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ARTIGO ORIGINAL

Relationship between the joint mobility index and the presence of injury and pain among ballet students in Brazil

Relação entre o índice de mobilidade articular e a presença de lesões e dor entre estudantes de balé no Brasil

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Abstract

Dance is a unique blend of art and athleticism, which makes its practitioners particularly susceptible to skeletal muscle injuries and pain. Dancers are subjected to intense training, which contributes towards increasing the severity of injury. Injuries occur significantly more frequently in hypermobile dancers than in the non-hypermobile individuals. The present study aimed to correlate the Joint Mobility Index, obtained through Carter and Wilkinson's Joint Mobility Scale, as modified by Beighton, with the prevalence of musculoskeletal injuries among students at vocational schools for classical ballet in Brazil, and to make a correlation with self-reported presence of pain and muscle fatigue. This study indicates that there is a real association between hypermobility as a risk factor for lesions, which were more present in hypermobile individuals. On the other hand, pain was inversely presented, such that it was more present in non-hypermobile dancers, perhaps because of skeletal muscle overload to meet the physical and esthetic needs of ballet. Fatigue was not an important variable in the analyses between the groups, and was similar between them. It is especially important to establish a relationship regarding the need for intensive therapeutic care for treating of skeletal muscle injuries among hypermobile individuals.

Key-words: classical ballet, musculoskeletal system, injuries, joint mobility index, physiotherapy.

Resumo

A dança é uma mistura única de arte e performance, o que torna seus praticantes particularmente suscetíveis a lesões e dores musculares esqueléticas. Dançarinos são submetidos a treinamento intenso, o que contribui para aumentar a gravidade da lesão. Lesões ocorrem significativamente mais frequentemente em bailarinos hipermóveis do que nos indivíduos não hipermóveis. O presente estudo teve como objetivo correlacionar o Índice de Mobilidade Articular, obtido pela escala de Carter e Wilkinson, conforme modificado por Beighton, com a prevalência de lesões musculoesqueléticas entre os estudantes das escolas profissionais de balé clássico no Brasil, e ainda correlacionar com o autorrelato da presença de dor e fadiga muscular. Este estudo indica que existe uma associação real entre a hiper mobilidade como fator de risco para lesões, que estavam mais presentes em indivíduos hipermóveis. Por outro lado, a dor foi inversamente apresentada, sendo mais presente nos bailarinos não hipermóveis, talvez pela sobrecarga musculoesquelética para atender às necessidades físicas e estéticas do balé. Fadiga não foi uma variável importante nas análises entre os grupos, sendo semelhante entre eles. É especialmente importante estabelecer uma relação com a necessidade de cuidados terapêuticos intensivos para lesões musculares esqueléticas entre indivíduos hipermóveis.

Palavras-chave: balé clássico, sistema musculoesquelético, lesões, índice de mobilidade articular, Fisioterapia.

Introduction

For artists, their occupation is not just a way to earn a living: it is their passion, and to fulfill this passion, they make great sacrifices, both physically and mentally, to bring this immeasurable beauty into the world [1].

Dance is a unique blend of art and athleticism, which makes its practitioners particularly susceptible to skeletal muscle injuries [2,3] and pain [4]. Dancers are subjected to intense training, which contributes towards increasing the severity of injury and the possibility of it becoming incapacitating [5], given the repetitive movements and the exercises with excessive range of motion to which they are subjected [6].

One of the attributes for being good dancer, prescribed by Balanchine in the twentieth century, is that in addition to having a lean and long body, the individual should have a wide range of active and passive movement around the hips, dexterity when the leg is in a high position and a high vertical jump. Wyon [7] further stated that flexibility is a vital component of classical ballet.

Injuries occur significantly more frequently in hypermobile dancers than in the non-hypermobile individuals [8]. Hypermobility is defined as the ability to have the widest range of joint movement which allows a broader range and variety of movements. In dancers' profession, this is often promoted for esthetic reasons inherent to dance, especially in classical ballet [9].

Joint hypermobility is a phenotypic characteristic shared by most, if not all hereditary diseases of connective tissue, and there are abundant reasons for demanding reliable and precise criteria for its competent diagnosis. It is identified by using Beighton's nine-point scale, on which obtaining a score greater than four out of the total of nine points constitutes as one of the major (primary) criteria for the diagnosis [10-12]. Currently, it is the most commonly used test for identifying and diagnosing Benign Joint Hypermobility Syndrome (BJHS) [13].

Hypermobility and BJHS are common both in general male and female students and in dancers and professional dancers. Declining prevalence, and more reports of arthralgia with other features of BJHS in young dancers, suggests that BJHS may have a negative influence with important implications for their training. The same pattern has not been observed in men, thus suggesting that the reports of presence of pain and injuries relate to factors other than BJHS [14].

The generalized joint laxity, also known as systemic joint laxity, was defined by Boyle [15] as a condition in which synovial joints have a range of movement beyond the normal limit. The potential consequence of this is hypermobility syndrome. Some studies have reported an association between generalized joint laxity and skeletal muscle complaints such as arthralgia, joint subluxation, dislocation and sprains.

Steinberg [16] concluded in their study that dancers need to understand that the range of passive movement, i.e. movements without voluntary muscle contraction, will probably not increase with age. Therefore, the main objective of a dance program should focus on exercises that maintain the natural flexibility of the dancers' joints, instead of trying to improve it and always make gains. Maintenance of activities that aim to achieve excessive gains in joint mobility may promote biomechanical changes such as twisting of the femur, as identified by Hamilton [17], in excessive training to increase the range of motion of passive external rotation of the hip.

Joint mobility in professional dancers was the reason for the study by Espelo [18], with the aim of correlating their changes with the most frequent injuries among these professionals. Khan [19] found that the dancers, when compared with a control group, showed a greater degree of joint motion for external rotation movements and a smaller degree for internal rotation movements of the hip. Another study along these lines was conducted by Nilsson [20], who assessed the degree of mobility of the spine among first-year students at the Swedish Ballet School. In comparison with a control group, they had a higher rate of joint hypermobility.

Garrick [21] considered that dancing, and especially classical ballet, was a career presenting risks. They reported that the practice of dancing promoted a variety of damage due to "overuse". Thus, it would be important to have specific treatment that included maintenance of good postural balance, extreme flexibility and stretching, which are the minimum needs for proper monitoring of dancers for injury prevention. Since hypermobility has been associated with fatigue in the general population, hypermobile dancers need to be careful, given the association between fatigue and etiology of injury in dancing [9,22,23].

Gannon [11] and O'Loughlin [24] quantified joint laxity of dancers and gymnasts, which is an aggravating factor for injuries. These authors evaluated the range of motion of the dancers

and gymnasts and observed a large difference between the passive and active ranges of motion, thus confirming that their samples presented a high degree of joint instability, which explained their subjects' propensity to injury.

Students with hypermobility require additional strength to accomplish their training, which reflects the seriousness of the issue [25]. The most commonly reported symptoms are instability and pain relating to tendinitis [26], in which the need for joint stabilization leads to muscle overuse, thus causing injuries and muscle fatigue [27].

The present study aimed to correlate the Joint Mobility Index, obtained through Carter and Wilkinson's Joint Mobility Scale, as modified by Beighton, with the prevalence of musculoskeletal injuries among students at vocational schools for classical ballet in Brazil, and to make a correlation with self-reported presence of pain and muscle fatigue.

Methods

This was a descriptive study using quantitative methodology, while highlighting the epidemiological method. It was conducted in three schools that have a recognized role in training professional dancers in Brazil. We used a semi-open questionnaire that registered students' information such as personal, professional and social characteristics, physical assessment information (anthropometric and morphofunctional data) and scores on Carter and Wilkinson's Joint Mobility Scale, as modified by Beighton.

This project was approved by the Research Ethics Committee of UFRJ and each potential participant received an informed consent statement that they could choose to agree or disagree with, regarding their participation in the research, in accordance with CONEP Resolution 196/96.

Quantitative data were collected and analyzed using the SPSS software, version 17.0, in which statistical tests (chi-square) were performed in order to obtain data for discussion and for reaching conclusions.

Results

We evaluated 100 classical ballet students (70 girls and 30 boys), of mean age 18 years (standard deviation 2.05). Of those 83% presented a level greater than four on Carter and Wilkinson's Joint Mobility Scale, as modified by Beighton, and were therefore classified as hypermobile according to the Brighton criteria: 90% of the girls and 67% of the boys ($p=0.004$) which was a statistically significant difference (see Table I). The mean for the Joint Mobility Index (JMI) was 5.58, with a standard deviation of 2.09.

Table I – Joint mobility and gender.

		Joint mobility index		
		Not hypermobile (< 4)	Hypermobility (≥ 4)	Total
Sex	Female	07 (10.0%)	63 (90%)	70 (100.0%)
	Male	10 (33.3%)	20 (66.7%)	30 (100.0%)
Total		17 (17.0%)	83 (83.0%)	100 (100.0%)

Note: $p=0.004$

Among the respondents classified as hypermobile ($JMI \geq 4$), 78.3% had injuries, versus 88.2% with injuries among the non-hypermobility individuals. Although the percentage was higher in the latter group, there was no statistically significant difference ($p = 0.351$). See Table II.

Table II - Hypermobility and injury.

		Have you had any skeletal muscle injury over the past year?		
		Yes	No	total
Non- hypermobile		15 (88.2%)	02 (11.8%)	17 (100.0%)
Hypermobility		65 (78.3%)	18 (21.7%)	83 (100.0%)
total		80 (80.0%)	20 (20.0%)	100 (100.0%)

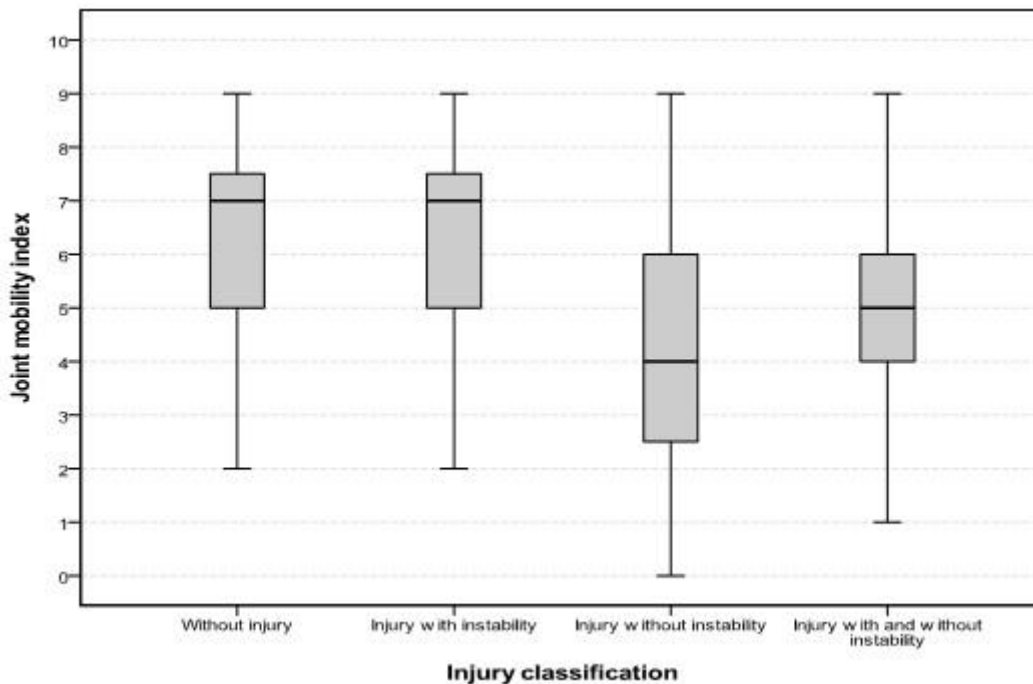
Note: $p = 0.351$

When the lesions were grouped into categories, according to the lesion characteristics, the most common type was joint trauma resulting from instability, such as sprains (24%), tendinitis (17.6%) and fractures (14.4%), thus representing 56% of the lesions. Of these instability lesions, 88.5% were among individuals classified as hypermobile. See Table III.

Table III – Types of injury and mobility.

	Classification of the injury				Total
	without injury	injury with instability	injury without instability	Injury with and without instability	
Non-hypermobile	02 (11.8%)	03 (17.6%)	09 (52.9%)	03 (17.6%)	17 (100.0%)
Hypermobile	18 (21.7%)	37 (44.6%)	15 (18.1%)	13 (15.7%)	83 (100.0%)
total	20 (20.0%)	40 (40.0%)	24 (24.0%)	16 (16.0%)	100 (100.0%)

Graph 1 (below) shows the distribution of the JMI according to the same injury classification. Attention is drawn to the lower levels in the group without instability group, albeit with great variability, and to the similarity between the groups without injury and with unstable injuries. In the group with both stable and unstable injuries, the distribution was greater than in the group without instability and less than in the others, thus showing the sum total of lesions with instability and lesions without instability.



Graphic 1 – JMI and injury classification.

Among the interviewees, 66% reported having pain and of these, 82.4% did not have hypermobility. The difference between the mobility groups was not significant. The same was found with regard to the 80% who presented fatigue. Fatigue was seen to be a little more frequent than pain: it was high in both groups, without any difference between them. Although not statistically significant, pain seemed to be a little more present in non-hypermobile individuals (see Table IV).

Table IV – Joint mobility and pain/fatigue.

	Has pain			Chi-square test
	Yes	No	total	
Non-hypermobility	14 (82.4%)	03 (17.6%)	17 (100.0%)	P=0,118
Hypermobility	52 (62.7%)	31 (37.3%)	83 (100.0%)	
total	66 (66.0%)	34 (34.0%)	100 (100.0%)	
	Presents fatigue			Chi-square test
	Yes	No	total	
Non-hypermobility	13 (76.5%)	04 (23.5%)	17 (100.0%)	P=0,690
Hypermobility	67 (80.7%)	16 (19.3%)	83 (100.0%)	
total	80 (80.0%)	20 (20.0%)	100 (100.0%)	

Discussion

Joint hypermobility has been shown to be an important factor in evaluating injuries in dancers, and has been the purpose of several authors' studies.

According to Stretanski [28], there is some stigma in classical ballet, such as the notion that dancers are not real ballet dancers unless they present extreme flexibility and hypermobility. In their study on 377 dancers, only 4% of the professionals and 9% of the students were considered to be hypermobile using Beighton's modification of the Carter and Wilkinson method for evaluating joint hypermobility.

This point of view is contrary to the study by McCormack [14], on students and professional dancers at the Royal Ballet School, using the Beighton score, in which it was noted that hypermobility and the syndrome are common in students and professional dancers. Moreover, Beighton [8] stated that injuries were significantly more numerous among hypermobile dancers than among non-hypermobility dancers; and Day [9] wrote: "Hypermobility ... among the dance profession is often promoted for reasons ... inherent to dance, especially in classical ballet." In our study, we saw that hypermobility was significantly present among our sample of dancers: in 90% of girls and 67% boys, with is in line with the above mentioned authors' findings.

Hypermobility is more frequent among girls and has a negative influence on their training, while among boys, the injuries and pain relate to factors other than hypermobility [11,12,14].

Generalized joint laxity, which was defined by Boyle [15], has the consequence of hypermobility syndrome. Some studies have reported that there is an association between generalized joint laxity and skeletal muscle complaints such as arthralgia, joint subluxation, dislocation and sprains.

When the injuries were grouped into categories based on their characteristics, whether the source of the injury was instability or otherwise, the results were different. Through this, the relationship between mobility and the injury characteristics was clarified.

Gannon [11] and O'Loughlin [24] quantified the joint laxity of dancers and gymnasts and confirmed that this population presented a high degree of joint instability, which would explain their propensity to injury. Students with hypermobility require additional strength to accomplish their training, which reflects the seriousness of the issue [25,26]. The most commonly reported symptoms are instability and pain relating to tendinitis, in which the need for joint stabilization leads to muscle overuse, thereby causing injuries and muscle fatigue [2,6,22,27]. Ankle sprain injuries are the most common type [23,24]. The most commonly reported symptoms are lesions with instability and tendinitis [27].

Because hypermobility has been associated with fatigue in the general population, hypermobile dancers need to be careful, given the association between fatigue and the etiology of injury in dancing [9,23]. Hypermobility among dancers may be present in as many as 44% of students. Its relationship with fatigue should be a point for assessment in dealing with injuries among dancers [3,9,11,23]. In our study, the muscle fatigue data did not differ between the hypermobile and non-hypermobility groups, and thus did not show any direct association.

Conclusion

This study points towards an association trend between joint hypermobility and prevalence of skeletal muscle injuries, in line with the findings from other authors who also identified high numbers of injuries among individuals classified as hypermobile. This association became established when we categorized the type of injury sustained and was not related to all types of injury.

This study indicates that there is a real association between hypermobility as a risk factor for lesions, which were more present in hypermobile individuals. On the other hand, pain was inversely presented, such that it was more present in non-hypermobile dancers, perhaps because of skeletal muscle overload to meet the physical and esthetic needs of ballet. Fatigue was not an important variable in the analyses between the groups, and was similar between them.

The Beighton score, which is used in most studies on dancers, may not provide an appropriate measurement of hypermobility for this population. Therefore, there is a need for further studies on this topic, thus confirming the hypothesis of Day.

It is our responsibility to take care of dancers in a broader manner, and to inform them, as honestly as possible, about the state of their health and of the possibility of monitoring, both for good development of their activities and for therapeutic approaches. It is especially important to establish a relationship regarding the need for intensive therapeutic care for treating of skeletal muscle injuries among hypermobile individuals.

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