collection and interpretation of the data. Guimarães ACL and Melo RA participated in the design of the project and critical review of the article. Azeredo MLR participated in the design of the project, data collection and critical review of the article. Dias BAC participated in the statistical analysis of the research data, interpretation of the results and critical review of the article. Dias GAS participated in the conception of the research question, methodological design, statistical analysis of the research data, interpretation of the results of the scientific article. All authors have reviewed and approved the final version and agree with its publication.

Competing interests

No financial, legal or political conflict involving third parties (government, companies and private foundations, etc.) has been declared for any aspect of the work submitted (including, but not limited to grants and financing, participation in advisory board, study design, manuscript preparation, statistical analysis, etc.).

References

1. Anjos KSS, Oliveira RC, Velardi M. The construction of the ideal body in classical ballet: a phenomenological investigation. Revis Brasil de Educ Fís e Esp. 2015;29(3):439-452. https://doi.org/10.1590/1807-55092015000300439

2. Costa C, Teixeira Z. The experience of pain among classical dance ballerinas: meanings derived from a qualitative study. Ciênc, saúde colet. 2019;24(5):1657-1667. https://doi.org/10.1590/1413-81232018245.04302019

3. Silva AMB, Emuno SRF. Pain and injury in adolescent dancers: systematic review. Rev Dor. 2016;17(2);132-135. https://doi.org/10.5935/1806-0013.20160030

4. Ribeiro JN, Moura UIS, Mendes LR, Antonelli BA, Schwingel PA, Angelo RCO. Postural profile of classical ballerinas from the Vale do São Francisco - Region of Brazil. Coluna/Columna. 2016;15(3):199-204. https://doi.org/10.1590/S1808-185120161503155900

5. Lima MA. Treino pliométrico para crianças e adolescentes [trabalho de conclusão de curso]. Santos: Universidade Católica de Santos; 2011.

6. Ackland TR, Elliot BC, Bloomfield J. Anatomia e biomecânica aplicadas no esporte. Barueri: Manole; 2011.

7. Souchard P. Autoposturas da RPG: O método do Stretching Global Ativo (SGA). São Paulo: Summus Editorial; 2019.

8. Grau N. SGA: A serviço do esporte. São Paulo: É realizações; 2003.

9. Oliveira AL, Nogueira N. Influência do Stretching Global Activo na flexibilidade da Cadeia Posterior e no Salto Vertical no Voleibol. Revista Portuguesa de Fisioterapia no Desporto [Internet]. 2008;1(2):7-17. Available from: https://www.academia.edu/7353396/Influ%C3%AAncia_do_Stretching_Global_Activo_na_Flexibilidade_da_Cadeia_Posterior_e_no_Salto_Vertical_no_Voleibol

10. Cunha RA. Elaboração e validação do questionário sobre qualidade de vida de atletas (QQVA) [dissertação] [Internet]. Belo Horizonte: Universidade Federal de Minas Gerais; 2008. Available from: https://repositorio.ufmg.br/handle/1843/KMCG-7NRM33

11. Mesquita CC, Ribeiro JC, Moreira P. Portuguese version of the standardized Nordic Musculoskeletal questionnaire: cross cultural and reliability. J Public Health. 2010;18(5):461-466. https://doi.org/10.1007/s10389-010-0331-0

12. Duarte M, Ferreira EA, Maldonado EP, Freitas AZ. Documentação sobre o SAPO – Software para avaliação postural [Internet]; 2005. Available from: https://pesquisa.ufabc.edu.br/bmclab/sapo2/SAPOdoc.pdf

13. Silva AMB, Enumo SRF, Afonso RM, Araújo MF, Luz TSR, Carvalho LF, et al. Survey on Quality of Life of Athletes: Adaptation and Validity Evidences for Dancers. Av En Psicol Latinoam. 2019;37(1):121-131. https://doi.org/10.12804/revistas.urosario.edu.co/apl/a.4575

14. Ribeiro ISCT, Finotelli Junior I. Associação entre qualidade de vida do atleta com sintomas de ansiedade e ansiedade pré-competitiva. 15º Congresso Brasileiro e 7º Congresso Internacional de Psicologia do Esporte e do Exercício [Internet]. Anais do XV Congresso Brasileiro e VII Congresso Internacional de Psicologia do Esporte e do Exercício [Internet]. Florianópolis; 2013. Disponível em: https://www.cesusc.edu.br/1746-congresso-internacional-de-psicologia-do-esporte-e-do-exercicio-comeca-na-quarta/

15. Dantas SV, Neves ISF, Mota DM, Marques COM, Sousa FAN, Leal SS. Evaluation of postural changes of badminton athletes submitted to Global Active Stretching. ConScien Saúde. 2014;13(2):211-217. https://doi.org/10.5585/conssaude.v13n2.4745

16. Ferreira EAG. Postura e controle postural: desenvolvimento e aplicação de método quantitativo de avaliação postural [tese] [Internet]. São Paulo: Universidade de São Paulo; 2005. Available from: https://www.teses.usp.br/teses/disponiveis/5/5160/tde-20092006-142252/pt-br.php

17. Salles TA. O balé clássico: principais lesões e um trabalho preventivo baseado na preparação física [monografia]. Campinas: Universidade Estadual de Campinas; 2008.

18. Cardoso AA, Reis NM, Marinho APR, Vieira MCS, Boing L, Guimarães ACA. Injuries in professional dancers: a systematic review. Rev Bras Med Esporte. 2017;23(6):504-509. https://doi.org/10.1590/1517-869220172306170788

19. Meereis ECW, Teixeira CS, Pranke GI, Lemos LFC, Mot ACB. Sintomatologia dolorosa em bailarinos: uma revisão. Rev bras. ciênc. mov. [Internet]. 2013; 21(2):143-150. Available from: https://portalrevistas.ucb.br/index.php/rbcm/article/view/3078

20. Carvalho RSG. Alterações posturais em bailarinas clássicas da escola livre de dança de Santos/SP [monografia]. Santos: Universidade Federal de São Paulo; 2019.

21. Schweich LC, Gimelli AM, Elosta MB, Matos WSW, Martinez PF, Oliveira Júnior AS. Epidemiology of athletic injuries in classic ballet practitioners. Fisioter, Pesq, 2014;21(4):353-358. https://doi.org/10.590/1809-2950/12833321042014

22. Garcia PU, Aranda MC. Analytical stretching and active global stretching in physical education classes. Fisiot. 2011;33(2):70-8. https://doi.org/10.1016/j.ft.2011.02.003

23. Silvestri BN, Polizelli AB. Implantação de um programa de stretching global ativo nas atletas de futsal feminino da UNESC. Rev Inic Cientif [Internet]. 2010;8(1):136-148. Available from: https://periodicos.unesc.net/ojs/index.php/iniciacaocientifica/article/view/1586

24. Fernandes SN, Fernandes O, Loss J, Cruz-Ferreira A. O efeito do método pilates na prevenção de lesões em bailarinos profissionais. Rev de Cienc del dep [Internet]. 2015:11(1); 53-69. Available from: https://e-balonmano.com/ojs/index.php/revista/article/view/199