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Wall Drop Punt Kick and Catch (Tripela) Test: More Than Just a Measure of Gross Manipulative Coordination

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ABSTRACT

Previous work has shown that the Wall Drop Punt Kick and Catch (Tripela) test has a strong correlation with the manipulative component (the two tests) of the Motor Competence Assessment (MCA) battery, especially for boys. In the present study, our aim was to broadly examine the association between the Tripela test and the six MCA battery tests. We recruited 68 children and early adolescents (36 boys; 32 girls; M age = 11.48, SD = 0.73 years) for assessment. Within the entire sample and in boys, the Tripela test significantly correlated with all the six MCA tests (r from 0.285 to 0.785 with the entire sample, and from 0.424 to 0.760 with boys). In girls, the Tripela test only correlated with two out of the six MCA tests (0.388 and 0.517). Results suggest that, for boys, the Tripela test may be an appropriate field-based test to assess motor competence. Compared to several MC assessment batteries, Tripela is much less time-consuming and does not require expensive resources. For girls, results are to be taken with care, as only two significant correlations occurred.

KEYWORDS

Motor competence; assessment; motor development; field-based test; validity

Introduction

Motor competence (MC) is a dynamic and multifaceted construct that, despite the absence of a universally accepted definition, remains deeply intertwined with the concept of motor coordination. The debate among researchers – and consequently among assessment tools – centers on whether MC should be restricted solely to gross motor coordination or if it should also integrate fine motor coordination skills. This divergence of perspectives has led to various interpretations; however, a predominant view in the field has been to emphasize the gross motor component. For example, Gallahue et al. (2012) define MC as the ability to proficiently perform a diverse range of locomotor, stability, and manipulative gross motor skills. Similarly, Barnett, Lai et al. (2016) reinforce this notion, stating that motor-competent individuals are primarily characterized by gross motor skill proficiency, which links fundamental movement skills (FMS) with broader motor coordination.

Having a well-developed MC increases the likelihood of children engaging in physical activity, which can bring all the benefits pointed out in the literature (Biddle et al., 2004; Thivel et al., 2018). The literature

shows (e.g., Holfelder & Schott, 2014; Lubans et al., 2010; Stodden et al., 2008) that children with well-developed FMS are more competent in terms of motor skills and are more likely to adopt healthy physical activity habits. According to several authors (e.g., Rodrigues et al., 2021; Utesch & Bardid, 2019), MC could also facilitate the learning of new skills, as well as be proficient in new motor tasks throughout life. In addition, MC has been associated with various aspects of development, including health in its multiple aspects (Barnett et al., 2008; Barnett, Stodden, et al., 2016; Haga, 2008; Robinson et al., 2015; Rodrigues et al., 2016). The development of MCs during childhood has been recognized as a key factor in engaging in regular physical activity throughout life (Ennis, 2011; Lubans et al., 2010; Stodden et al., 2008; Strong et al., 2005). As an example, Wrotniak et al. (2006) drew attention to the fact that motor proficiency is positively associated with physical activity and inversely associated with sedentary behaviors in children and should therefore be an appropriate target for increasing physical activity in youth.

As stressed by Blank et al. (2012), it is crucial to identify and address, in a timely way, motor coordination problems. Otherwise, motor problems across life,

associated with health problems, may emerge later on. Therefore, several batteries have been proposed to assess MC.

Among the most widely recognized and utilized assessment batteries for MCs, the Motor Competence Assessment (MCA) has emerged as a leading tool. Validated for individuals aged 3 to 23 years (Luz et al., 2016; Rodrigues et al., 2019), this battery comprises locomotors (Standing Long Jump and Shuttle-Run tests), stability (Shifting Platforms and Jumping Sideways tests), and manipulative (Ball Kicking Velocity and Ball Throwing Velocity tests) skills sub-scales, each featuring the two indicated independent tests. MCA has been heralded as a major advancement in the field due to its inclusivity across age groups, its ability to mitigate floor and ceiling effects, and its comprehensive assessment of essential movement components. In fact, this level of inclusivity was not achieved with other widely used assessment tools such as the Körperkoordinationstest für Kinder (KTK), Test of Gross Motor Development-3 (TGMD-3), or Movement Assessment Battery-3 (MABC-3). Nevertheless, and despite its strengths, the MCA presents certain limitations: examinees are required to complete six demanding and time-intensive tests, and some assessments involve costly equipment (e.g., velocity radar), rendering them less accessible for widespread implementation, particularly in educational settings. This underscores the need for a practical and adaptable alternative that maintains scientific rigor while enhancing accessibility. Thus, despite the existence of various standardized MC assessments, there remains a critical need for efficient, accessible, and ecologically valid tools that accurately capture MCs across diverse populations (Logan et al., 2018).

Recognizing this gap, Matos et al. (2022) developed the Wall Drop Punt, Kick, and Catch (Tripela) test, a motor task that uniquely integrates upper limb (releasing and catching) and lower limb (kicking) coordination. This distinctive feature offers a novel perspective in MC and coordination research, as it simultaneously assesses eye-hand and eye-foot coordination—two fundamental aspects of motor skill development. Matos et al. (2022) reported higher performance among boys compared to girls in the Tripela test. This gender-based trend is well-documented across literature and extends beyond object control skills. For instance, Rodrigues et al. (2019) found that boys consistently outperformed girls in all MC assessments, a finding corroborated by Barnett, Lai, et al. (2016) in a systematic review, which concluded that boys outperformed girls in motor coordination across various

age groups (3–12 years), not just in object control competence. More recently, Matos et al. (2025) identified a significant positive correlation between the Tripela test and the MCA manipulative tests, with stronger correlations observed in boys. The authors underscored that although the Tripela test primarily focuses on manipulative skills, it might serve as a viable alternative to traditional MC batteries. Their argument is grounded in the observation that both stability and locomotor skills appear to influence test performance. Notable examples include rapid lateral movements to intercept an obliquely rebounding ball, balancing on one foot to execute a controlled kick, and dynamically adjusting body position – through jumping or running backward – to successfully receive an erratically bouncing ball. These elements suggest that the Tripela test may demand more than just manipulative skill proficiency—engaging multiple components of MC in an integrated manner.

Therefore, this study aims to investigate the extent to which the Tripela test correlates with all six subtests of the MCA. If meaningful correlations emerge, this would suggest that the Tripela test extends beyond its initial characterization as a gross manipulative coordination assessment. Instead, it can be posited as a comprehensive and holistic measure of MC, integrating multiple dimensions like MCA does, such as object control, locomotor, and stability skills (Cools et al., 2009a). The assumption that this may happen relies on the fact that Tripela Test demands participants to manipulate a ball with foot and hands (MCA manipulative or object control component has the Ball Kicking and the Ball Throwing Velocity tests), to jump and run backward or forward to intercept a ball that rebounds with unexpected force (MCA locomotor component has Shuttle-Run and Standing Long Jump tests) and to quickly move sideways to catch a ball that rebounds from wall in an oblique direction to the participant after kicking (MCA stability component has the Shifting Platforms and the Jumping Sideways tests). Such findings could hold transformative implications for the field of MC assessment. By establishing the Tripela test as a scientifically validated field-based test, researchers and practitioners could benefit from a more time-efficient, cost-effective, and widely implementable alternative to traditional MC evaluation methods. This would not only streamline assessment procedures but also enhance inclusivity, particularly in resource-limited settings where comprehensive MC batteries may not be feasible (Luz et al., 2017).

In summary, this study examines the concurrent validity of the Tripela test with MCA battery in assessing MC.

Method

Study design

The present paper presents a cross-sectional concurrent validity study. Data were collected on 28 February 2025, during Physical Education morning classes.

Participants

We conducted a priori power analysis to determine the required sample size for our planned analyses, specifically a bivariate Pearson correlation. Using G*Power 3.1.9.7 software (Faul et al., 2009). Following Matos et al. (2025), where the Tripela Test correlations were all strong, within the global sample and boys' subsample, namely with kicking MCA ($r = .802$, $p < .01$) and with Throwing MCA ($r = .762$, $p < .01$), and with girls' subsample, where the correlation with kicking MCA was strong ($r = .612$, $p < .01$) and moderate with Throwing MCA ($r = .330$, $p < .01$), parameters were set as follows: expected correlation (ρ) under H1 = 0.5, significance level (α) = .05, and statistical power ($1 - \beta$) = .95. The analysis indicated that a minimum sample size of 38 participants was necessary to achieve adequate power for the bivariate correlations. Considering the purpose of the study, we followed a non-probability sampling method and recruited 68 early adolescents (36 boys, 32 girls; M age = 11.48, $SD = .73$ years). No participants presented any motor or perceptual limitations. Participant characteristics are reported in Table 1.

Ethical considerations and testing procedures

The study was conducted in accordance with the principles of the Declaration of Helsinki for research involving human participants (World Medical Association, 2013). Before data collection, we obtained ethical approval for the research protocol (n. ° EA06.2022.CIEQV) and then contacted local middle schools for consent to recruit participants. The first author explained the study's objectives, and after obtaining authorization from the school

administration, we contacted physical education teachers regarding the study objectives. Subsequently, considering the participants' ages, we contacted the children's parents and informed them fully of the study's objectives and procedures. We emphasized anonymity, data confidentiality, and voluntary participation. Parents or legal tutors who authorized their early adolescents to participate in this study signed informed consent documents with mediation as needed from physical education teachers. With the organizational support of the teachers, we set up the participants' execution of the tests before the physical education class. All participants first engaged in a light warm-up involving both upper and lower body movements. Participants were organized into small groups, following recruitment, while they attended physical education classes, and trained examiners administered the tests. Participants were provided with a verbal explanation and demonstration of each test, and examiners instructed all participants perform each task with their maximum effort.

When each small group came to be tested, they were divided by the different tasks/tests. In each test place, a researcher would receive and assess them. Each subject would be given a data record sheet that they had to take for each of the different tests to be filled by different assessors. They would pass from one test to another clockwise until they complete the entire assessment. Although the Protocol for assessing MCA does not refer to the order in which the six tests should be applied, we used the arrangement described below in a clockwise direction, mainly to avoid fatigue and separate the Tripela Test from MCA Ball kicking: Standing Long Jump, Shifting Platforms, Ball Kicking Velocity, Ball Throwing Velocity, Jumping Sideways, Tripela Test, and Shuttle-Run. Nevertheless, given time and material constraints, the different participants began being assessed on different tests, thus they would not all perform the same exact sequence. When all the subjects of a small group were tested, they would return to the Physical Education class, and another small group would come to be tested.

Measures

Height and weight

We used a portable stadiometer scale, model SECA (Hamburg, Germany), to measure both body weight and height. Participants were instructed to stand bare-foot on the platform of the stadiometer, in an upright position, maintaining a conventional positioning of their arms alongside their body. Weight measurements

Table 1. Sample characteristics.

Participants	Age (years)	Height (cm)	Weight (kg)
Total Sample ($n = 68$)	11.48 (0.73)	149.28 (9.65)	45.19 (10.60)
Boys ($n = 36$)	11.44 (0.74)	148.69 (10.36)	44.97 (10.99)
Girls ($n = 32$)	11.53 (0.74)	149.96 (8.86)	45.44 (10.31)

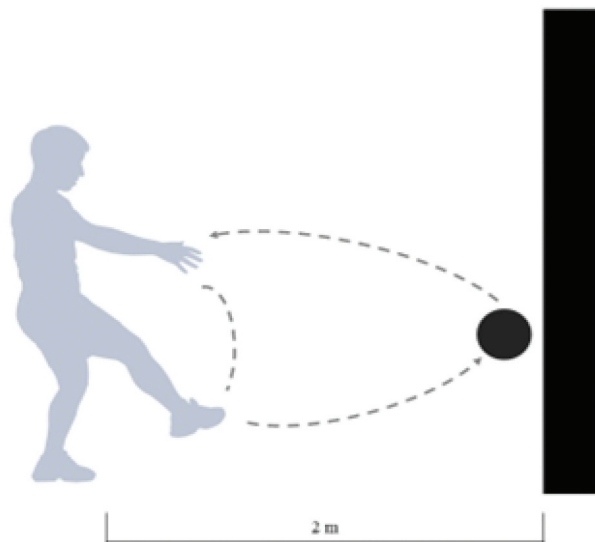


Figure 1. Tripela test design.

were obtained from participants while wearing sports clothing and without shoes, using a digital scale (Tanita BC-50, Arlington Heights, IL, USA).

Wall drop Punt Kick and Catch (Tripela) test

Participants were required to perform (Figure 1) a drop punt kick movement pattern and impact a wall with the ball as many times as possible, with subsequent catches, in 30 sec, following Matos et al.'s (2022) protocol with a difference explained in Matos et al. (2025). Specifically, participants were directed to drop the ball and kick it to a wall without any ground rebound. Successful attempts were wall ball impacts, with subsequent successful ball catching of the ball (novelty). Thus, only a complete cycle (i.e., drop, kick, wall impact, and catch) was to be accepted as successful and counted for data analysis, being this the novelty in comparison with Matos et al. (2022) protocol. They were not to step on or over a line marked on the ground 2 m from the front of the wall during the kicking action. Participants could enter the 2-m zone if the ball was retained there. Each performer was entitled to five warm-up repetitions before attempting two consecutive trials with a 30-sec recovery period between trials so that the best performance could be registered. The test was performed with a size 4 ball (Ballground 500; 62 cm perimeter, 350 g weight, and a soft touch). The wall had a clean valid zone 5 m wide, marked with vertical band stripes, and over 4 m high (the minimum required). In the Matos et al. (2023) study, the intra-class correlation coefficient (ICC and the Cronbach's Alpha showed acceptable scores of reliability and internal consistency, $\alpha = 0.945$ and $ICC = 0.896$,

respectively. Lin's CCC was 0.896, indicating an excellent reproducibility result. Also, in the Matos et al. (2022) study, the authors found an excellent ICC of (0.937) and α (0.972).

Motor Competence Assessment(MCA)

This battery is composed of six tests, grouped two by two into three different components: manipulative, locomotor, and stability. The procedures followed Rodrigues et al. (2019) protocol, described below. Following Matos et al. (2025), only raw values of MCA tests will be used, as percentile values for the Tripela Test results are not yet available.

Manipulative component

Ball Kicking Velocity

Participants kicked a size 4 ball (Ballground 500; 62 cm perimeter, 350 g of weight, and a soft touch), at maximum speed. Maximum speed was captured with a Bushnell Velocity Speedgun (Speed Radar Gun Model 1101911). Participants took three trials, and their best effort was considered for subsequent analysis. An ICC value of 0.983 was found for the Kicking Velocity Test in the study of Rodrigues et al. (2019).

Ball Throwing Velocity

Participants were instructed to throw a tennis ball, at maximum speed, against a cushioned surface. Maximum throwing velocities were captured with a Bushnell Velocity Speedgun (Speed Radar Gun Model 1101911). Three attempts were registered, and the best effort was considered for analysis. An ICC value of 0.979 was found for the Throwing Velocity Test in the study of Rodrigues et al. (2019).

Note: In several MCA published studies, the authors state that using the Stalker radar Gun (Pro II Stalker radar gun) is considered to be the Golden Standard on measuring these throwing velocities. However, its cost impels the use of more economic alternatives although equally valid. In fact, the Bushnell Velocity Speedgun has been revealed to be a good alternative, such that the Portuguese Football Federation, in its Superquinas project, which resulted in the publication of an article by Rodrigues et al. (2025), used this radar in measurements carried out in all districts of Portugal. Additionally, the article by Makar et al. (2024) concluded that there is an excellent correlation between the Stalker device (reference criterion) and the Bushnell radar, with an ICC of 0.989 for throwing the ball and 0.986 for kicking the ball, suggesting that the Bushnell radar is a reliable

tool for measuring ball speed with minimal deviation from the reference standard.

Locomotor component

Shuttle-Run

At the starting voice ("Ready, Go!"), the participant runs at maximal speed from an initial line marked on the floor to a similar second line (100 cm × 5 cm) placed 10 m apart where two blocks (10 cm high, 5 cm wide) are placed immediately after the line and 25 cm apart from each other. The participant picks up one of the blocks, returns (running) to the starting line, and places it on the ground (no throwing) after the line (no matter what position). Then, runs back again to retrieve the second block. The test finishes when the participant passes through the start/finish line carrying the second block. Two attempts are allowed with a 2 min interval between them. The best time (measured with a mobile phone application) of the two attempts is considered for analysis. This test is part of the AAHPER Youth Fitness Test. An ICC value of 0.968 was found for this test in the study of Rodrigues et al. (2019).

Standing Long Jump

Placed behind a line marked on the floor, the participant must jump as far as possible, using both feet simultaneously on take-off and landing. The jump is made with a measuring tape placed on one side of the free jumping space, perpendicular to the starting line. The distance (in cm) is measured between the starting line and the place of landing of the back of the heel of the closest feet to the starting line. The best of the three attempts is considered for analysis. This test, likewise Shuttle-Run, belongs originally to AAHPER Youth Fitness Test. An ICC value of 0.987 was found for this test in the study of Rodrigues et al. (2019).

Stability component

Shifting Platforms

The test starts with the participant standing with both feet on one of the two wooden platforms (25 cm × 25 cm × 2 cm with four 3.7 cm feet at the corners) and having the second wooden platform at their side on the floor (right or left as convenient). In the starting voice, the participant reaches for the platform on the ground next to them, moves it to the opposite side, and steps into it as quickly as possible. This process is repeated for 20 s, and each successful transfer from one platform to the other is scored with two points (one point for moving the

platform from side; one point for moving the body to the platform). Participants have two trials with a 2 min interval between trials. The best score is considered for analysis. This test belongs originally to KTK, and, in Rodrigues et al. (2019), the ICC value was 0.950.

Jumping Sideways

The test starts with the participant standing on one side of a rectangular surface (100 cm length × 60 cm width) divided by a small wooden beam (60 cm length × 4 cm high × 2 cm width) in the middle. At the starting voice, the participant jumps sideways with two feet simultaneously as many times as possible for 15 s. Each correct jump (two feet together, without touching outside the rectangle, and without stepping in the wooden beam) scores 1 point. The best results over two trials are considered for analysis. This test, likewise Shifting Platforms, belongs originally to KTK and, in Rodrigues et al. (2019), the ICC value was 0.987.

Statistical analysis

We conducted all statistical analyses on IBM SPSS STATISTICS (v.29 for Windows, SPSS Inc., Chicago, IL). First, we checked the database for outliers and missing values. We found no extreme values or missing data. Second, we checked for normality of the data distribution using the Kolmogorov-Smirnov test ($n > 50$) as suggested by Ho (2014). As the distribution was normal, we described it with means and standard deviations.

To compare the participants' performance by sex we used independent sample *t* tests. We set the statistical significance for rejecting the null hypothesis at 5%. To examine the associations between variables for the total sample and when divided into boys and girls, we calculated Pearson correlation coefficients again using $p < 0.05$ to reject the null hypothesis (Ho, 2014). In the case of statistical significance, we calculated the effect size and considered the following cutoff values: $d = 0.20$ or $r = .10$ interpreted as small effects, $d = 0.50$ or $r = 0.30$ as medium effects, and $d = 0.80$ or $r = 0.50$ as large effects (Cohen, 1988, 1992).

Results

Descriptive statistics and mean comparisons of participants' performances on the Tripela test and the six MCA tests are displayed in Table 2. Boys obtained significantly better scores than girls in four out of the seven tests, with $p < .001$ in three (Tripela, Ball Kicking Velocity, and Ball Throwing Velocity) and $p < 0.01$ in

Table 2. Participants' means (and standard deviations) and *t*-test comparisons across sex on WDPK&C (Tripela) test and on MCA tests.

	WDPK&C (Tripela) (repetitions)	Ball Kicking Velocity (km/h)	Ball Throwing Velocity (km/h)	Standing Long Jump (cm)	Shuttle-Run (s)	Shifting Platforms (repetitions)	Jumping Sideways (repetitions)
	Mean (SD)						
Total Sample	8.56 (6.01)	51.03 (9.58)	52.77 (10.92)	142.36 (24.67)	12.42 (1.06)	21.32 (3.83)	30.68 (6.79)
Boys	11.97 (5.60)	55.68 (9.24)	59.16 (8.95)	144.56 (27.72)	12.13 (1.15)	21.38 (3.80)	30.35 (8.05)
Girls	4.72 (3.74)	45.66 (6.82)	45.38 (7.96)	139.82 (20.75)	12.76 (0.85)	21.25 (3.91)	31.06 (5.07)
<i>t</i> -test	6.198	5.056	6.714	0.794	-2.591	0.138	-0.431
<i>p</i>	< 0.001	< 0.001	< 0.001	0.215	< 0.01	0.445	0.334
<i>d</i>	1.506	1.220	1.621	–	-0.625	–	–

Table 3. Bivariate correlations of participant performances across measures.

Tests	1	2	3	4	5	6	7
Total sample							
1. Tripela test	1						
2. Shuttle-Run	-0.553**	1					
3. Standing Long Jump	0.389**	-0.797**	1				
4. Shifting Platforms	0.285*	-0.588**	0.502**	1			
5. Jumping Sideways	0.303**	-0.509**	0.351**	0.421**	1		
6. Ball Kicking Velocity	0.785**	-0.649**	.495**	.304*	.255*	1	
7. Ball Throwing Velocity	0.670**	-0.558**	.405**	.314**	.247*	.698**	1
Boys/Girls							
1. Tripela test	1						
2. Shuttle-Run	-0.571**	1					
3. Standing Long Jump	0.431**	-0.797**	1				
4. Shifting Platforms	0.424*	-0.551**	0.506**	1			
5. Jumping Sideways	0.476**	-0.538**	0.438**	0.453**	1		
6. Ball Kicking Velocity	0.760**	-0.638**	0.590**	0.344*	0.307	1	
7. Ball Throwing Velocity	0.665**	-0.591**	0.513**	0.498**	0.446**	0.671**	1

* $p < .05$; ** $p < .01$. below diagonal line = boys; above diagonal line = girls.

one (Shuttle-run), with large effect sizes on the first three (≥ 1.220) and medium on the last one (-0.625).

The results of the bivariate correlations between participants' performances are reported in Tables 3 and 4. Focusing on the Tripela Test correlations with MCA tests, and within the entire sample, the Tripela test significantly correlated with all the six MCA' tests,

with just one weak correlation (Shifting Platforms test, from the stability component, $r = 0.285$), three moderate correlations (Shuttle-Run, $r = -0.553$ and Standing Long Jump, $r = 0.389$, the two tests of the MCA loco-motor component, and Jumping Sideways, from the stability component, $r = 0.303$) and two strong correlations with the two MCA manipulative tests (Ball

Table 4. Correlations of the Tripela test with MCA tests and respective lower (LCI) and upper (UCI) confidence intervals.

Tripela corr. MCA Tests	<i>r</i>	<i>n</i>	LCI	UCI
Total sample				
Shuttle-Run	-.553	68	-.700	-.363
Standing Long Jump	.389	68	.166	.574
Shifting Platforms	.285	68	.050	.490
Jumping Sideways	.303	68	.070	.505
Ball Kicking Velocity	.785	68	.673	.862
Ball Throwing Velocity	.670	68	.513	.783
Boys				
Shuttle-Run	-.571	36	-.758	-.299
Standing Long Jump	.431	36	.119	.665
Shifting Platforms	.424	36	.111	.660
Jumping Sideways	.476	36	.175	.696
Ball Kicking Velocity	.760	36	.574	.871
Ball Throwing Velocity	.665	36	.430	.815
Girls				
Shuttle-Run	-.271	32	-.566	.086
Standing Long Jump	.388	32	.045	.649
Shifting Platforms	.219	32	-.141	.527
Jumping Sideways	.222	32	-.137	.530
Ball Kicking Velocity	.517	32	.205	.733
Ball Throwing Velocity	.083	32	-.274	.419

Kicking Velocity, $r = 0.785$, and Ball Throwing Velocity, $r = 0.670$). When considering the results separately by sex, two different results emerged. In boys, six correlations were also detected, all with higher results. In fact, four moderate correlations emerged, namely with the MCA locomotor component (Shuttle-Run, $r = -0.571$, and Standing Long Jump, $r = 0.431$) and the stability MCA component (Shifting Platforms, $r = 0.424$, and Jumping Sideways, $r = 0.476$). With the two tests of the MCA manipulative component, strong correlations were verified (Ball Kicking Velocity, $r = 0.760$, and Ball Throwing Velocity, $r = 0.665$). In girls, the Tripela test only correlated (moderately) with two out of six MCA tests (one of the manipulative components, the Ball Kicking Velocity, $r = 0.517$, and one of the locomotor components, the Standing Long Jump, $r = 0.388$).

Additionally, Table 4 data display Lower and Upper Confidence Intervals for the reported correlation' values, which allow us to maintain confidence on the assumption of the existence of the above referred to as significant correlations.

Discussion

Considering the entire sample, significant correlations between the Tripela test and all six MCA tests were found, allowing to conclude of its concurrent validity with MCA as a whole and reinforcing the possibility of the Tripela Test to be used as a measure of MC. However, a more nuanced picture emerged when analyzing results by sex. Among boys, the correlations between the Tripela test and all six MCA tests remained statistically significant. Notably, the highest correlations were found with the manipulative tests, followed by the Shuttle Run. These are interesting data and, in some ways, to be expected. In fact, the most obvious component in the Tripela test is the manipulative aspect; then, the constant need for movement, braking, and changes of direction (longitudinally and transversely) will have resulted in a high degree of similarity with the Shuttle Run locomotor test, where changes of direction are relevant to its execution (agility). In contrast, among girls, only two of the six correlations – Ball Kicking Velocity and Standing Long Jump – were significant and, in both cases, with lower values than in boys' sample, like already happened in Matos et al. (2025) with the correlations between Tripela Test and each of the two MCA manipulative tests. An unexpected result came from the fact that, with girls' sample, no significant correlation between Tripela Test and Ball Throwing Velocity was found, contrary to Matos et al. (2025) results, where the correlations of Tripela Test with both MCA manipulative tests were significant

with the entire sample and also by gender. In Matos et al. (2025), in girls, MCA kicking was “already” more strongly related to WDPK&C performance ($r = .612$) than MCA throwing ($r = .330$). May be the reduction of the “n” on the present study (52 girls in the former, 32 in the present) has affected this correlation, along with the fact that this girls' sample was somewhat younger (about a year) than the previous one (11.53 ± 0.74 vs 12.73 ± 1.77), which may impact these results. While some variations may stem from innate physiological characteristics, such as muscle mass, coordination patterns, and hormonal influences, a growing body of research points to the significant impact of sociocultural factors, including gender norms, access to physical activity opportunities, and varying levels of encouragement for participation in sports.. As previous research has consistently shown, boys tend to engage more frequently in sports and ball-related activities (Mota et al., 2008; Randler & Kauderer, 2013), which provides them with an advantage in manipulative tasks that emphasize ball control (Badrić et al., 2015; Harrell et al., 2003).

Future studies should delve deeper into these discrepancies by investigating the interplay between biological predispositions and environmental influences in shaping MC trajectories. Additionally, examining the role of school-based physical education programs in mitigating gender disparities could yield valuable insights into how educational strategies can foster equal opportunities for boys and girls to develop and refine their motor skills.

Further reinforcing these trends, our study found that boys significantly outperformed girls on four of the seven administered tests, with no significant differences observed in the remaining **three**. This aligns with previous findings that have consistently highlighted boys' superior performance in manipulative and object control tasks (Barnett, Lai et al., 2016; Carvalhal & Vasconcelos-Raposo, 2007; Platvoet et al., 2018; Rodrigues et al., 2019; Valtr et al., 2016; Wicks et al., 2015).

The present results extend to all six MCA tests, in general and in boys' sample, the findings of Matos et al. (2025), which demonstrated strong correlations between the Tripela and the MCA two manipulative tests.

Importantly, the Tripela test also presents a more accessible, cost-effective alternative to existing MC batteries. Many established assessment tools require specialized equipment, extensive resources, or are overly time-consuming, making them impractical for widespread use in school or physical education settings (Cools et al., 2009b; Hoeboer et al., 2018). For instance, some tests require balance beams of different widths, while others necessitate a radar for measuring ball

speed – resources that are often unavailable in educational environments. Alternatively, the Tripela test requires only a ball and a wall, making it a highly feasible and ecologically valid alternative.

Beyond its practical advantages, the Tripela test has an inherent connection to sport-specific skills, as its core components (drop, kick, and catch) form the basis of Tripela, a sport introduced in Portugal in 2008 (Matos, 2009). This highlights its potential as both an assessment tool and a skill-development activity within physical education curricula. In addition, the test appears to engage multiple facets of MC, extending beyond manipulative skills to incorporate stability and locomotor elements. For instance, test-takers often exhibit quick lateral movements to catch rebounding balls, balance on one foot to execute a controlled kick, or jump and run backward to intercept an over-rebounding ball. These aspects reinforce the test's ability to provide a holistic evaluation of MC.

Given these findings, the Tripela test stands out as a conceivable practical assessment tool for MC evaluation. Whether integrated into existing MC batteries, used as a standalone test, or incorporated into physical education programs, it offers a new approach on assessing and improving fundamental motor skills. Its affordability, accessibility, and alignment with natural movement patterns make it a valuable resource to be considered by educators, researchers, and practitioners in the field of MC development.

Limitations

While the present study makes significant contributions to the understanding of the relationship between the Wall Drop Punt Kick and Catch (Tripela) test and the six assessments within the MCA battery, it is important to acknowledge certain limitations that pave the way for future research and refinements in this area. These considerations highlight not only the study's boundaries but also the numerous opportunities for advancing our understanding of MC across different populations.

Generalizability limited to a specific age and cultural group

One of the primary limitations of this study lies in the composition of the sample, which was exclusively comprised of children and adolescents in the early stages of development. Although this age range is critical for studying MC, the findings cannot be easily generalized to other age groups, such as younger children, older adolescents, adults, or even the elderly. The development of motor skills is

a lifelong process, influenced by neuromuscular maturation, cognitive development, and environmental factors. Future studies should, therefore, broaden their scope to include a more diverse sample, spanning from early childhood to adulthood and even older age groups. Investigating whether the correlations observed in this study persist, strengthen, or weaken across different stages of life and cultural environments will provide deeper insights into how MC evolves over time and how early assessment tools like the Tripela test can be used to predict long-term motor development. Besides, and additionally, expanding the assessments to participants from different school-centers, public and private, may expand the generalizability of results.

Samples small size

However, respecting the required sample size for the planned analyses, a total of 68 participants (36 boys, 32 girls) must be considered, in absolute terms, a small one. If, with boys, that seems to not have hindered the correlation results, with girls that may not be the case, not only by the nonexistence of more significant correlations but, specially, by not finding them on a specific one, the possible correlation of the Tripela Test with Ball Throwing Velocity, given that that was a reality in Matos et al. (2025) study. More studies are needed and with greater samples, namely with girls.

Out-of-school sports experience and participation

Another key limitation of this study was the lack of data regarding the participants' history of engagement in sports and physical activities. It is well established that exposure to organized and informal sports from an early age plays a pivotal role in shaping MC. Differences in training experience, frequency, and diversity of motor tasks could significantly impact performance on both the Tripela test and MCA assessments. Furthermore, previous research suggests that these influences may vary considerably between boys and girls due to differences in societal expectations, access to sports programs, and intrinsic motivation for physical activity. To refine our understanding of the factors driving MC, future research should incorporate comprehensive data on participants' sports practice history, including intensity, duration, type of activities performed, and level of engagement in structured training environments. Such information would allow for a more nuanced analysis of participants' MCs and, possibly, help to identify moderator variables in MC results.

Precision of the Tripela test

Although some strong correlations were found between Tripela Test results and results of the MCA tests, at this stage of development of Tripela Test it is not possible to know-how well it differentiates between test-takers of varying abilities, i.e., how precise the results are. Additionally, it is still not possible to define MC levels, as not enough data have been collected.

Conclusion

This study provides compelling evidence that the Wall Drop Punt Kick and Catch (Tripela) test exhibits strong correlations with all six assessments that compose the MCA battery when considering the total sample. Notably, this association was particularly pronounced among boys, reinforcing the test's potential as a valid and efficient measure of overall MC in this gender. Given its simplicity, ease of administration, and integration of fundamental manipulative and locomotor skills, the Tripela test presents itself as a possible future alternative to more complex and time-intensive MC assessments, particularly in educational, recreational, and sports settings, at least with boys. Actually, girls exhibited significant correlations in the Tripela Test with only two of the six MCA tests. This discrepancy raises crucial questions about potential sex-based differences in MC development and assessment. Several factors may contribute to this finding, including biological differences in neuromuscular coordination, variations in exposure to motor skill development opportunities, and disparities in participation in structured sports activities from an early age.

These findings underscore the need for further research to determine whether the Tripela test effectively captures MCs across both sexes or whether alternative approaches are needed to ensure equitable assessment. Future studies should investigate whether modifications to the test protocol – such as adaptations in execution criteria, scoring methods, or the inclusion of complementary tasks – could enhance its applicability and validity for both boys and girls. Additionally, exploring the influence of sociocultural and educational factors on MC development will be essential for refining motor assessment tools and ensuring they accurately reflect the abilities of diverse populations.

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