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Review

The role of the dominant leg while assessing balance performance. A systematic review and meta-analysis

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ABSTRACT

Background: Good balance is a pre-requisite for various activities of daily life and sports. Physiotherapists thus regularly assess and train patient's balance capacities. In order to interpret the test results of unilateral balance tests, a comparison with normative data is common. In patients who had an injury or a surgery, the performance of the injured leg is often compared with performance of the non-injured leg. Nevertheless, it remains unclear if unilateral balance performance differs between the dominant and non- dominant legs. If so, this should take into consideration when interpreting test results.
Research question: This meta-analysis summarized the current evidence to determine if the balance performance of healthy adults was influenced by the leg's dominance.
Methods: Articles were searched in PubMed, CINAHL, Cochrane and Embase. Data from studies meeting the pre-defined inclusion criteria were extracted in a standardized form. A meta-analysis was conducted using a random effect model.
Results: Forty-six studies were included. Their data were allocated in 7 categories of balance tests. Significant differences between the dominant and the non-dominant legs were not found in any of the categories (surface stable, eyes open: −0.04, 95 % CI −0.12 to 0.05, surface stable eyes closed: −0.06, 95 % CI −0.22 to 0.11, surface unstable, eyes open: −0.15, 95 % CI −0.38 to 0.07, surface unstable, eyes closed: -0.06, 95 % CI −0.27 to 0.15, BESS (Balance Error Scoring System): 0.03, 95 % CI −1.09 to 1.14, SEBT (Star Excursion Balance Test)/YBT (Y Balance Test): 0.06, 95 % CI −0.04 to 0.16, jump: 0.04, 95 % CI −0.28 to 0.36).
Significance: Results indicate that balance performance is not influenced by the leg's dominance. This means that performances of both legs can be used as reference. Evidence is strong for the one leg stance. However, future studies are needed to confirm our results for stabilization tasks after a jump landing.

1. Introduction

Balance is defined by the capacity to maintain the center of mass (COM) of the body vertically over the base of support with minimal movements [1]. Keeping balance while executing efficient movements is essential for various activities of daily life and sport activities [2,3].

Maintaining balance necessities a successful interaction between different elements, namely muscle activity, coordination, the somatosensory, auditory, motor, premotor and vestibular systems as well as visual functions [4,5]. Various factors, such as pain, restriction of joint movement, reduced muscle strength or lack of endurance can perturb balance capacity and disrupt balancing strategies [6]. Furthermore, numerous musculoskeletal problems and most neurological diagnoses lead to balance deficits which have been described to be related to falls in older persons [7] and to sport injuries among athletes [8], [9].

Physical therapists routinely assess patient's balance performance and set up training programs for patients with balance deficits [10,11]. Several tests exist to assess balance problems and its underlying neuromuscular deficits and to monitor patient's rehabilitation progress [11]. Among these tests we count very "simple" clinical tests as well as tests requiring more sophisticated material such as a force platform or a biodex stability system to measure body postural sway or a stability index [12,13].

Overall, balance tests can be classified in static (e.g. maintain posture

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in upright position or single leg stance [14,15]) and dynamic tests (e.g. Star Excursion Balance Test (SEBT) [16] or YBT [17]), which require more proprioception, mobility and strength and are thus more adequate to challenge postural control by healthy people and athletes [18]. For this population we can also use sport specific tests such as the time to stabilize a position (TTS) after a jump [19].

In general the difficulty of balance tests can be varied by reducing somatosensory inputs, changing the base of support (e.g. ask the subject to stand with on leg in front of the other [6]) or by using unstable surfaces [20]. Private the patients from visual inputs is another way to challenge patient's balance [6].

For all these tests, physical therapists generally compare results of both legs to make therapeutic choices [21]. More specifically, the non-injured leg is commonly used as reference value when interpreting the test results [22]. However, in the last few years, many authors have discussed whether balance performance differs between the dominant and the non-dominant legs. Various studies evaluated the influence of one leg's dominance on balance performance but without coming to an unanimous conclusion [3,22]. The same applies for athletes when measuring balance capacity while landing a jump. Some authors reported differences between the dominant and the non-dominant legs in landing strategies [23] whereas others reported no difference between the legs in the TTS [24].

It is indeed likely that balance performance differs between the dominant and the non- dominant leg since the functional activities and the body weight support are more intense on the dominant side [21]. However, if this is the case, this should be taken into consideration when interpreting tests results by comparing both legs.

It is thus of importance to assess if the dominance of one leg affects balance performance or not. Therefore, the aim of the present work is to review in a systematic way the literature which assessed if the balance performance is influenced by the leg's dominance. To answer this question, two sub-issues have been defined: a) is there a difference between the dominant and the non-dominant legs to keep balance on one leg? And b) is there a difference in the stabilization during one leg landing after a jump when assessing the dominant leg compared to an assessment of the non-dominant leg?

2. Method

2.1. Design

To examine whether there are differences between the dominant and the non-dominant legs in balance performance of healthy adults, a systematic literature search and meta- analysis was performed. This work follows the PRISMA guideline [25]. A protocol was registered on PROSPERO (registration number: CRD42019111580).

2.2. Database and search strategy

An electronic search was conducted in July 2019 in the following electronic databases: PubMed, CINAHL, Cochrane, Embase. We used the following equation: "(postural control OR balance OR stabilization OR stabilisation OR stabilise OR stabilize OR stabilizing OR stabilising OR land OR landing OR jump OR jumping OR kinetic) AND (dominant leg OR dominant limb)". It was adapted for each database. English, French and German languages restrictions were applied. In addition, we screened the references of the selected articles.

2.3. Inclusion and exclusion criteria for study selection

We included cohort studies, case-control studies or cross-sectional studies assessing a healthy adult population (over 18 years old). We only considered studies which were written in English, French or German.

We considered all studies reporting data for both, the dominant and the non-dominant legs, regardless of the method used to determine leg's dominance. Concerning balance/stability assessment, all types of balance/stability evaluation on one leg and during the landing on one leg after a jump were included, on firm and on foam ground. However, we excluded studies using balance tests which required an external intervention. We further excluded studies evaluating subjects with any orthopedic, neurological, metabolic, rheumatic or vestibular diseases that might influence balance performance. Studies assessing subjects with any leg injury or previous leg surgery were also excluded.

2.4. Study selection

We screened the titles and abstracts of the studies using the predefined in- and exclusion criteria. If there was a doubt about the selection of an article, the opinion of a second researcher (LA4 or RH5) was requested and disagreements were discussed and a consensus found. The reasons for the exclusion of articles are specified in the flow diagram (Fig. 1). After having read the abstracts, the reviewers proceeded with the full text reading.

2.5. Assessment of risk of bias

To assess the quality of the articles, a new quality scale had to be developed (Table 1) as none of the existing tools were appropriate to judge the included articles. The elaboration of this quality scale was inspired by existing questionnaires (the "Quality Assessment tool for Observational Cohort and Cross-sectional study" [26], the "STROBE" [27] and "Evidence-based Medicine: How to Practice and Teach EBP" [28]). Items concerning population, determination of the dominant leg, validity and reliability of the outcomes, blinding of the assessors, confounding variables, missing values, other bias, standardization of the tests and randomization of the tests order were used. For each item, the reviewer could choose between "high risk", "low risk" and "unclear risk".

In case of insufficient information, the category "unclear risk" was chosen. In case of doubt about the assessment of an item, the advice of another researcher (LA6 or RH7) was asked and a consensus was sought. We performed a pre-test of the quality scale by assessing and discussing the quality of two articles.

For the determination of a leg's dominance, the following tests/questionnaires were considered as valid: preferred leg to kick a ball, lateral preference inventory (LPI) and functional test assessing leg used to kick a ball, leg used for stepping initiation and leg used to recover balance after a nudge applied at the back [22,29,30].

Funnel plots were created to assess publication bias.

2.6. Data extraction

We extracted the study characteristics in a table and reported author, year, participants (number, sex distribution), age, activity level, balance tests, outcome measures and method used to determine the dominant leg (Table 2).

2.7. Data processing

All data needed to perform the meta-analysis were exported in Review Manager software.

In the case of studies which reported data before and after an intervention, only the data collected before the intervention were taken. If data of several groups were reported, the average was used, except if the activity level of the groups was different (in this case groups were separately analyzed). If studies assessed different groups, only data of healthy group(s) were analyzed. If the balance/stability was assessed in several sessions/tests, the data of the first session/test were taken, except if the average of the different sessions/tests was reported in the study. Concerning the position of the foot, only the values calculated

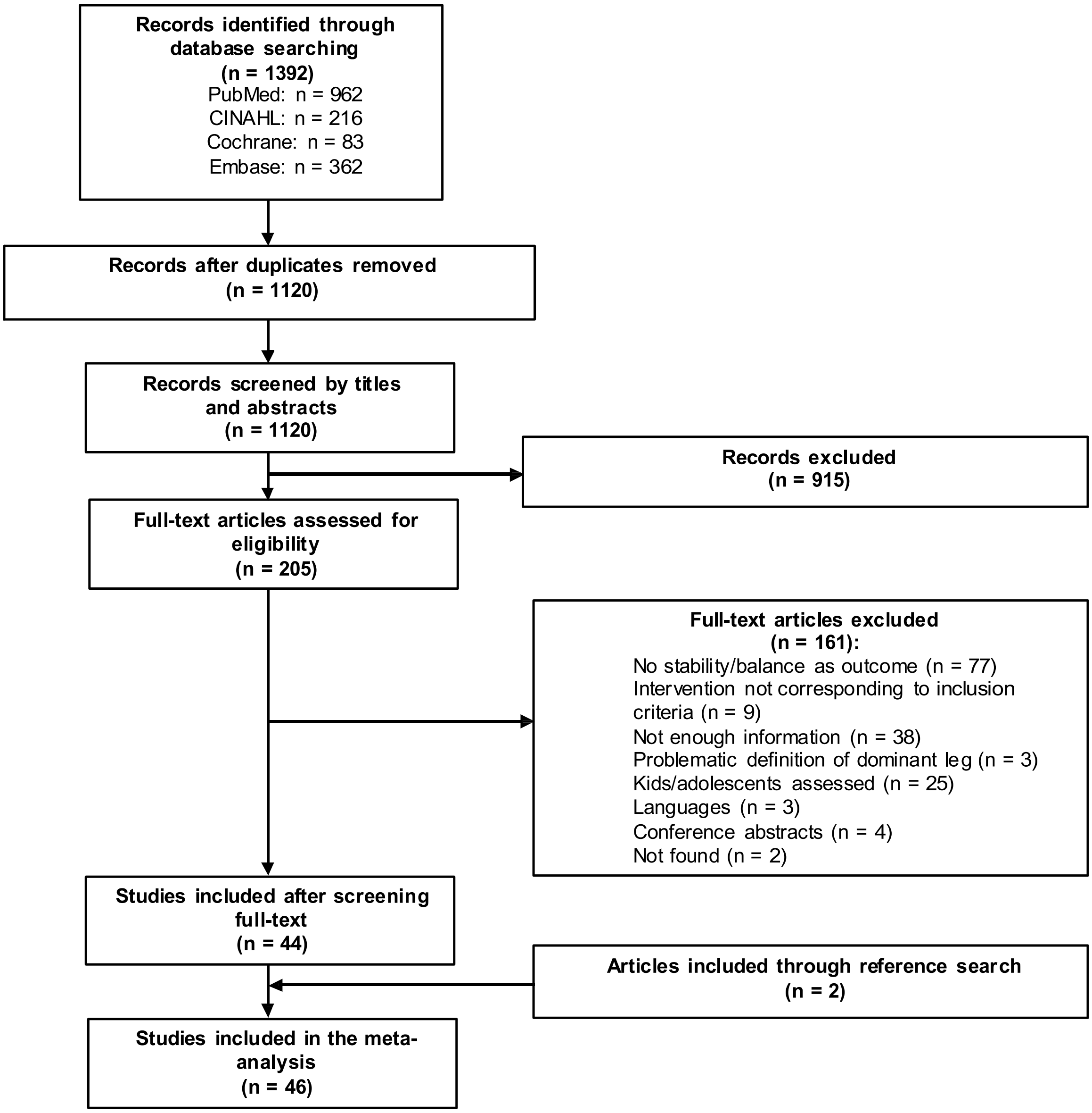

Fig. 1. Flow Chart of the study selection process.

with the foot in a neutral position were taken in account, if possible, without shoes. Concerning measuring time, if balance/stability tests were assessed during different periods of time, the test with the time closest to 15 s was taken [31].

If authors only presented graphs, we converted them with PDF-Xchange Editor software into numeric data.

Given that the included studies used different tests and different outcomes to assess balance abilities, we created seven categories of balance/stability tests: 1. “surface stable, eyes open”, 2. “surface stable, eyes closed”, 3. “surface unstable, eyes open”, 4. “surface unstable, eyes closed” 5. “BESS”, 6. “SEBT/YBT”, 7. “jump”. For each category, a hierarchy of outcome variables was defined a priori based on the literature and always the variable on the top of the hierarchy per category was chosen to be used for statistics.

Balance/stability data were extracted whenever mean and SD were available or when the available data allowed their calculation.

2.8. Data analysis and synthesis

All analyses were performed in Review Manager. A random effect model was chosen to compare balance capacity between the dominant and the non-dominant legs. Because balance/stability was assessed with different tests using different scales, standardized mean differences (SMDs) with 95 % confidence intervals (CIs) were used for the comparisons. The interpretation of the effect size calculated with SMDs was made as follows: 0.2 indicates a small effect size, 0.5 a moderate effect size and 0.8 a large effect size [32]. All outcomes of interest were continuous data. Means and standard deviations of dominant and non-dominant legs were extracted to perform the meta-analysis. Heterogeneity between studies was assessed with I2 tests. Values were interpreted as small (I2 < 25 %), moderate (I2 = 25–75 %) or high (I2 > 75 %) [33]. All analyses with a p- value less than 0.05 were considered as statistically significant. Results of each category are presented in Table 3.

3. Results

3.1. Charateristics of included studies

Forty-six studies met the inclusion criteria and were used for the meta-analysis [2,21,39–48,22,49–58,30,59–68,31,69–74,34–38]. The characteristics of the included studies are presented in Table 2. The

Table 1
Quality AssessmentScale.

Was the study population clearly specified and defined?	High risk / unclear risk / low risk
Were inclusion and exclusion criteria defined?	High risk / unclear risk / low risk
Were characteristics of participants reported?	High risk / unclear risk / low risk
Was the method to determine the dominant leg clearly explained?	High risk / unclear risk / low risk
Was the method to determine the dominant leg valid?	High risk / unclear risk / low risk
Were the outcome measures clearly defined, valid and reliable?	High risk / unclear risk / low risk
Were the outcome assessors blinded to the dominance of the leg?	High risk / unclear risk / low risk
Were potential confounding variables reported and if necessary, statistically adjusted for their impact?	High risk / unclear risk / low risk
Were there less than 15 % of missing values?	High risk / unclear risk / low risk
Other bias	High risk / unclear risk / low risk
Was the performed test standardized?	High risk / unclear risk / low risk
Was limb testing order randomized?	High risk / unclear risk / low risk

included articles were published between 1998 [30] and 2019 [69,72,74] and included a total of 2104 healthy adults (817 females, 1264 males and 23 subjects whose the gender is not reported [74]) with sample sizes ranging from 10 [30,67] to 210 [59] subjects. Concerning the activity level,

9 studies included professional athletes [35,36,38,43,48,65,68,69,72], 25 studies included physically active subjects or recreational athletes [2,22,44,48–51,55,57–59,62,31,63,70,71,74,75,36,37,39–43] and 6 studies included sedentary subjects [21,35,45,49,50,73].

Data from 28 studies were included in the category "surface stable, eyes open" [2,21,45,47–54,56,22,57–60,63,64,67,70,30,31,35,38–40,44]. Data from 13 studies were included in the category "surface stable, eyes closed" [2,22,63,65,70,35,39,45,48,52,48–54,57]. Data from 7 studies were included in the category "surface unstable, eyes open" [21,22,31,43,53,59,68]. Data from one study were included in the category "surface unstable, eyes closed" [61]. Data from one study were included in the category "BESS" [37]. Data from 15 studies were included in the category "SEBT/YBT" [34,36,69,71,72,74,75,37,38,41,42,46,47,55,63] and data from 3 studies were included in the category "jump" [62,65,66].

3.2. Risk of bias of included studies

A detailed analysis of the risk of bias is presented in Fig. 2. The population was clearly specified in all studies, except one [74]. In most studies inclusion and exclusion criteria were reported (83 % of the studies) and patients characteristics clearly defined (72 % of the studies). Concerning the determination of the dominant leg, the method used was reported in 85 % of the studies and was valid in 72 % of the studies. The outcomes used were valid and reliable in 78 % of the studies. The outcomes assessors were never blinded to the leg's dominance. 89 % of the studies did not show risk of confounding variables. 96 % of the studies had less than 15 % of missing values. 10 % of the studies possessed an "other risk of bias". The balance tests were standardized in 60 % of the studies. The leg testing order was standardized in only 43 % of the studies. No evidence of publication bias was found based on the observation of the funnel plots.

3.3. Meta-analysis

Data of all forty-six studies were included in the meta-analysis. The effect sizes for the outcome measures of each category are summarized in Table 3.

3.3.1. Surface stable, eyes open

Twenty-eight studies [2,21,45,47–54,56,22,57–60,63,64,67,70,30,31,35,38–40,44] including 1017 participants reported data for the category "surface stable, eyes open". The pooled overall SMD was −0.04 (95 % CI −0.12 to 0.05) indicating no significant difference between the dominant and the non-dominant legs. There was no evidence of heterogeneity (I2 = 0%, p = 0.61).

3.3.1.1. Centre of pressure (COP) displacements anteroposterior (AP). Ten studies analyzed the COP displacements AP [22,44,49–51,54,60,63,67,70]. The subgroup analysis for this outcome did not show significant differences between the dominant and the non-dominant legs (SMD: 0.07; 95 % CI −0.09 to 0.24). There was no evidence of heterogeneity between these studies (I2 = 0%, p = 0.91).

3.3.1.2. COP velocity mediolateral (ML). One study analyzed the COP velocity ML [35]. No difference between the dominant and the non-dominant legs was detected (SMD: 0.07; 95 % CI −0.29 to 0.43).

3.3.1.3. COP total path lengths. Two studies analyzed the COP total path lengths [30,64]. The subgroup analysis for this outcome did not show differences between the dominant and the non-dominant legs (SMD: −0.00; 95 % CI −0.33 to 0.33). There was no evidence of heterogeneity between these studies (I2 = 0%, p = 0.96).

3.3.1.4. COP displacements ML. One study analyzed the COP displacements ML [47]. No difference between the dominant and the non-dominant legs was detected (SMD: 0.02; 95 % CI −0.49 to 0.53).

3.3.1.5. COP/sway average speed. Two studies analyzed the COP/sway average speed [45,52]. The subgroup analysis for this outcome did not show differences between the dominant and the non-dominant legs (SMD: -0.02; 95 % CI −0.40 to 0.36). There was no evidence of heterogeneity between these studies (I2 = 0%, p = 0.92).

3.3.1.6. COP average radial displacements. One study analyzed the COP average radial displacements [39]. A significant difference between the dominant and the non-dominant legs was detected (SMD: −1.25; 95 % CI-1.91 to -0.58).

3.3.1.7. COG sway amplitude on Y axis. One study analyzed the COG sway amplitude on the Y axis [48]. No difference between the dominant and the non-dominant legs was detected (SMD: 0.17; 95 % CI -0.52 to 0.87).

3.3.1.8. AP force ratio. One study analyzed the AP force ratio [56]. No difference between the dominant and the non-dominant legs was detected (SMD: −0.42; 95 % CI −1.07 to 0.22).

3.3.1.9. Overall/general stability index. Three studies analyzed the overall/general stability index with a biodex system [21,31,59]. The subgroup analysis for this outcome did not show differences between the dominant and the non-dominant legs (SMD: −0.03; 95 % CI −0.19 to 0.14). There was no evidence of heterogeneity between these studies (I2 = 0%, p = 0.64).

3.3.1.10. Seconds (single leg stance). Two studies calculated the seconds during single leg stance [2,57]. The subgroup analysis for this outcome did not show differences between the dominant and the non- dominant legs (SMD: −0.13; 95 % CI −0.56 to 0.30). There was no evidence of heterogeneity between these studies (I2 = 0%, p = 0.84).

3.3.1.11. Seconds (stork stand). One study calculated the seconds

Table 2
Characteristics of included studies.

Author	Year	Participants (N, sex distribution)	Age (mean +/- SD)	Activity level	Balance tests	Outcome measures	Method used to determine the dominant leg
Alnahdi, A. H.	2015	61 (31 females, 30 males)	Females: 20.61 +/- 1.1; males: 21.40 +/- 1.4	Not reported.	YBT.	YBT composite score.	Leg used to kick a ball.
Armstrong, R.	2018	30 females	20.09 +/- 0.97	University dancers.	SEBT in anterior, posteromedial and posterolateral dirrections.	SEBT (YBT) composite score.	Leg used to kick a ball.
Armstrong, R.	2019	23 subjects	Not reported	University dancers.	SEBT in anterior, posteromedial and posterolateral dirrections.	SEBT (YBT) composite score.	Not reported.
Barone, R.	2010	80 males	Soccer players (SOC): 23.7 +/- 3.2; windsurfers (WDS): 22.3 +/- 5.3; basketball players (BSK): 22.9 +/- 2.6; sedentaty (SED): 25.5 +/- 3.2	SOC, WDS and BSK playing in in the Italian league. SED never practising any kind of physically activity.	Single leg stance on a baropodometric platform with eyes open and eyes closed; measuring time: 5 seconds.	COP velocity laterolateral.	Leg used to kick a ball.
Booysen, M. J.	2015	50 males	University: 21 +/- 2.22; professional: 22 +/- 2.22	27 participants from the university senior first team squad and 23 from a professional football club competing in the South African Football Association second division.	YBT.	YBT composite score.	Leg used to kick a ball.
Bressel, E.	2007	34 females	20.4 +/- 1.1	Collegiate athletes who had to be currently competing in only 1 sport for the previous 3 years (11 soccerplayers, 11 basketball players, 12 gymnastics).	Balance Error Scoring System (BESS). SEBT.	BESS: Number of Errors. SEBT: SEBT composite.	Preferred leg to kick a ball.
CastilhoAlonso, A.	2011	40 males	26 +/- 5	Sedentary males.	Single leg balance test using a Biodex Balance System equipment at level 8 (more stable) and at level 2 (less stable); measuring time: 20 seconds.	General stability index.	Leg used to kick a ball.
Cinar- Medeni, O.	2016	37 (4 females, 33 men)	26.77 +/- 7.25	Professional orienteering athletes.	Flamingo balance test. SEBT.	Flamingo balance test: number of falls or balance losses in 60 seconds. SEBT: anterior reached distance.	Leg used to kick a ball.
Cug, M.	2016	73 (35 females, 38 men)	Females sedentary: 28.61 +/- 2.85; females soccer: 20.41 +/- 1.62; males sedentary: 26.74 +/- 3.65; males soccer: 22.74 +/- 2.94	Subelites soccer players from different divisional levels of Turkish soccer leagues, having a minimum of 3 years of soccer history, and self-reported completing ~5 training sessions per week that were generally at least 60 minutes in length. Sedentary people having an inactive life style (ie, <60 min exercise per week) and no regular participation in any sporting activity.	Modified SEBT.	Anterior direction.	Leg used to kick a ball.
Dabadghav, R.	2016	21 (10 females, 11 males)	21.6 +/- 1.9	Participants playing basketball for at least one years, playing at least six hours per week.	Single leg stance on a force platform, eyes open and eyes closed; measuring time: 10 seconds.	COP average radial displacements.	Three functional tests: leg used to kick a ball, leg used to step onto a 20-cm high step and leg used to recover balance after a nudge applied between the scapulae.
Erkmen, N.	2012	12 males	20.92 +/- 2.81			Balance Index (BI).	Leg used to kick a ball.

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Table 2 (*continued*)

Author	Year	Participants (N, sex distribution)	Age (mean +/- SD)	Activity level	Balance tests	Outcome measures	Method used to determine the dominant leg
				Basketball players from the basketball team at Gazi University.	Static balance tests on one leg using a Kinesthetic Ability Trainer (stabilometer). Measuring time: 20 seconds.		
Hoffman, M.	1998	10 (5 females, 5 males)	19.2 +/- 3.2	Not reported.	Single leg stance on a force platform. Measuring time: 15 seconds.	Total sway path length (calculated with the COP).	Three functional tests: leg used to kick a ball, leg used to step onto a 20-cm high step and leg used to recover balance after a nudge applied between the scapulae.
Hudson, C.	2016	90 females	19.6 +/- 1.2	Females collegiate volleyball players from Division I universities.	YBT.	YBT composite score.	Lower extremity used to put majority of weight during hitting approach, which is the same side as the arm used to hit the ball.
Jackson	2015	72 (39 females, 33 males)	40.61 +/- 10.23	Participants of running groups and clubs training in preparation for half or full marathons.	YBT.	YBT composite score.	Not reported.
Jadczak, L.	2018	107 males	PRO group (52): 25.7 +/-3.9; U-21 group (55):20.3 +/- 0.6.	Professional and junior elite soccer players.	Dynamic balance test on one leg on an unstable platform designed to permit only lateral movements (Delos Postural Proprioceptive System measurement tool); measuring time: 30 seconds.	Postural priority index.	Self-report measure and kicking- ball test.
Johnson, S.	2010	22 females	21.77 +/- 1.5	Majority of the participants reported performing regular physical activity.	Single leg stance eyes open and eyes closed; easuring time: maximum duration for the subject to keep balance.	Seconds.	Foot taking the first step when participants were asked to initiate gait.
Kilroy, E. A.	2016	14 females	Non-dancers: 20.29 +/-1.50 ; dancers: 21.14 +/-1.57	Non dancers: less than one year of dance experience or no experience at all.; dancers: seven years or more of dance experience.	Single leg stance on a force platform with and without shoe; measuring time: 30 seconds.	Excursion of the COP in antero- posterior direction.	For non dancers: leg used to kick a ball. For dancers: supporting leg for turns.
Lin, W. H.	2009	28 (14 females, 14 males)	19.8 +/- 1.4	No involvement in any kind of physical training prior to this study.	Single leg stance on an AMTI force platform with eyes open and eyes closed; measuring time: 10 seconds.	Average speed of the COP.	Three functional tests: leg used to kick a ball, leg used to step onto a 20-cm high step and leg used to recover balance after a nudge applied between the scapulae.
Lopez-Plaza, D.	2018	27 males	24.54 +/- 3.05	Recreationally active males.	SEBT.	SEBT composite score (diagonal).	Not reported.
Lopez-Valanciano, A.	2018	132 (44 females, 88 males)	Females: 20.1 +/- 4.2; males: 25.5 +/- 5.0	Professional football players.	YBT.	YBT composite score.	Not reported.
Lynn, S. K.	2012	24 (14 females, 10 males)	23.0 +/- 1.6	Not reported.	Single leg balance test on an AMTI forceplate; measuring time: 30 seconds. Dynamic balance test standing in single-leg stance on an AMTI forceplate and performing YBT.	Mediolateral COP displacements.	Leg used to kick a ball.
Masu, Y.	2014	18 males	High level group: 19.3 +/-0.7; low level group: 20.3 +/- 0.7	High level group: member of teams ranked amog the top 3 at the All Japan Badminton Championships; low level group: males playing badminton for	One leg stand on a stabilometer with eyes open and eyes closed; measuring time: 30 seconds.	CoG sway amplitudes on Y- axis.	Leg on the side used to grip the racket.

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Table 2 (*continued*)

Author	Year	Participants (N, sex distribution)	Age (mean +/- SD)	Activity level	Balance tests	Outcome measures	Method used to determine the dominant leg
				recreation in university clubs.			
Matsuda, S.	2011	34 males	20.1 +/- 1.3	Soccer players (n=17) who had experienced technical soccer training for at least 8 years; untrained male students (n=17).	One leg stance while operating a lifted leg on a stabilometer (participants moved their foot around a ball in front of them at a constant tempo); measuring time: 30 seconds.	Anterior-posterior COP sway.	Leg used for kicking a ball.
Matsuda, S.	2008	40 males	Swimmers: 20.1+/- 1.3; soccer players: 20.8+/- 2.5; basketball players:19.6+/-0.5; non- athletes: 20.9+/- 0.9	Swimmers (n=10), soccer players (n=10), basketball players (n=10), non-athletes (n=10).	One leg stance on a stabilometer. Measuring time: 60 seconds.	Anterior-posterior COP sway.	Leg used for kicking a ball.
Matsuda, S.	2010	50 males	control group: 21.2 +/- 1.3; soccer group : 20.5 +/- 2.0	Soccer players (n=25): members of a university soccer club ; control group (n=25): no technical soccer training.	One leg stance on a stabilometer; measuring time: 60 seconds.	Anterior-posterior COP sway.	Leg used for kicking a ball.
Mazzella, N. L.	2015	25 (17 females, 8 males)	23.6 +/-6	Not reported.	Unilateral stance with eyes open and with eyes closed on a force platform (Neurocom Balance Master); measuring time: 10 seconds.	Mean sway velocity.	Leg used to kick a ball.
McCurdy, K.	2006	42 (25 females, 17 males)	Females: 21.9 +/- 1.3; males: 21.7 +/- 1.8	No previous long-term participation in a sport or activities of daily living with high repetitions of asymmetrical lower body activity.	Stork Stand Test. Single leg stance on a wobble board, measuring time: 15 seconds.	Stork Stand Test: seconds. Single leg stance on a wobble board: seconds off balance (duration the wobble board touchs the contact plate).	Leg used to kick a ball.
Mitchell, A.	2008	19 males	25.1 +/- 3.9	Not reported.	Single leg stance on a force platform with eyes open and eyes closed; measuring time: 35 seconds.	COP displacements in anteroposterior direction.	Self reported dominance.
Muehlbauer, T.	2014	30 (10 females, 20 males)	23.3 +/- 1.5	Every-day and sports-related physical activity: 15.1 +/- 8.3 h/week.	Single leg stance under 3 sensory conditions on a balance platform: eyes open/firm ground, eyes open/foam ground (elastic pad on top of the balance plate), and eyes closed/firm ground; measuring time: 30 seconds.	COP displacements in anterior-posterior direction.	Lateral preference inventory (LPI) including the following questions: which foot would you use to kick a ball or hit a target? If you wanted to pick up a pebble stone with your toes, which foot would you use? Which foot would you use to step on a bug? When stepping up onto a chair, which foot would you use first?
Ness, B. M.	2016	17 females	18.8 +/- 0.9	W omen's soccer team participating in an offseason training program.	SEBT.	Composite score with anterior, posteromedial and posterolateral directions.	Leg used to kick a ball.
Niu, W.	2015	19 (9 females, 10 males)	24.5 +/- 2.5	Not reported.	Unipedally stand on a custom- made balance board; measuring time: 2 seconds.	A/P force ratio.	Preferred leg for kicking a ball for maximum distance.
Onofrei	2019	73 males	23.8 +/-5.4	Male soccer players from four elite soccer teams (second division).	Modified SEBT.	Composite score with anterior, posteromedial and posterolateral directions.	Leg used to kick a ball.
Ozer, D.	2009	20 males	23.2 +/- 2.4	Physically active males.	Single leg balance test eyes open and eyes	Seconds.	Not reported.

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Table 2 (*continued*)

Author	Year	Participants (N, sex distribution)	Age (mean +/- SD)	Activity level	Balance tests	Outcome measures	Method used to determine the dominant leg
					closed; measuring time: maximum duration for the subject to keep balance.		
Promsri, A.	2018	26 (12 females, 14 males)	Females: 24.6 +/- 5.3; males: 25.8 +/- 2.9	Active subjects.	Single leg stance on a rigid floor; measuring time: 80 seconds.	Number of zero-crossing of the principal postural accelerations.	Leg used to kick a ball.
Rein, S.	2010	210 (84 women, 126 men)	32 +/- 11	Average of 4.5 ± 5.8 sports activities per month.	Single leg stance on a Biodex Balance System at the most stable level (level 8) and the more unstable level (level 2); measuring time: 20 seconds.	Overall stability index.	Leg used to kick a stationary ball.
Riemann, B. L.	2017	30 (15 females, 15 males)	23.3 +/- 3.2	Physically active adults.	Single leg balance tests on stable and unstable surfaces, using a Balance System SD (Biodex); measuring time: 15 seconds.	Overall stability index.	Leg used to kick a ball.
Russo, L.	2018	16 males	27.3 +/- 3.3	Rugby players, members of a non - professional rugby team.	One-leg static balance on a sensor matrix platform with eyes open and with eyes closed; measuring time: 10 seconds.	Antero-posterior sway amplitude.	Preferred kicking foot.
Schlenstedt, C.	2017	23 (12 females, 11 males)		Not reported.	Standing balance on one-leg on a force-plate; measuring time: 30 seconds.	COP range in anterioposterior direction.	Leg with the smaller mean velocity at the baseline assessment.
Schneiders, A. G.	2010	172 (110 females, 62 males)	Females: 21.6 +/- 3.3; males: 23.1 +/- 4.5	Not reported.	Single-leg stance on a firm surface and on a foam balance pad (Airex) with eyes closed. Measuring time: maximum duration for the subject to keep balance.	Seconds.	Dichotomous self-report preference survey.
Shiravi Z.	2017	12 (3 females, 9 males)	24.08 +/- 4.37	Physical education students of Tehran University. All subjects were college basketball, volleyball or football players.	Sudden quickly lateral jump (75% of their maximal jump distance) to a force plate and keeping balance 5 seconds after landing on one leg.	Dynamic postural stability index.	Limb used to kick a ball.
Simpson, J. D.	2017	19 females	21.0 +/- 2.0	Physically active females participating in resistance and/or high intensity interval training ≥4 days per week for the previous 6 months.	Balance tests on a force platform: unilateral stance with eyes open, measuring time: 20 seconds; unilateral stance with eyes closed, measuring time: 10 seconds. SEBT.	Balance tests on a force platform: COP displacements in anteroposterior direction. SEBT: anterior reached distance.	Not reported.
Steidl-Müller, L.	2018	83 (39 females, 44 males)	Females: 21.8 +/- 2.9; males: 21.2 +/- 3.2	Elite ski racers who were members of the Austrian Skiing Federation and who participated in W orld Cup, European Cup, or Federation Internationale de Ski races.	One-leg stability test on an MFT Challenge Disc; measuring time: 20 seconds.	Stability Index.	Leg preferred to kick a ball and to step on a platform. In case of differing preferred legs in these 2 situations, the athletes were asked to let themselves fall forward; the front leg that took the whole body weight was then defined as the subjective dominant leg.
Teranishi, T.	2011	60 (30 females, 30 males)	Females: 20.7 +/- 1.24; males: 21.9 +/- 3.11	Not reported.	Balance test on a force plate on one-foot; measuring time: 30 seconds.	COP total path lengths.	Leg used to kick a ball.
Troester, J. C.	2018	24 males	25.4 +/- 3.7	Rugby union players which are a part of the pre- season training	Single leg stance on a force plate with eyes closed; measuring time:	Single leg stance: COP sway velocity in medial-lateral	Leg used to kick a ball.

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Table 2 (*continued*)

Author	Year	Participants (N, sex distribution)	Age (mean +/- SD)	Activity level	Balance tests	Outcome measures	Method used to determine the dominant leg
				roster for a professional rugby franchise.	20 seconds. Single leg landing on a forceplate 1 meter from the starting position.	direction. Single leg landing: time to stabilize.	
W ikstrom, E. A.	2006	40 (20 females, 20 males)	Females: 21.1 +/- 1.4; males: 21.2 +/- 2.4	Not reported.	Jump with both legs and land on one leg, then stabilizing as quickly as possible and keeping balance for 3 seconds.	Dynamic postural stability index.	Limb used to kick a soccer ball.
Yiou, E.	2009	10 (4 females, 6 males)	26 +/- 6	Not reported.	Displacement of a bar forward with both hands at maximal velocity toward a target while standing on one-leg on a force plate.	COP displacements along AP axis.	Three functional tests: leg used to kick a ball, leg used for stepping initiation and leg used to recover balance after a nudge applied at the back.

Table 3
Summary of the results.

Meta-Analyses per Category	Pooled Results of the Subgroups Meta-Analyses						Test Subgroups Differences	
Meta-Analyses per Outcome	**N**	**N Studies**	**Pooled SMD** (95 % **CI)**	**Weight**	**P(Q)**	**I^2**	**P (Q)**	**I^2**
Surface Stable, Eyes Open	1017	28	−0.04 (-0.12, 0.05)	100.0	0.61	0	0.08	37.0
COP displacements AP	290	10 [25,49,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67]	0.07 (-0.09, 0.24)	28.5	0.91	0		
COP velocity ML	80	1 [27]	0.07 (-0.29, 0.43)	7.8	0.26	25		
COP total path lengths	70	2 [29,60]	0.00 (-0.33, 0.33)	6.9	0.96	0		
COP displacements ML	30	1 [61]	0.02 (-0.49, 0.53)	3.0	1.00	0		
COP average speed	53	2 [30,59]	−0.02 (-0.40, 0.36)	5.3	0.92	0		
COP average radial displacement	21	1 [28]	**−1.25 (-1.91, -0.58)**	1.7	1.00	0		
COG sway amplitude on Y axis	16	1 [63]	0.17 (-0.52, 0.87)	1.6	0.99	0		
AP force ratio	19	1 [31]	−0.42 (-1.07, 0.22)	1.8	1.00	0		
Overall/general stability index (Biodex)	279	3 [24,33,43]	−0.03 (-0.19, 0.14)	27.7	0.64	0		
Seconds (single leg stance)	42	2 [4,64]	−0.13 (-0.56, 0.30)	4.2	0.84	0		
Seconds (stork stand)	42	1 [65]	−0.07 (-0.50, 0.35)	4.2	1.00	0		
Balance index (Kinesthetic Ability Trainer)	12	1 [66]	−0.51 (-1.32, 0.31)	1.1	1.00	0		
Number of falls/balance losses	37	1 [62]	−0.04 (-0.50, 0.41)	3.7	1.00	0		
Number of zero-crossings	26	1 [32]	−0.49 (-1.04, 0.06)	2.5	1.00	0		
Surface Stable, Eyes Closed	524	13	−0.06 (-0.22, 0.11)	100.0	0.10	32	0.45	0.0
COP displacements AP	116	4 [53,54,25,67]	0.01 (-0.30, 0.32)	25.7	0.25	27		
COP velocity ML	104	2 [27,68]	−0.17 (-0.57, 0.23)	26.0	0.08	52		
COP average speed	53	2 [59,30]	0.09 (-0.29, 0.47)	12.6	0.57	0		
COP average radial displacement	21	1 [28]	**−0.63 (-1.25, -0.01)**	5.1	1.00	0		
COG sway amplitude on Y axis	16	1 [63]	0.00 (-0.70, 0.69)	4.8	0.50	0		
Seconds (single leg stance)	214	3 [64,4,50]	0.00 (-0.35, 0.35)	25.8	0.16	45		
Surface Unstable, Eyes Open	541	7	−0.15 (-0.38, 0.07)	100.0	0.01	65	0.08	51.4
COP displacements AP	30	1 [25]	−0.13 (-0.64, 0.37)	9.8	1.00	0		
Overall/general stability index (Biodex)	279	3 [24,33,43]	−0.03 (-0.39, 0.33)	38.7	0.06	65		
Stability index (MFT® Challenge Disc)	83	1 [70]	**−0.50 (-0.81, -0.19)**	14.6	1.00	0		
Seconds off balance	42	1 [65]	0.19 (-0.24, 0.62)	11.5	1.00	0		
Postural priority index	107	1 [69]	**−0.31 (-0.58, -0.04)**	25.4	0.85	0		
Surface Unstable, Eyes Closed	172	1	−0.06 (-0.27, 0.15)	100.0	<0.01	100	1.00	0.0
Seconds (single leg stance)	172	1 [50]	−0.06 (-0.27, 0.15)	100.0	<0.01	100		
BESS	34	1	0.03 (-1.09, 1.14)	100.0	0.01	80	1.00	0.0
Number of Errors	34	1 [51]	0.03 (-1.09, 1.14)	100.0	0.01	80		
SEBT/Y-Balance Test	773	15	0.06 (-0.04, 0.16)	100.0	1.00	0	0.80	0.0
SEBT composite	34	1 [51]	0.18 (-0.30, 0.66)	4.4	0.81	0		
YBT composite	553	9 [76,75,48,77,78,71,47,72,46]	0.04 (-0.08, 0.16)	71.6	0.99	0		
SEBT composite (diagonal)	27	1 [73]	−0.04 (-0.58, 0.49)	3.5	1.00	0		
SEBT/YBT anterior reached distance	129	3 [62,26,53]	0.10 (-0.14, 0.35)	16.6	0.63	0		
ML COP movement	30	1 [61]	0.33 (-0.18, 0.83)	3.8	1.00	0		
Jump	76	3	0.04 (-0.28, 0.36)	100.0	0.78	0	0.51	0.0
Time to stabilize	24	1 [68]	0.20 (-0.37, 0.77)	31.5	1.00	0		
DPSI	52	2 [79,34]	−0.03 (-0.41, 0.35)	68.5	0.78	0		

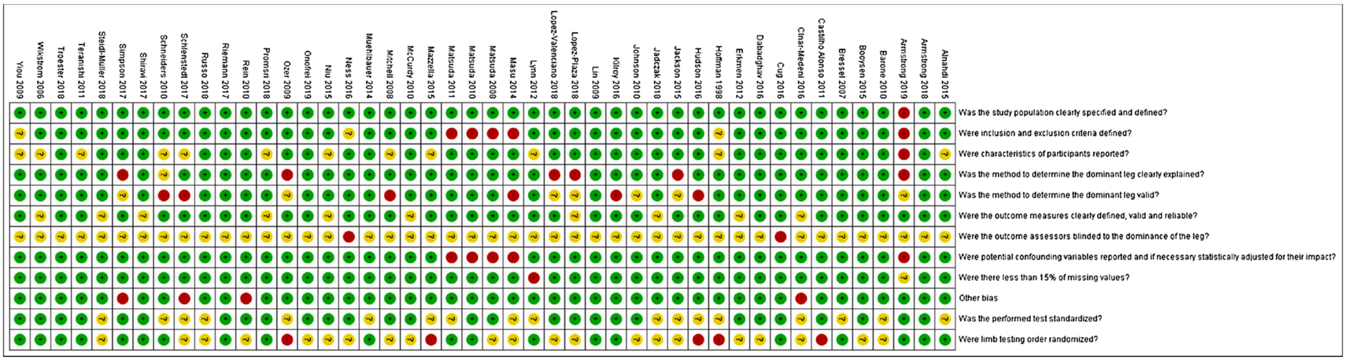

Fig. 2. Risk of bias summary.

during stork stand [53]. No difference between the dominant and the non-dominant legs was detected (SMD: −0.07; 95 % CI −0.50 to 0.35).

3.3.1.12. Balance index (kinesthesic ability trainer). One study measured a balance index with a Kinesthesic Ability Trainer [40]. No difference between the dominant and the non-dominant legs was detected (SMD: −0.51;95 % CI −1.32 to 0.31).

3.3.1.13. Number of falls/balance losses. One study analyzed number of falls/balance losses [38]. No difference between the dominant and the non-dominant legs was detected (SMD: -0.04; 95 % CI −0.50 to 0.41).

3.3.1.14. Number of zero crossings. One study calculated the number of zero crossings [58]. No difference between the dominant and the non-dominant legs was detected (SMD: -0.49; 95 % CI −1.04 to 0.06).

3.3.2. Surface stable, eyes closed

Thirteen studies [2,22,63,65,70,35,39,45,48,52–54,57] including 524 participants, reported data for the category “surface stable, eyes closed”. The pooled overall SMD was -0.06 (95 % CI −0.22 to 0.11) indicating no significant difference between the dominant and the non-dominant legs. There was evidence for moderate heterogeneity (I2 = 32 %, p = 0.10).

3.3.2.1. COP displacements AP. Four studies analyzed COP displacements AP [22,54,63,70]. The subgroup analysis for this outcome did not show differences between the dominant and the non- dominant legs (SMD: 0.01; 95 % CI -0.30 to 0.32). There was evidence of moderate heterogeneity between these studies (I2 = 27 %, p = 0.25).

3.3.2.2. COP velocity ML. Two studies analyzed COP velocity ML [35, 65]. The subgroup analysis for this outcome did not show differences between the dominant and the non-dominant legs (SMD: −0.17; 95 % CI −0.57 to 0.23). There was evidence of moderate heterogeneity between these studies (I2 = 52 %, p = 0.08).

3.3.2.3. COP/sway average speed. Two studies analyzed COP/sway average speed [45,52]. The subgroup analysis for this outcome did not show differences between the dominant and the non-dominant legs (SMD: 0.09; 95 % CI −0.29 to 0.47). There was no evidence of heterogeneity between these studies (I2 = 0%, p = 0.57).

3.3.2.4. COP average radial displacements. One study analyzed COP average radial displacements [39]. Significant difference between the dominant and the non-dominant legs was detected (SMD: −0.63; 95 % CI-1.25 to −0.01).

3.3.2.5. Centre of gravity (COG) sway amplitude on Y axis. One study analyzed COG sway amplitude on the Y axis [48]. No difference between the dominant and the non-dominant legs was detected (SMD: −0.00; 95 % CI −0.70 to 0.69).

3.3.2.6. Seconds (single leg stance). Three studies calculated the seconds during single leg stance [2,57,61]. The subgroup analysis for this outcome did not show differences between the dominant and the non-dominant legs (SMD: −0.00; 95 % CI −0.35 to 0.35). There was evidence of moderate heterogeneity between these studies (I2 = 45 %, p =0.16).

3.3.3. Surface unstable, eyes open

Seven studies [21,22,31,43,53,59,68] including 541 participants, reported data for the category “surface unstable, eyes open”. The pooled overall SMD was −0.15 (95 % CI −0.38 to 0.07) indicating no significant difference between the dominant and the non-dominant legs. There was evidence for moderate heterogeneity (I2 = 65 %, p = 0.005).

3.3.3.1. COP displacements AP. One study analyzed COP displacements AP [22]. No difference between the dominant and the non-dominant legs was detected (SMD: −0.13; 95 % CI −0.64 to 0.37).

3.3.3.2. Overall/general stability index. Three studies analyzed the overall/general stability index with a biodex system [21,31,59]. The subgroup analysis for this outcome did not show differences between the dominant and the non-dominant legs (SMD: −0.03; 95 % CI −0.39 to 0.33). There was evidence for moderate heterogeneity (I2 = 65 %, p = 0.06).

3.3.3.3. Stability index. One study calculated a stability index with an MTF Challenge disc [68]. A significant difference between the dominant and the non-dominant legs was detected (SMD: −0.50;95 % CI −0.81 to −0.19).

3.3.3.4. Seconds off balance. One study calculated the seconds off balance (duration the wobble board touched the contact plate) [53]. No difference between the dominant and the non-dominant legs was detected (SMD: 0.19; 95 % CI −0.24 to 0.62).

3.3.3.5. Priority index. One study analyzed the Priority index (quotient of the mean deviation of the Delos Equilibrium Board platform (in degrees) from the vertical axis and deviation of the participant from the resultant mean axis (also in degrees, measured using an accelerometer)) using a Delos Postural Proprioceptive System measurement tool [43]. Significant difference between the dominant and the non-dominant legs was detected (SMD: −0.31; 95 % CI −0.58 to −0.04).

3.3.4. Surface unstable, eyes closed

One study, including 172 participants, reported data for the category "surface unstable, eyes closed" [61]. This study did not show significant differences between the dominant and the non-dominant legs (SMD: −0.06; 95 % CI −0.27 to 0.15).

3.3.5. BESS

One study, including 34 participants, reported data for the category "BESS" [37]. This study did not show significant differences between the dominant and the non-dominant legs (SMD: 0.03; 95 % CI −1.09 to 1.14).

3.3.6. SEBT/YBT

Fifteen studies, including 773 participants, reported data for the category "SEBT/YBT" [34,36,69,71,72,74,75,37,38,41,42,46,47,55,63]. The pooled overall SMD was 0.06 (95 % CI −0.04 to 0.16) indicating no significant difference between the dominant and the non-dominant legs. There was no evidence of heterogeneity (I2 =0%, p = 1.00).

3.3.6.1. SEBT composite. One study calculated a SEBT composite [37]. No difference between the dominant and the non-dominant legs was detected (SMD: 0.18; 95 % CI −0.30 to 0.66).

3.3.6.2. YBT composite. Nine studies calculated a YBT composite [34,36,41,42,55,69,71,72,74]. The subgroup analysis for this outcome did not show differences between the dominant and the non-dominant legs (SMD: 0.04; 95 % CI −0.08 to 0.16). There was no evidence of heterogeneity (I2 = 0%, p = 0.99).

3.3.6.3. SEBT composite (diagonal). One study calculated a SEBT composite with the diagonal directions [46]. No difference between the dominant and the non-dominant legs was detected (SMD: −0.04; 95 % CI-0.58 to 0.49).

3.3.6.4. SEBT/YBT anterior reached distance. Three studies calculated the SEBT/YBT anterior reached distances [38,63,75]. The subgroup analysis for this outcome did not show differences between the dominant and the non-dominant legs (SMD: 0.10; 95 % CI −0.14 to 0.35). There was no evidence of heterogeneity (I2 = 0%, p = 0.63).

3.3.6.5. ML COP movements. One study analyzed ML COP movements [47]. No difference between the dominant and the non-dominant legs was detected (SMD: 0.33; 95 % CI −0.18 to 0.83).

3.3.6.6. Jump. Three studies, including 76 participants, reported data for the category "jump" [62,65,66]. The pooled overall SMD was 0.04 (95 % CI −0.28 to 0.36) indicating no significant difference between the dominant and the non-dominant legs. There was no evidence of heterogeneity (I2 = 0%, p = 0.78).

3.3.6.7. Time to stabilize (TTS). One study calculated the TTS [65]. No difference between the dominant and the non- dominant legs was detected (SMD: -0.20; 95 % CI −0.37 to 0.77).

3.3.6.8. Dynamic postural stability index (DPSI). Two studies calculated a DPSI [62,66]. The subgroup analysis for this outcome did not show differences between the dominant and the non-dominant legs (SMD: −0.03; 95 % CI −0.41 to 0.35). There was no evidence of heterogeneity (I2 = 0%, p = 0.78).

4. Discussion

The aim of this study was to determine if balance performance is influenced by the leg's dominance. This meta-analysis included 46 studies with a total of 2104 participants. To accommodate for the different methods used to assess balance performance, seven test categories were created. Results are consistent for all seven categories. Among the 46

studies included in the meta-analysis, only three [39,43,68] reported significant differences between the dominant and the non-dominant legs. We could not find any explanation why the results of these two studies differed from the other 43 studies.

We found strong evidence that the leg's dominance does not influence balance performance in unilateral stance. However, concerning stabilization while unilateral landing after a jump, the evidence is weak because only three studies assessing this issue could be included in our meta-analysis [62,65,66].

Results of our meta-analysis are rather surprising. Authors reported more intense functional activities and more muscle strength for the dominant side [21,76,77]. We expected therefore also differences between both legs in balance performance. However, balance is a complex skill influenced by different parameters, such as motor coordination, biomechanical components (for example strength and endurance) and somatosensory information that are continually interacting [6,78,79]. Their interactions are dependent on the context and on the movement tasks to effectuate [79]. In addition, it is likely that these interactions allow the different systems to compensate for each other [6]. Motor coordination components include balance strategies which are established by the central nervous system [5,80]. These strategies are individual and might be adapted if the person must compensate for a weakness [10]. For example, a new strategy could be established by the central nervous system to maintain balance and compensate for a difference in leg strength. In addition, sensory components (visual, vestibular and somatosensory systems) play an essential role [6]. The fact that information from the visual and vestibular systems is interpreted by the central nervous system [78] and the fact that cutaneous sensibility is symmetric between the right and left sides of the body [81] could further explain the similarity in performance between the dominant and the non-dominant legs.

It should be noted that only healthy persons were tested and that the tests used in the included studies are rather easy. Nevertheless, it is unlikely that differences would appear when testing older persons with visual or sensory deficits or when using more challenging tests as no differences were identified on unstable surfaces with eyes closed.

Clinically, the results of our meta-analysis suggest that both legs can be used as a reference while assessing unilateral balance performance. Furthermore, post injury or surgery of one leg, the other leg could be used as reference without taking into account that leg's dominance. Nevertheless, a direct comparison between the injured and non- injured leg when monitoring progress should be done with caution since the non-injured

leg can also be affected due to altered weighting after the trauma [82] or due to a reorganization of the central nervous system after an injury [83].

To our knowledge, this study is the first meta-analysis assessing the influence of leg's dominance on balance performance. So far, the effects of leg dominance were investigated in a systematic review assessing lower leg performances [84] and in several studies with controversial results assessing strength [76,77]. The systematic review reported results which are similar to ours. The authors measured isokinetic strength of quadriceps and of hamstrings, hamstrings: quadriceps strength ratios, single-leg vertical jump height, single-leg hop for distance and peak vertical ground reaction force by single- leg vertical jump and did not found significant differences between the performances of the dominant and of the non-dominant legs for all these tests [84]. They concluded that leg dominance was more pertinent to specific skills or movements than to strength or power capacity [84].

Major strengths of our review are the large number of included studies with a large sample size and consistent results. The wide variety of balance tests leading to a very complete overview is another strength. However, we are aware that our study possesses also some limitations. The main limitation is the inclusion of studies which did either not indicate how they determined the dominant leg or which used a non-validated method to determine leg dominance. However, we noted that the results were consistent regardless of the method used. In addition, we conducted a meta-analysis using only the studies which presented a valid method to determine leg dominance and whose statistics showed that the results remained the same. It might be criticized that we included studies with unclear and high risk of bias. However, we observed that the studies with more risk of bias showed the same results as studies with low risk of bias. Another limitation is the presence of a moderate heterogeneity for the categories "surface stable, eyes closed" and "surface unstable, eyes open". This can be explained by the variability of outcomes within these categories. It might be also that the use of group means values influenced our results. It is possible that results differ when assessing a single-subject. The fact that the dominant leg is better in some subjects and the non-dominant leg is better in others could participate to the absence of significance in the differences between the legs [22]. This review possesses also a language bias since only studies in English, French and German were included. It is possible that other relevant articles exist in other languages. Finally we have to mention that we included a study assessing very young subjects aged between 15 and 40 years and with 80 % of participants between 18 and 24 years old [61].

Our meta-analysis included a large number of trials assessing the influence of leg dominance while testing balance in unilateral stance and the results were consistent, regardless of the balance tests used. It is thus not necessary to perform additional studies of this subject. However, we could only include 3 studies concerning the stabilization while unilateral landing a jump. Additional trials of this condition would be useful. Furthermore, the results of our meta-analysis are limited to the assessment of balance without external disturbance. However, an individual's balance system should also be able to execute adequate reactions with an external perturbation [78]. Therefore, future studies should investigate whether there is a difference in dominant vs. non- dominant legs during reactive balance. In addition, studies concerning the validity of the different methods to determine the dominance of the leg are needed. At the moment a variety of method are used [2,22,34,39,61] and no consensus concerning the best method exist.

5. Conclusion

The present meta-analysis investigated the role of the leg dominance during balance performance in healthy subjects. Results did not show significant differences between the dominant and the non-dominant legs in unilateral balance tests. These findings suggest that physical therapists can use the results of both legs as reference while assessing unilateral balance performance. This further means that theoretically the injured leg can be compared with the non-injured leg after an injury or a surgery, to assess the development of the rehabilitation process and to make decisions concerning return to sport. In addition, physical therapists need only the measurement of one leg to compare test results with normative data.

Evidence of our results is strong for balance performance in one leg stance. However, future studies are needed to confirm our results for stabilization on one leg after a jump landing.

Declaration of Competing Interest

The authors declare that there is no conflict of interest.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.gaitpost.2020.11.008.

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