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SYSTEMATIC REVIEW

Methods used to evaluate the en dehors or turnout of dancers and classical ballet dancers: a literature review

Métodos usados para avaliar o en dehors ou turnout de dançarinos e bailarinos clássicos: revisão da literatura

Métodos utilizados para evaluar el en dehors *o* turnout *de bailarines y bailarines clásicos: revisión de la literatura*

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ABSTRACT | The classical ballet technique requires the maximum *en dehors* or *turnout*, which is the lower limbs external rotation. Considering its importance, several evaluation and measurement protocols have been proposed. This review aims to investigate systematically which methods were used to assess the classical dancers' or classical ballet practitioners' *turnout*. A systematic search was made in the Scopus, Science Direct, and PubMed databases in February 2016 for studies written in English that evaluated classical dancers or ballerinas, and the *en dehors* or *turnout* was measured. We found 593 articles, of which 25 were pre-selected for this review, featuring fifteen different methods and instruments for measuring *turnout*: kinemetry; inclinometer; Turnout Protractor, or protractor to measure the *turnout*; goniometer; dupuis tropometer; original protractor; subjects photos; rotational discs; Nicholas flexibility test; fleximeter; clinical drawing of the feet; subject standing on a piece of paper, or soil, or whiteboard; magnetic resonance; filming the subject during a sequence of dance steps; Dasco pro angle finder. This review provides convincing evidence that there is not a method or gold-standard instrument for measuring dancers' *turnout*, therefore such measurement is usually adapted and chosen according to each study objectives.

Keywords | Dance; Evaluation Studies; Evaluation.

RESUMO | A técnica do *ballet* clássico exige a realização máxima do *en dehors* ou *turnout*, caracterizado pela rotação externa de membros inferiores. Considerando a sua importância, diversos protocolos para a sua avaliação e mensuração têm sido propostos. O objetivo desta revisão foi investigar sistematicamente quais os métodos utilizados para avaliar o *turnout* de bailarinos clássicos e/ou praticantes de *ballet* clássico existentes atualmente. A busca foi feita nas bases de dados Scopus, Science Direct e PubMed, no mês de fevereiro de 2016, e os artigos encontrados deveriam: estar redigidos na língua inglesa, avaliar bailarinos clássicos ou dançarinos que praticassem *ballet* clássico e mensurar o *en dehors* ou *turnout*. Foram encontrados 593 artigos, dos quais 25 foram pré-selecionados para esta revisão, apresentando quinze diferentes métodos e instrumentos de mensuração do *turnout*: cinemetria; inclinômetro; *turnout protactor* ou transferidor para medir o *turnout*; goniômetro; Dupuis Tropometer; transferidor original; fotos dos sujeitos; discos rotacionais; teste de flexibilidade de Nicholas; flexímetro; desenho clínico dos pés; sujeito sobre um pedaço de papel ou solo ou quadro branco; ressonância magnética; filmagem do sujeito executando sequência de passos; Dasco Pro Angle Finder. Esta revisão apresenta forte evidência para afirmar que não há, até o presente momento, um método

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ou instrumento padrão-ouro para mensuração do *turnout* de bailarinos, de modo que esta costuma ser adaptada e escolhida de acordo com o objetivo de cada estudo.
Descritores | Dança; Estudos de Avaliação; Avaliação.

RESUMEN | La técnica del *ballet* clásico exige la realización máxima del *en dehors* o *turnout*, caracterizado por la rotación externa de miembros inferiores. Considerando su importancia, varios protocolos para su evaluación y medición han sido propuestos. El objetivo de esta revisión ha sido investigar sistemáticamente los métodos utilizados para evaluar el *turnout* de bailarines clásicos y/o practicantes de *ballet* clásico existentes actualmente. Se hizo la búsqueda en las bases de datos Scopus, Science Direct y PubMed, en el mes de febrero de 2016, y los artículos encontrados deberían: estar redactados en la lengua inglesa, evaluar bailarines clásicos o bailarines que practicaran *ballet* clásico y medir el *en dehors* o *turnout*. Se encontraron 593 artículos, de los cuales se preseleccionaron 25 para esta revisión, presentándose 15 diferentes métodos e instrumentos de medición del *turnout*: cinemetría; inclinómetro; *turnout protactor* o transferidor para medir el *turnout*; goniómetro; Dupuis Tropometer; transferidor original; fotos de los sujetos; discos rotacionales; prueba de flexibilidad de Nicholas; flexímetro; diseño clínico de los pies; sujeto sobre un pedazo de papel o suelo o cuadro blanco; resonancia magnética; filmación del sujeto ejecutando secuencia de pasos; Daco Pro Angle Finder. Esta revisión presenta una fuerte evidencia para afirmar que no hay, hasta el momento, un método o instrumento estándar-oro para la medición del *turnout* de bailarines, de modo que ésta suele ser adaptada y elegida de acuerdo con el objetivo de cada estudio.
Palabras clave | Danza; Estudios de Evaluación; Evaluación.

INTRODUCTION

The classical *ballet* technique requires the maximum realization of the *en dehors*, or turnout[1], considering that an ideal turnout should be performed exclusively by the hips[2-4], through an external 90° rotation of the hip joints, bilaterally, while the feet are in an angle of 180° between them[1]. Nevertheless, there has been a substantial influence of compensatory rotations of knees, tibia, and feet to achieve this 180° angle. This is characterized as a fake turnout since it is not performed exclusively by the hips[5-7].

Given this context, it has also been described that this "fake" (or compensatory) action is characterized by a technical glitch causing acute and chronic injuries in dancers, as it causes the bones, muscles, tendons, ligaments, and nerves to be under constant stress in an extreme anatomical position[1,8-13]. Epidemiological studies report that 90% of the dancers have lesions, with approximately 75% of these occurring in the lower limbs, being 40% in feet, ankles, and tibia[10-12,14-19]. This occurs because the lack of a good and natural external rotation of the hips lead to external rotations of knees, tibia, ankles, and feet to achieve the 180° angle on the ground, as a compensation. Also, the most common injurious compensatory movements are the pronation or fall of the feet longitudinal arch, the knee twisting, and even the increase or rectification of the lumbar lordosis[1,8-13].

Considering the importance of the turnout to the classical *ballet*, various protocols have been proposed to its evaluation and measurement. While some recommend the use of measurement protocols that include all the lower limb to assess the individual participation rate of each segment and joint[20-22], others defend the use of measurements that simulate functional dance movements, based on the assumption that those measures will be more useful for doctors, teachers, and the dancers themselves[1,23-25]. This discrepancy suggests there is no consensus on which protocol to follow in the turnout evaluation. The aim of this systematic review was to answer the following question: Which are the methods used to evaluate the turnout of classical dancers and or classical *ballet* practitioners that currently exist?

METHODOLOGY

A systematic search was conducted in the databases Scopus, Science Direct and PubMed, in February 2016. The keywords used were: "Dancing" OR "Ballet Dancers" OR "Ballet Dancer" OR "Dancer" OR "Dancers" OR "Ballet" OR "Classic ballet" OR "Classical Dance" OR "Dance" OR "Classical Ballet" AND "Ballet Positions" OR "Foot Position" OR "Feet Position" OR "Turnout" OR "Hip Rotation" OR "Hip External Rotation" OR "External Rotation"

OR "Outward Rotation" OR "Lower Extremity Rotation" OR "Lower Extremity" OR "Lower Limb" OR "Turnout Angle" OR "Leg Rotation" OR "Tibial Torsion".

To compose this review, the articles found should meet the following inclusion criteria: (a) being written in English; (b) evaluate classical dancers or who practiced classical *ballet*; and (c) evaluate and measure the *en dehors*, or turnout. The exclusion criterion was not describing the method used to assess the *en dehors,* or turnout.

All procedures for search, selection, quality evaluation, data reading and collection from the articles were performed by two independent assessors. In cases of divergence among assessors, a third evaluator was invited to conduct the article evaluation.

Initially, the studies were selected from the reading of titles and abstracts, and the articles that had potential to be included in the search were read and analyzed in full. Then, were finally included those that complied with all inclusion criteria. The bibliographies of each article were also investigated to find studies not located in the electronic search.

To assess the studies' quality was used the STROBE scale, which consists of a 22-item checklist that should be contained in observational articles for them to be considered of excellent quality. These items are related to title and abstract, methods, results, discussion, and other information[26]. However, the STROBE scale was modified, i.e., the items 1(b), 4, 9, 15, 16 (a) (b) (c), 17, and 21 were excluded, considering they did not apply to this study. A similar procedure was also performed in other systematic reviews[27-31]. For insertion of the article in this review, it was intentionally set as minimum criteria a minimum of five points in the modified STROBE scale, whose maximum score is 17 points.

Scientific evidence strength of this review was analyzed by the Best Evidence Synthesis (BES), an alternative to the meta-analysis that proposes a studies' quantitative analysis, in which the evidence strength is determined by the number and quality of the studies and the consistency of their results[32]. The criteria used to rank evidence strength were: strong evidence, obtained through many high-quality studies; moderate evidence, obtained through one high-quality study and one or more low-quality studies; limited evidence, obtained through a high-quality study of many low-quality ones; and no evidence, obtained through a low-quality study or contradictory results[33].

This study is registered on the PROSPERO under the number CRD42016027856.

RESULTS

Initially, 593 articles were found from the data search, of which 39 were included. After eligibility evaluation, thirteen were excluded for not measuring the turnout or not presenting the values of the turnout measurements. Thus, 25 articles were pre-selected to compose this systematic review (Figure 1).

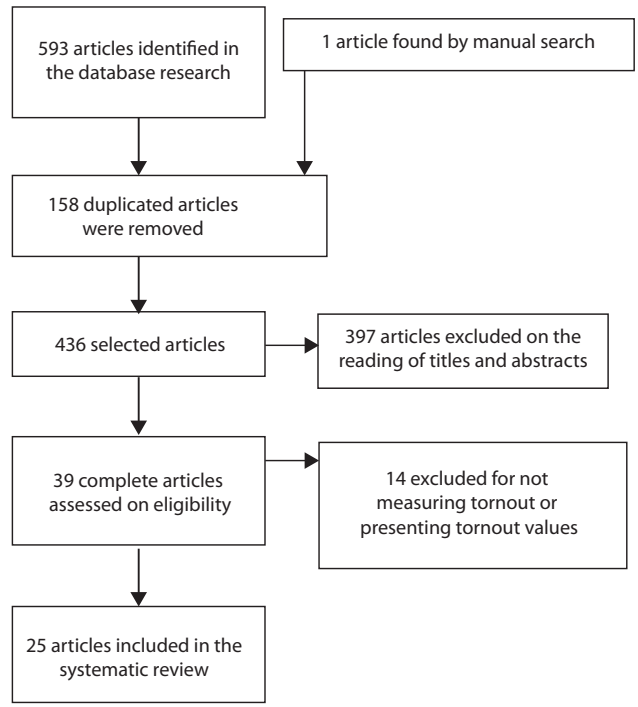

Figure 1. Flowchart of article selection

The pre-selected studies were evaluated on methodological quality using the modified STROBE criteria (Table 1), and only three out of the 25 studies presented a score inferior to 10.

Table 2 shows the 25 studies included, discerned by first author, year, sample size, mean or variation of age, gender, and instruments used in the turnout evaluation.

Based on the methodological quality assessment and the bias risk through the modified STROBE scale, considering the score obtained and the type of studies included (Tables 1 and 2), this systematic review shows a robust evidence since twelve studies showed high scores, superior to 13 points.

Table 1. Results of the studies methodological quality assessment through the modified STROBE checklist

Studies – 1st author (year)	STROBE Checklist Criteria																Total (n° of ✓)
	1	2	3	5	6	7	8	10	11	12	13	14	18	19	20	21	
Barnes et al.[34]	×	✓	✓	✓	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	14
Bennell et al.[35]	✓	✓	✓	✓	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	15
Bennell et al.[36]	✓	✓	✓	✓	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	15
Bronner et al.[37]	×	✓	✓	✓	✓	✓	✓	✓	✓	✓	×	✓	✓	✓	✓	✓	14
Champion et al.[38]	✓	✓	✓	?	?	✓	?	?	?	✓	✓	?	✓	✓	✓	✓	10
Cimelli et al.[13]	×	✓	✓	✓	✓	✓	✓	×	✓	✓	✓	×	✓	✓	✓	✓	13
Coplan et al.[21]	✓	✓	✓	✓	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	✓	×	14
Filipa et al.[39]	×	✓	✓	×	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	13
Gilbert et al.[40]	×	✓	✓	✓	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	14
Girón et al.[41]	✓	✓	✓	×	✓	×	×	×	×	×	✓	×	✓	✓	×	✓	8
Grossman et al.[42]	×	✓	✓	✓	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	14
Hamilton et al.[43]	×	✓	✓	✓	✓	✓	✓	×	✓	✓	✓	×	✓	✓	✓	×	12
Iunes et al.[44]	×	✓	×	×	✓	✓	✓	×	✓	✓	×	×	✓	✓	✓	×	9
Khan et al.[22]	✓	✓	✓	×	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	✓	×	13
Khan et al.[45]	✓	✓	✓	✓	✓	✓	✓	×	✓	✓	✓	×	✓	✓	✓	✓	14
Khoo Summers et al.[46]	✓	✓	✓	✓	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	15
Kushner et al.[16]	×	✓	✓	✓	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	14
Lin et al.[47]	✓	✓	✓	×	✓	×	✓	×	✓	✓	×	×	✓	✓	✓	×	10
Merkensteijn et al.[48]	×	✓	×	×	×	×	✓	×	✓	✓	×	✓	✓	✓	✓	✓	9
Negus et al.[1]	✓	✓	✓	✓	✓	✓	✓	×	✓	✓	✓	×	✓	✓	✓	✓	14
Pata et al.[49]	×	✓	✓	✓	✓	✓	✓	×	✓	✓	✓	×	✓	✓	✓	✓	13
Sherman et al.[50]	×	✓	✓	✓	✓	✓	✓	×	✓	✓	✓	×	✓	✓	✓	✓	13
Shippen et al.[52]	×	✓	✓	✓	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	14
Sutton-Traina et al.[51]	✓	✓	×	✓	✓	✓	✓	×	✓	✓	×	✓	✓	✓	✓	×	12
Welsh et al.[20]	×	✓	✓	✓	✓	✓	✓	×	✓	✓	✓	×	✓	✓	✓	✓	13

Table 2. Characteristics of the studies included

Study	Sample size	Range of Age (Mean)	Gender F/M	Methods used to evaluate the dancers' turnout
Barnes et al.[34]	14	17-34	14/-	Kinemetry: 3D technology and analyses.
Bennell et al.[35]	77 dancers; 63 non-dancers	8-11	140/-	Inclinometer; turnout protractor.
Bennell et al.[36]	53 dancers; 40 non-dancers	8-11	93/-	Inclinometer; turnout protractor.
Bronner et al.[37]	17	18-27	10/7	Kinemetry: 5-camera motion capture system
Champion et al.[38]	Review article: 24 published articles that reported original turnout measurement methods in dancers			Standard goniometer; modified goniometer with a level; inclinometer; Dupuis Tropometer; original protractor; photos of the subjects standing on pedal free of feet friction; flexibility test: Nicholas lower extremity tourniquet; fleximeter.
Cimelli et al.[13]	12	21-36	5/7	Clinical outlying/drawing of the feet.
Coplan et al.[21]	30	16-50	27/3	Goniometer; subject standing on a piece of paper in the 1st ballet feet position.
Filipa et al.[39]	10	5-9	10/-	Subject standing on a piece of paper.

(continues)

Table 2. Continuation

Study	Sample size	Range of Age (Mean)	Gender F/M	Methods used to evaluate the dancers' turnout
Gilbert at al.[40]	20	11-14	20/-	Universal goniometer.
Girón et al.[41]	3	Mean: 19.7	3/-	Kinemetry: 8-camera three-dimensional optical motion capture system.
Grossman et al.[42]	14	Age: 10	14/-	Rotational disks; magnetic resonance; goniometer.
Hamilton et al.[43]	64	14-25	64/-	Digital electronic inclinometer; subject standing on a piece of paper.
Iunes et al.[44]	52 dancers; 59 non-dancers	7-24	111/-	Photos
Khan et al.[22]	66 dancers; 47 non-dancers	F – Mean: 16.9; M – Mean: 18	Dancers: 36/30; Non-dancers: 31/16	Goniometer; turnout protractor.
Khan et al.[45]	48	16-18	28/20	Goniometer; turnout protractor.
Khoo Summers et al.[46]	23	18-21	23/-	Universal goniometer; subject standing on a piece of paper in the 1st ballet feet position.
Kushner et al.[16]	22	F – mean: 19.4; M – mean: 24	14/8	Goniometer.
Lin et al.[47]	22 dancers; 11 non-dancers	Injured dancers – mean: 19.7; dancers without injury – mean: 18.8; non-dancers – mean: 20	33/-	Goniometer; subject standing on a piece of paper in the 1st and 5th ballet feet position.
Merkensteijn et al.[48]	22	19-23	20/2	Goniometer; subject standing on a piece of paper in the 1st ballet feet position.
Negus[1]	29	15-22	24/5	Goniometer; subject standing on a piece of paper.
Pata et al.[49]	6	Not informed	6/-	Rotational discs; filming of the subject performing a sequence to the right and left sides.
Sherman et al.[50]	16	13-17	16/-	Articulated goniometer; Dasco Pro Angle Finder; subject standing on a piece of paper in the 1st ballet feet position; rotational discs.
Shippen[52] (2011)	10	18-28	10/-	Kinemetry: 12-cameras 3-dimensional optical tracking system MX40.
Sutton-Traina et al.[51]	23 dancers; 13 non-dancers	18-30	36/-	Rotational discs; Goniometer.
Welsh et al.[20]	17	18-32	Not informed	Subject standing on a withe board; rotational discs.

DISCUSSION

When systematically reviewing the studies included in this research, we observed that there is no consensus in the literature on a standard procedure to measure the turnout in dancers, with a series of procedures and protocols available. Fifteen different methods and instruments for measuring turnout were found: kinemetry (4 studies); inclinometer (4 studies);Turnout Protractor, or a protractor to measure the turnout (4 studies); goniometer (13 studies); *dupuis tropometer* (1 study); original protractor (1 study); subjects photos (2 studies); rotational discs (6 studies); Nicholas flexibility test (1 study); fleximeter (1 study); feet clinical drawing (1 study); subject standing on a piece of paper or soil or whiteboard (9 studies); magnetic resonance (1 study); filming of the subject performing a steps sequence (1 study); Dasco Pro Angle Finder (1 study). Of these fifteen, six methods/instruments were used by four or more studies: kinemetry; inclinometer; Turnout Protractor, or protractor to measure the turnout; goniometer; rotational discs; and subject standing on a piece of paper, or on the soil, or a whiteboard. Among these six, three methods/instruments stood out by the

amount of found studies that used them: goniometer (13 studies), subjects standing on a piece of paper or soil or whiteboard (9 studies), and rotational discs (6 studies).

Studies that used goniometers to evaluated dancers' turnout focused their measurements in isolated joint motion ranges of hips, tibia, and feet. However, Gilbert et al.[40] suggest that the hips external rotation motion range, for example, is not the best alternative to predict the dancers' turnout, as these measures are considered as relating to a passive turnout because its measurements are made with subjects in different decubitus, and not in orthostasis. Reinforcing this non-prediction, Welsh et al.[20] found in their study a tendency of several dancers using less active turnout than they are passively capable, showing greater turnout values in passive than in active measurements (in orthostasis or in rotational discs without friction). Still on the lack of correlation between passive measures and real values of turnout when the dances are in orthostasis, Negus et al.[1] did not find, in their study, a correlation between external rotation movement range of the hips (passive turnout, measured through goniometry) and functional turnout (measured by them with the subject standing on a piece of paper).

The measurement of the dancers' turnout with the subject standing on a piece of paper or soil or whiteboard, used by 9 out of the 25 studies found by this systematic review[1,20,21,39,43,46-48,50], is characterized as a static evaluation and, considering the friction of the subjects' feet with the soil, can interfere with the found values for turnout. Therefore, to dynamically evaluate the turnout and to eliminate the influence of this friction on its values, six studies used no-friction rotational discs to measure it[20,38,42,49-51]. We highlight the study of Pata et al.[49], which suggests that rotational discs (without friction) are the best strategies to predict real turnout angles, as they allow a visualization of the most real, active, dynamic, and complete turnout of each dancer.

Kinemetry, used by four of the 25 studies found in this review[34,37,41,52], also has been used to evaluate the turnout more dynamically. Given that static methods have not shown much efficiency nor presented results concordance (being also insufficient to the analysis of dancers' complete turnout), this alternative is highlighted among the other ones found.

On turnout types, many denominations were found for the angles measured in the studies, according to the method type or instrument used. Among these denominations we can quote: passive turnout, active turnout, functional turnout, fake turnout, and total turnout, for example. Of the 25 studies in this review, we highlight that of Sherman et al.[50], for presenting clear definitions on each type of turnout, in accordance with the method chosen for each type. In their study, four methods were presented, considered to be practical and easy to use in clinic, being them: (1) measuring of passive turnout: the evaluator mobilizes the limbs of the subject, who can be in dorsal or abdominal decubitus, or sitting, to obtain an external rotation of the hips with the knee flexed at 90°, being then measured with a goniometer; (2) static measuring of active turnout: the subject must achieve, over a piece of paper, its maximum turnout in the first feet position, keeping the ankles together to mark on the paper the center of the posterior calcaneus region and the second metatarsus of each foot, enabling the calculation of the angle created by the two lines obtained by the connection of this points (one for each foot), thus obtaining the angle of active static turnout on the floor through a goniometer, (3) dynamic measuring of active turnout: the subject must climb a set of rotational discs that has a rolling mechanism between disc surface and ground, eliminating the friction with the latter and, soon after, align the second metatarsus and the center of each heel with the line in the center of the two discs. Both discs must be over great paper sheets, which allows the demarcation of final positions (maximum first position of feet in classical *ballet*) of each foot on the discs, after the evaluator solicitation. The points demarcated on the sheets of paper, referring to the final positions of the calcaneus center and the second metatarsal on the disc, should be joined by straight lines to measure the intersection angles between them, thus obtaining dynamically the active turnout angle on the discs with the use of a goniometer; (4) measurement of the tibia external passive rotation: the subjects should be positioned in ventral decubitus, with knees and ankles flexed at 90° on a table to enable, after performing an external rotation of the tibia with the goniometer over the calcaneus center, the measurement of the angle between thigh and foot since one of the goniometer arms should point to the second metatarsal and the other to the ischial tuberosity.

However, even though these methods are clearly described by Sherman et al.[50], they lead to turnout degrees measurement problems, also identified here, which are, first of all, the lack of a gold-standard for reliable and valid measurements of active and passive turnout due mainly to the complexity of studying a movement that involves the lower limbs as a whole,

which suffers with static and dynamic changes[38]. Furthermore, another problem identified is the absence of a normative pattern for measuring segments composing the lower limb, and for the sum of measures that compose the total turnout[50].

The own International Association for Dance Medicine and Science, since 2008, recognized the necessity of standardizing these measurements and the registry of normative data, and incentive the use of the studies of Chatfield[38], Grossman et al.[42], and Welsh et al.[20] as references for future studies. In short, these three studies show that measuring only the hips external rotation does not predict the dancers' turnout since no correlations were found among these measures and those regarding functional or total turnout angles. This measurement, according to Champion and Chatfield[38], still has at least eight issues that can affect its results: (1) the type of procedure, active or passive; (2) the position of measuring (prone, supine, sitting, or standing); (3) the pelvic position (stabilized and corrected pelvic tilt degrees); (4) hip position (hip flexion and extension degrees); (5) contralateral limb position (neutral or abducted); (6) the presence of knee flexion or extension; (7) sample warming up before collection; and (8) the presence of friction, which increases in contact with the soil when the subject is in orthostasis.

Similarly, Negus et al.[1] also believe the angular measures of a functional turnout are more relevant to understand the dancer itself and its associated lesions, since the injuries that affect classical dancers are associated with "fake" (or compensatory) performance of total turnout (maximum of 180° between the feet medial edges when in the first feet position). Thus, if the hip is not the only responsible for the final angle obtained between the medial edges of the feet in a total turnout, compensatory movements of external rotation in the knees, tibia, ankles, or feet end up occurring. Grossman et al.[42] measured the external rotation angles of hips, tibia, and feet and demonstrated that the tibial torsion, specifically, when measured by magnetic resonance imaging, is the primary contribution outside the hip to the total turnout angle, corresponding to more than 20% of its value when knee stress is not induced by rotational stress. Therefore, tibial torsion is understood as a factor of potential influence on the dancers' total turnout, and seeking its relationship with the external rotation of hip, ankles, and feet is a more coherent tendency in the study of turnout angulation, directing its measures towards a standardization that, until this moment, was not yet established.

Finally, only one study was found using dynamic filming of *ballet* steps, with only one camera[49]. In such study, the dancer executed a specific sequence of steps (adagio) for both sides, while being filmed for posterior verification of differences before and after the intervention proposed by the authors. Given the existence of only this study in the active evaluation of turnout, it is suggested that future studies prioritize this kind of measurement approach. It is believed that, thus, the research can approach increasingly the practical reality of dance studies and schools, allowing even more professionals involved with dancers use the methods and instruments developed and used in the scientific realm. As a limitation of this review, we cite the fact that the STROBE checklist, although used in other systematic reviews, is not an appropriate scale to assess the methodological quality of the included studies since its main objective is to provide the authors with evidence about their own methodological procedures.

CONCLUSION

This literature review provides compelling evidence to assert that there is not, until now, a method or gold-standard instrument for measuring dancers' turnout; hence, the measurement is usually adapted and chosen according to the objective of each study. The methods and instruments found for turnout evaluation were: kinemetry; inclinometer; Turnout Protractor, or protractor to measure the turnout; goniometer; Dupuis Tropometer; original protractor; subjects' pictures; rotational discs; Nicholas flexibility test; fleximeter; clinical drawing of the feet; subject standing on a piece of paper or white board; magnetic resonance; filming of the subject performing a sequence of steps; Dasco Pro aAgle Finder.

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