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Design and validity of an instrument - run cross hopping throw and catch (rcht&c) test for assessing motor competence in athletics

Diseño y validez de un instrumento: prueba de lanzamiento y recepción con salto cruzado (rcht&c) para evaluar la competencia motriz en atletismo

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Abstract. The aim of this study was to design and validate a tool for assessing motor competence (MC) and detecting talent in children aged between 6 and 10 years in athletics. Ten experts were carefully selected to collaborate in the validation. Cronbach's alpha and intraclass correlation coefficient (ICC) were used, respectively, to check for construct's validity and to reliability. Lin's Concordance Correlation Coefficient (CCC) was calculated as a complementary test. Additionally, the Aiken's V value was used to validate the tool. ICC (0.855) and Cronbach's alpha (0.922) showed acceptable reliability and consistency, respectively, and Lin's CCC (0.786) indicated excellent reproducibility, thus proving stability and consistency over a two-week period. Aiken's V value was 0.92, confirming the validity of the test. By parameter, univocity had Aiken's V of 0.92, relevance of 0.91, and importance of 0.91. Therefore, we conclude that this tool can be a valid test for assessing MC in athletics.
Keywords: Validation, Instrument, Motor Competence, Talent, Children and Athletics

Resumen. El objetivo de este estudio fue diseñar y validar un instrumento para evaluar la competencia motriz (CM) y detectar talentos en niños de entre 6 y 10 años en atletismo. Se seleccionaron cuidadosamente diez expertos para colaborar en la validación. Se utilizaron el alfa de Cronbach y el coeficiente de correlación intraclase (CCI), respectivamente, para comprobar la validez de constructo y la fiabilidad. El coeficiente de correlación de concordancia de Lin (CCC) se calculó como prueba complementaria. Además, se utilizó el valor V de Aiken para validar el instrumento. El ICC (0,855) y el alfa de Cronbach (0,922) mostraron una fiabilidad y consistencia aceptables, respectivamente, y el CCC de Lin (0,786) indicó una reproducibilidad excelente, demostrando así la estabilidad y consistencia durante un periodo de dos semanas. El valor V de Aiken fue de 0,92, lo que confirma la validez de la prueba. Por parámetros, la univocidad tuvo una V de Aiken de 0,92, una relevancia de 0,91 y una importancia de 0,91. Por lo tanto, concluimos que esta herramienta puede ser una prueba válida para evaluar la MC en atletismo.
Palabras clave: Validación, Instrumento, Competencia Motriz, Talento, Niños y Atletismo

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Introduction

Athletics is a group of sports events that involve competitive running, jumping, throwing, and walking. The most common types of athletic competition are track and field, road running, cross-country running, and race walking (Federação Portuguesa de Atletismo, 2014). In the first years of practice, between the ages of 5 and 10, the approach to sports is mainly aimed at developing Fundamental Movement Skills (FMS), such as running, jumping, and throwing. In this sense, one of the most widely used programs is kids' Athletics of World Athletics.

In early childhood, children begin to learn how to move their bodies through space by developing the FMS (Stodden et al., 2008), which forms the foundation for more complex movement skills in the future (Schmutz et al., 2020). Thus, mastery of FMS has been purported to contribute to children's physical, cognitive, and social development and is thought to provide the foundation for an active lifestyle (Lubans et al., 2010). FMS have been described as the initial building blocks of more complex coordinated movements (Gallahue & Ozmun, 2006), having a reciprocal and dynamic relationship at a young age (Stodden et al., 2008). It is composed of locomotor skills, stability and object control skills (Haywood, 2009) and is commonly developed in childhood and subsequently refined into context- and sport-specific skills. The Locomotor skills include (e.g. running and hopping) (Branta et al., 1984; D. L., Gallahue & Donnelly, 2007), manipulative or object control (e.g., catching and throwing) (Gallahue & Donnelly, 2007; Haywood, 2009), and stability (e.g., balancing and twisting) (Barnett et al., 2016; Lubans et al., 2010), which represent the essential foundations for future movement and involvement in Physical Activity (PA) (Malambo et al., 2022). This provides a foundation for children to develop more specialized movement sequences, such as sport-specific sequences (Clarke & Metcalfe, 2002) and lifelong PA movement skills (Hulteen et al., 2015). However, some lifelong PA does not require a foundation in FMS, meaning that children who are not competent in FMS may alternatively perform lifelong PA only to be physically active (Hulteen et al., 2015). Thus, the FMS is encapsulated by Motor Competence (MC) (Jones et al., 2020).

Many experts have studied MC (Coppens et al., 2021; Niet et al., 2021; Platvoet et al., 2018), presenting valid and high-quality studies and proposals for understanding its nature, scope, and concept. MC is a broad concept that relates to human movement, development, and performance (Rodrigues et al., 2022), and is described as the ability to be skilful in a wide variety of gross motor skills that are associated with multiple developmental outcomes, including physical health (Barnett et al., 2008; Chagas & Marinho, 2021), psychological, social-emotional, and cognition/achievement (Barnett et al., 2022; Leonard & Hill, 2014; Robinson et al., 2015). Accordingly, MC is a global term used to describe goal-directed gross movements that involve large muscle groups or the whole body (e.g., running, jumping, and balancing) (Robinson et al., 2015). It is defined as gross motor skill competency, encompassing FMS and motor coordination but excluding motor fitness (Barnett et al., 2016), or a person's ability to execute different motor acts, including coordination of fine and gross motor skills that are necessary to manage everyday tasks (Henderson et al., 2007). According to Barnett et al. (2016), it is associated with various terminology used in the literature: fundamental movement/motor skills, stability skills, and motor coordination, and has been found to be positively affected by children's participation in organized PA such as sports (Field & Temple, 2017).

Therefore, the development of overall movement skills and sport-specific skills is a primary priority in the discovery of sports talent. According to Cobley et al. (2012), factors such as broad abilities (e.g., FMS, intelligence), holistic performance (e.g., netball game performance), and sport-specific skills (e.g., court movement and positioning) are predictors of talent.

Talent is used to refer to a specific capability to execute a learned skill exceptionally or referring to the quality (or qualities) identified at an earlier time that promotes (or predicts) exceptionality in the future (Cobley et al., 2012).

Therefore, to better understand MC, its evolution, and how it affects children's development throughout life, it is important to have tools to help assess it. The assessment of movement skills (e.g., FMS, sport-specific, lifelong), according to Hands (2002), is vital for informing individuals of their competency levels as well as informing teachers and researchers of potential movement skill deficiencies in a population, so programs or interventions can be designed and implemented.

Then, many batteries, such as the Körperkoordinationstest für Kinder (KTK) of Kiphard & Schilling (1974), the Test of Gross Motor Development (TGMD) of Ulrich (2000), the Bruininks-Oseretsky Test of Motor Proficiency (BOTMP) of Bruininks & Bruininks (2005), the Movement Assessment Battery for Children MABC (Henderson & Sugden, 1992), and the Motor Competence Assessment MCA of Luz et al. (Luz et al., 2016), have appeared for their assessment. In addition to these tools, others such as the Wall Drop Punt Kick & Catch (WDPK&C) of Matos et al. (2021), editions of the existing Test of Gross Motor Development 2nd and 3rd editions TGMD-2 and TGMD-3 (Ulrich, 2000) or KTK3$^+$ (Körperkoordinationstest für Kinder (KTK-3) and eye hand coordination test item (EHC)) of Platvoet et al. (2018), have appeared to complement the ones mentioned above, as there is no instrument that is comprehensive enough to measure all the components of MC owing to its nature, characteristics, and scope. These batteries have helped sports, physical education (PE), and PA professionals gain a better understanding of the fine and gross motor skills of children and adolescents. For these reasons, given the number of tests or batteries that exist to assess CM, we wanted to create something that was different and responded to the specific needs of athletics. Thus, the aims of this research were: i) to design an intervention tool for assessing MC and detecting talent in children aged between 6 and 10 years, who are beginners in athletic sports, and ii) to analyse the content validity and internal consistency of the instrument through expert assessment.

We believe that this battery could be important for detecting children with athletic talent.

Material and Methods

Design

The design of this research falls within the scope of instrumental studies, as its aim was to create an instrument/test battery to assess the motor competence of children who practise athletics, fulfilling the following requirements: i) the possibility of implementation at the training site, and ii) assessment of different types of movements. To create it, it was necessary to carry out a validation process using a committee of judges who are specific experts in the field of assessment to ensure that the analysis was accurate. (Gómez-Carmona et al., 2020; Triguero et al., 2019).

Stages in the development and realisation of the test battery proposal

The proposed tool was developed in several stages. In the first phase, we compiled a systematic review of the children's motor skills. This review allowed us to deepen our knowledge of the effects of physical exercise, physical activity, and sports on motor competence. It also allowed us to learn about the various instruments that have been developed over the years to assess CM, and to determine which are currently the most widely used in scientific research.

In the second phase, based on the knowledge acquired previously, we wanted to present a differentiated battery that covered various skills (locomotion, stability, and manipulation) and suited our study objectives, which was to assess the motor competence of children aged between 6 and 10 years who practiced athletics.

Procedures

To begin the process, a literature review was conducted on MC in children. An exploratory study was conducted using the instruments used to assess gross motor skills. In addition, although it was not covered in the systematic review, our research undertook a cursory look at how to design and validate an evaluation tool. Nevertheless, the conclusions drawn from the systematic review allowed us to move forward in a manner consistent with our proposal for an instrument/test for assessing motor competence.

We then analysed the criteria for creating a panel of judges to evaluate the instrument. An online survey tool (Google form) was also drawn up with a summary of the study (objectives, context, and explanation setting out that we were conducting a study on the construction and validation of RCHT&C), sent by e-mail, and returned by expert evaluators. The experts performed their evaluations and returned them to the researchers.

Participants

Participants who agreed to collaborate in the validation of the instrument were consciously chosen and selected according to the criteria defined by Rodríguez et al. (1996). The experts had to fulfil at least 80% or five of the six inclusion criteria identified: C1– Have a doctorate degree; C2 – Be a university professor/Teacher; C3 - More–more than 10 years' experience as a university lecturer in a sport; C4 – Have publications on instrument/tool validation; C5 – Have publications related to Motor Development or Motor Control; C6 – Have experience as a teacher and/or coach in athletics.

To assess the tool, selected participants used a quantitative evaluation form which included a 10-point Likert-type scale (Likert, 1932) for all the surveys, based on univocacy, relevance and importance. The data collected in Google Forms was used for statistical analysis in Microsoft Excel.

Table 1.
Inclusion Criteria Met by Experts

	Criteria					
Experts	1	2	3	4	5	6
1	X	X	X	X	X	X
2	X	X	X		X	X
3	X	X	X	X		X
4	X	X	X	X		X
5	X	X	X	X		X
6	X	X	X	X	X	
7	X	X	X	X	X	X
8	X	X		X	X	X
9	X	X	X	X	X	X
10	X	X	X	X	X	X

Proposal and evaluation of a test battery for the evaluation of Gross Motor Competence

To assess the gross MC of children aged 6–10 years, a specific tool called Run Cross Hopping Throw and Catch (RCHTC) was proposed to analyse the different movements, abilities, and skills that are performed in athletics. It combines locomotion (shuttle run), stability (side jump), and manipulation (throw and catch).

Run Cross Hopping Throw and Catch (RCHT&C)

The participant starts by running at maximum speed to a cone 10 metres away, goes around it, turns back and picks up the volleyball that is lying in the centre of the cross – (point 0), that is placed one metre from the wall. Then throws the ball at the wall, catches it, and jumps to the next number. The participant must always follow the same sequence (0-1-0-2-0-3-0-4-0-1… etc.). To avoid errors in execution and understanding, the starting point is always the centre of the cross (0). Whenever the participant moves to the other square, they must throw the ball and catch it to continue the sequence. The total time allowed needed to complete the task is 45 seconds. If the participant drops the ball or does not catch it, they are not penalised directly; that is, the penalty is the number of executions they manage to do, as the time continues to count. The number of points a participant can get for each square or number is three: one for jumping, one for throwing, and one for catching the ball. Each participant is entitled to one trial and two counting attempts. Figure 1 shows the RCHT&C Test.

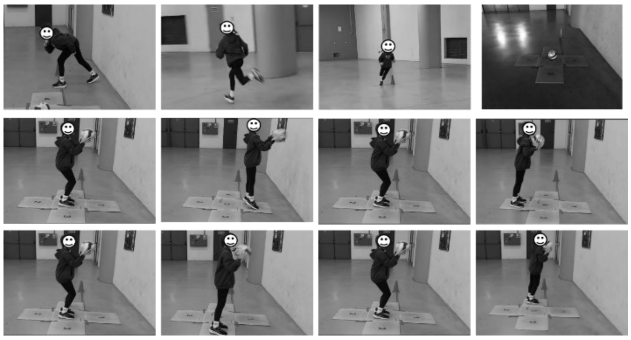

Figure 1. The RCHT&C Test

Study Variables

In addition to the variables that made up the instrument, other variables were identified to analyse the content validity and reliability of the tool. In this study, the technique used to achieve the optimal level of content validity was evaluated based on expert criteria (Bulger & Housner, 2007). Experts assessed the appropriateness and writing sections of each variable using a quantitative scale ranging from 1 to 10. Appropriateness is the degree to which a variable is considered relevant and should be included in the instrument. On the other hand, wording refers to a variable that is written correctly. Likewise, the experts made a general qualitative assessment of each element, if they considered it adequate, where they expressed their alternatives to certain aspects that they would improve on a personal basis. Reliability, understood as the internal reproducibility of a measure (Thomas et al., 2015), was measured using the Cronbach's α coefficient.

Data Analysis

Validity

Content validity was calculated using Aiken's V coefficient (Aiken, 1985). Aiken's V coefficient value ranges from 0 to 1, with 1 (highest value) indicating perfect agreement among experts in relation to the validity of the content evaluated. The Aiken's V coefficient score establishes which items should be eliminated, modified, or retained. Visual Basic software (version 6.0) developed by Merino and Livia (2009) was used, which applies the formula modified by Penfield and Giacobbi (2004). X = mean of the scores obtained by the experts, l = is the lowest value on scale (1), and k is its range (10-1=9).

$$V = \frac{\bar{X} - \iota}{K}$$

Aiken's V confidence intervals of 90, 95, and 99% using the score method were calculated following the algebraic equation modified by Penfield and Giacobbi (2004). To establish the criteria for the elimination, modification, or acceptance of variables, we used the formula proposed by Aiken (1985), where Z = significant value of content validity,

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m = number of variables, n = number of experts, and c = range of the scale.

$$V = \frac{z}{.2\sqrt{\frac{3mn(c-1)}{(c+1)}}} + .5$$

Reliability

Reliability is a coefficient that shows the extent to which an instrument or measuring device can be trusted, meaning that, if an instrument is used repeatedly to measure the same thing, the results are stable or consistent (Scholtes et al., 2011). Cronbach's alpha is a statistic commonly quoted by the authors to show that tests and scales that have been constructed or adopted for research projects are fit for purpose (Taber, 2018). The size of the reliability coefficient ranges from to 0-1, where a higher reliability coefficient indicates a more consistent measurement. (Muhammad, 2020; Scholtes et al., 2011). The Intraclass Correlation Coefficient was used to assess reliability between two or more observers.

For reliability purposes, young athletes were recorded and assessed. The sample consisted of forty-seven subjects of both sexes (boys, n=25; girls, n=22). Considering a convenience sample, all the subjects belonged to a local Athletics Club called Juventude Vidigalense (Leiria City). They underwent three sessions of training per week with a duration of 60 min.

The inclusion criteria were as follows: (i) the participants had to be 6–10 years old at baseline; (ii) they were apparently healthy (free from motor and mental impairments); and (iii) they had authorization from their parents or legal tutor by signing a consent form stating that the child voluntarily took part in the tests.

Procedures

First, the parents or legal tutors were called following approval from the ethical commission to conduct the investigation. During this conference, the nature, ethics, and data collection procedures of the project were presented. They signed an informed consent form, allowing their children to take part in the study.

Anthropometric measurements were obtained, and data collection began on the first day of the study (e.g., height and weight). We conducted the tests and provided an explanation and demonstration of the measurement techniques on the second day. A typical warm-up consisting of ten minutes of dynamic stretching and five minutes of running was performed prior to testing.

Statistics

Cronbach's alpha was calculated to demonstrate that tests that have been constructed for research projects are fit for purposes in terms of internal consistency reliability. Higher Cronbach's alpha values indicate a higher level of reliability when interpreting internal consistency, and coefficients above 0.70 represents adequate score of reliability scores (Beeckman et al., 2010; Bonett & Wright, 2015).

ICC values less than 0.50, between 0.50 and 0.75, and 0.75, and 0.90, are considered to be poor, moderate, and good reliability, respectively, while there are no standard values for acceptable ICC scores in every domain. Lin's Concordance Correlation Coefficient (ICCC) was also used as a complementary test for the evaluation of RCHT&C reproducibility, as it measures how well bivariate pairs of observations conform relative to a gold standard or another set. In the present circumstance, if pairs of results at moments 1 and 2 are near the 45-degree line, the line that would represent a perfect match between those two moments, with a CCC of 1. Therefore, following Altman's recommendations, suggesting that CCC should be interpreted as close to other correlation coefficients, such as Pearson's, results <0.2 are to be classified as poor and > 0.8 as excellent.The Aiken V value was used to validate the RCHT & C test instrument. This coefficient is one of the principal means to quantify and validate the content or relevance of each item relative to the content domain for N judgments (number of expert judges). Aiken's V coefficient value ranges from 0 to 1, with 1 (highest value) indicating perfect agreement among experts in relation to the validity of the content evaluated (Aiken, 1985). Bivariate Pearson correlations were conducted considering age, weight, height, body mass index, sports experience, and RCHT&C test results at baseline and after two weeks. The significance level for rejecting the null hypothesis was set at 5% for all the tests. In addition, the mean and standard deviation of the battery were calculated using the RCHT&C test, and a reliability analysis was conducted considering the intraclass correlation coefficient (ICC) to measure the degree of dependence among individuals within a higher-level grouping.

Results

Table 2 shows the results obtained using Aiken's coefficient and their confidence intervals for univocacy.

Table 2.
Results of Aiken's V Coefficient and Confidence Intervals (Univocacy)

Variables	Univocacy							
	A	V	90% CI		95% CI		99% CI	
			Lower	Upper	Lower	Upper	Lower	Upper
1	9.2	.91	.85	.95	.93	.95	.80	.96
2	8.8	.87	.80	.91	.78	.92	.75	.93
3	9.1	.90	.84	.94	.82	.95	.79	.96
4	9.0	.89	.82	.93	.81	.94	.78	.95
5	9.4	.93	.88	.97	.86	.97	.83	.98
6	9.4	.93	.88	.97	.86	.97	.83	.98
7	9.4	.93	.88	.97	.86	.97	.83	.98
8	9.4	.93	.88	.97	.86	.97	.83	.98
9	9.5	.94	.89	.97	.88	.98	.85	.98
10	9.5	.94	.89	.97	.88	.98	.85	.98
11	9.6	.96	.90	.98	.89	.98	.86	.99
12	9.5	.94	.89	.97	.88	.98	.85	.98
13	9.3	.92	.86	.96	.85	.96	.82	.97
14	9.2	.91	.85	.95	.93	.95	.80	.96
15	8.9	.88	.81	.92	.79	.93	.76	.94

CI (Confidence Interval); lower (lower limit); upper (Upper Limit); A (average); V (Aiken's V); * p <.87.

It can be observed that, except for variable 3, almost all the other items exceeded the critical value for Aiken's V with respect to relevance established at .87. Only Items 3 and 7 obtained the .87 Aiken's V.

Table 3 shows the results obtained using Aiken's coefficient and their confidence intervals for relevance.

Table 3.
Results of Aiken's V Coefficient and Confidence Intervals (Relevance)

	Relevance							
Variables	A	V	90% CI		95% CI		99% CI	
			Lower	Upper	Lower	Upper	Lower	Upper
1	9.1	.90	.84	.94	.82	.95	.79	.96
2	8.9	.88	.81	.92	.79	.93	.76	.94
3	8.8	.87	.80	.91	.78	.92	.75	.93
4	9.4	.93	.88	.97	.86	.97	.83	.98
5	8.9	.88	.81	.92	.79	.93	.76	.94
6	8.6	.84	.77	.90	.76	.91	.72	.92
7	8.8	.87	.80	.91	.78	.92	.75	.93
8	9.3	.92	.86	.96	.85	.96	.82	.97
9	9.4	.93	.88	.97	.86	.97	.83	.98
10	9.6	.96	.90	.98	.89	.98	.86	.99
11	9.5	.94	.89	.97	.88	.98	.85	.98
12	9.8	.98	.94	.99	.92	.99	.90	.99
13	9.5	.94	.89	.97	.88	.98	.85	.98
14	9.3	.92	.86	.96	.85	.96	.82	.97
15	9.3	.92	.86	.96	.85	.96	.82	.97

CI (Confidence Interval); lower (lower limit); upper (Upper Limit); A (average); V (Aiken's V); * p <.87.

It can be observed that, except for item 2 (.87), all the other items exceed the critical value for Aiken's V with respect to importance established at .87.

Table 4 shows the results obtained using Aiken's coefficient and their confidence intervals for importance. It can be observed that, except for variable 2, all other variables exceed the critical value for Aiken's V with respect to the importance established at .87.

Table 5 shows the results obtained by variable using Aiken's V

Table 4.
Results of Aiken's V Coefficient and Confidence Intervals (Importance)

	Importance							
Variables	A	V	90% CI		95% CI		99% CI	
			Lower	Upper	Lower	Upper	Lower	Upper
1	9.2	.91	.85	.95	.95	.95	.80	.96
2	8.4	.87	.75	.88	.88	.89	.70	.90
3	8.3	.90	.73	.87	.87	.88	.69	.90
4	9.5	.89	.89	.97	.97	.98	.85	.98
5	9.2	.93	.85	.95	.95	.95	.80	.96
6	9.5	.93	.89	.97	.97	.98	.85	.98
7	8.9	.93	.81	.92	.92	.93	.76	.94
8	9.3	.93	.86	.96	.96	.96	.82	.97
9	9.4	.94	.88	.97	.97	.97	.83	.98
10	9.6	.94	.90	.98	.98	.98	.86	.99
11	9.5	.96	.89	.97	.97	.98	.85	.98
12	9.6	.94	.90	.98	.98	.98	.86	.99
13	9.5	.92	.89	.97	.97	.98	.85	.98
14	9.4	.91	.88	.97	.97	.97	.83	.98
15	9.4	.88	.88	.97	.97	.97	.83	.98

CI (Confidence Interval); lower (lower limit); upper (Upper Limit); A (average); V (Aiken's V); * p <.87.

Table 5.
Results Obtained by Variable using Aiken's V

	Univocacy	Relevance	Importance
Aiken's V	.92	.91	.91

Table 6 shows, by way of example, the qualitative assessments provided by the experts as well as the actions that were taken accordingly.

Table 6.
Qualitative Evaluations by Experts

Variable	Nºof C.	Example	Action
1	4	E1: The quality of the tool; E6: Show an illustrated graph with the cross and numbers. Indicate what the objective of the test is in terms of motor skills to be assessed; E7: It would be interesting to include a graphic to help understand the task.; E10: I believe that the 45-second pressure may not be perceptible to children aged 6. It's important to test its comprehension for this age beforehand.	As the experts only make general comments and do not make any suggestions for changing the item, we prefer to keep it.
2	5	E2: It might be more sensible to count how long it takes each child to do everything once it's done well; E4: I guess you have thought to measure time instead of points; E5: Be aware that time may be insufficient for some children due to lack of understanding of the test. You should seek an alternative or a second chance; E6: Indicate in the description of the test what is the objective of the test in terms of motor skills to be assessed; E10: Consider different ball sizes in relation to hand size between children aged 6 and 10.	Before carrying out the test, the children were given the opportunity to try it out and, depending on their assessment, the test was adjusted to suit all the participants. The distance from the wall, the size of the ball and the time to perform the test were adjusted.
3	3	E6: Show an illustrated graph with the cross and numbers; E7: It is possible that the task generates fatigue and influences the final result. Just a thought; E10: This may not be much time for 6-year-olds. However, what matters is the final value (points in the test) and not the execution time.	As the experts only make general comments and do not make any suggestions for changing the item, we prefer to keep it.
4	4	E2: Although it includes throwing and receiving, a large part of the task is dedicated to running; E5: Possible adaptation of the balls must be taken into account; E6: Indicate in the description of the test what is the objective of the test in terms of motor skills to be assessed. E10: Consider different ball sizes in relation to hand size between children aged 6 and 10. It's not clear where the volleyball is caught.	Before carrying out the tests, we tested balls of different sizes, choosing the one we thought best suited the type of population.
5	3	E6: Show an illustrated graph with the cross and numbers; E7: It is possible that the task generates fatigue and influences the final result. Just a thought; E10: It should be clear that the transition to the 5 zones (0, 1, 2, 3 and 4) is always done together.	As the experts only make general comments and do not make any suggestions for changing the item, we prefer to keep it
6	3	E5: You must take into account a turnover. can a second chance be granted?; E7: It would be interesting to include a graphic of the task for better understanding; E10: The 'start line' could be centred with the '0' square, but this requires you to consider whether you want to keep the launch distance of 1 metre.	As the experts only make general comments and do not make any suggestions for changing the item, we prefer to keep it
7	4	E2: I don't understand why we're jumping up and down together; E6: Improve the description of the whole test by using illustrations; E7: It would be interesting to include a graphic of the task for better understanding; E10: The limited time can lead to errors in the jumps, but as it is not graded if this occurs the criterion can be maintained.	As the experts only make general comments and do not make any suggestions for changing the item, we prefer to keep it.
8	1	E2: If performance accounting continues as originally planned, it makes sense that this should be the case.	As the experts only make general comments and do not make any suggestions for changing the

			item, we prefer to keep it
9	3	E2: Why both hands instead of one?; E5: It is possible that the ball bounces to an unsuitable place for the child and he/she loses it. is it possible to include a second chance?; E7: It would be interesting to include a graphic of the task for better understanding.	As children performing better catching with both hands, instead of one, due to size ball, week we keep the previous idea.
10	2	E2: If performance accounting continues as originally planned, it makes sense that this should be the case; E7: It might be interesting to indicate how many jumps he/she has to make.	As what is defined is to count the jumps, throws and balls caught, the item remained.
11	2	E5: It is possible that the ball bounces to an unsuitable place for the child and he/she loses it. is it possible to include a second chance?; E10: See if it's worth changing the size of the ball according to age. I'm not sure it's necessary, as the changes in hand length can be small (check with specialised literature - anthropometry)?	Each participant had two attempts. With regard to the size of the ball, after trying other sizes, they chose the one that best suited them.
12	2	E2: The fact that the complete throwing/receiving/jumping cycle in the different positions is scored makes sense for the Grasp to be taken into account when counting together. E7: It might be interesting to indicate how many captures would be correct.	As the experts only make general comments and do not make any suggestions for changing the item, we prefer to keep it.
13	3	E6: Clarify the description of the position of the cross and the area of the displacement on a graph.; E7: Indicate on the drawing; E10: The centre of zone '0) is more than a metre from the wall. Check.	The bottom edge is 1 m away from the part. The centre of the cross is about 1.20 m. The distance seemed more appropriate.
14	2	E2: The distance seems fine to me, even on the basis of other existing protocols; E6: Clarify the description of the position of the cross and the area of the displacement on a graph.; E7: Indicate on the drawing	
15	2	E2: The interpretation of the results will be difficult to attribute causal effects to any of the variables (motor skills involved in the protocol), although in general this is naturally normal.; E4: Is it better measure times or repetitions?	For the analysis and interpretation of the test results, we chose time over repetitions.

The descriptive statistics of the two measures of the RCHT&C test are presented in Table 7. The mean of the total score of Moment 1 was 66.2±27.8, and the mean of the total scores of Moment 2 was 79.0±33.3. The results of ICC (0.855) and Cronbach Alpha (0.922) showed acceptable reliability and consistency, respectively, and Lin's CCC (0.786), indicating excellent reproducibility. Using the best score obtained for each participant at each moment, the results of ICC (0.844), Cronbach's alpha (0.916), and Lin's CCC (0.768) were not very different; therefore, we decided to use the total score obtained at each moment.

Table 7.
Results of Study Endpoints and Reliability Coefficients

Total Moment 1	Total Moment 2	ICC	Cronbach Alpha	CCC
66.2±27.8	79.0±33.3	0.855	0.922	0.786

Discussion

This study aimed to determine the validation, consistency, and reproducibility of the test over a period of two weeks. This task requires four linked fundamental motor skills (running, jumping, throwing, and catching).

The test complied with the methodological procedures recommended in the scientific literature (Escobar-Pérez & Cuervo-Martínez, 2008) as well as those followed in some similar studies (García-Santos & Ibáñez, 2016a, 2016b; Gómez-Carmona et al., 2020).

The results of Aiken V, ICC, Cronbach's alpha, and Lin's CCC support the hypothesis that this test provides validation and sufficient reliability over time. The ICC of 0.864 seems to be acceptable when compared with the results of ICC reported in other studies; for example, Sigmundsson et al. (2016) reported a global ICC of 0.87 for their TMC battery, Matos et al. (2023) reported an ICC of 0.89 for their reliability test, and Hulteen et al. (2018) reported an ICC of 0.84 for their validity and test-retest reliability of the Lifelong Physical Activity Skills Battery in adolescents.

Aiken's V (1985) was used to calculate content validityClique ou toque aqui para introduzir texto.. This technique has been used in various research projects to validate new instruments in the field of sports and/or learning (Calle et al., 2024; Escudero-Tena et al., 2023; Feu et al., 2023).

The experts were almost always unanimous in both the qualitative and quantitative evaluations. Aiken's V score was .92, which confirms the validity of the test. By parameter, univocacy had an Aiken's V of .92, relevance of.91, and importance of.91. The experts' comments, being more general in nature, were not enough for us to have changed or eliminated any items despite the strict criteria used for this purpose.

Looking at the battery as a whole, we can see that it consists of just one task that includes the three fundamental skills (running, jumping, and throwing) used in athletics, and generic skills are the building blocks for more specific (sports) skills learned at later developmental stages (Cattuzzo et al., 2016; Clark, 2005; D. Gallahue & Ozmun, 2006). Most of the batteries, TGMD (Ulrich, 2000), KTK3$^+$ (Zancanaro et al., 2021), and MCA (Luz et al., 2016; Rodrigues et al., 2022) present the tasks separately, but we wanted to combine the skills of locomotion (10 metre run), manipulation or control of objects (throwing and catching), and balance (sideways jumping) in a single task.

MC and PA are important determinants of physical and psychological health in youth, while sedentary behavior is associated with an increased risk of overweight/obesity and associated health risks (Greier et al., 2018). Anthropometry is a generally used, inexpensive, and economical method for assessing and evaluating body fatness and assessing growth, dietary status, and physical well-being in growing children using growth standards and growth references (Wang et al., 2006); it is also crucial in monitoring health status and tracing growth and MC.

Our results revealed that weight, height, and BMI were positively associated with the RCHT&C test results at baseline (moment 1) and after two weeks (moment 2). These results support those of previous studies (Cattuzzo et al., 2016; Logan et al., 2011; Matos et al., 2023; Webster et al., 2021), suggesting an interrelationship between weight status and BMI in MC. A higher BMI is associated with low MC (Logan et al., 2011), and a child's current weight status influences gross motor coordination later in life (Barnett et al., 2008; Cheng et al., 2016). Santos et al. (2017) mentioned in their study that anthropometric indicators negatively influence MC.

Regarding age, we also found a positive and significant association between age and the RCHT&C test in both moments. Several studies (Arceneaux et al., 1997; Chow et al., 2006; Navarro-Patón et al., 2021) have shown that motor competence improves with age of the group advances. In early childhood, children begin to learn how to move their bodies through space by developing fundamental movement skills (e.g., running, jumping, and balancing) (Robinson et al., 2015; Schmutz et al., 2020).

Given that athletics is a sport in which running, jumping, and throwing are the basic movements, and that the RCHT&C test is based mainly on these three fundamental movements, we believe it could help in the assessment of young athletes. However, as the battery showed reproducibility and consistency two weeks after the first application, this reinforces our initial hypothesis that it could be used to detect new talent in athletics. However, further studies with a larger sample and comparing its results with those of other tests such as the KTK, KTK 3+, TGMD 2, or TGMD3, or even the MCA, are needed to confirm its validity.

Conclusion

The RCHT&C test proved to be stable and consistent over a two-week period, which makes us optimistic, as it indicates that it can be useful and will fulfil our expectations.

Despite the fact that it manages to combine the three fundamental basic movements of athletics (running, jumping, and throwing) in a single task, as it is just a proposal for a battery to assess gross motor competence in a specific sport, it still needs to be validated, despite its stability and internal consistency.

Finally, the creation of a battery of this nature is not intended to replace existing batteries but rather to be another valid option that can be used in a specific sport and in a specific context of sports training, which is to detect and attract young talent to athletic practice.

Limitations and Future Research

The sample was drawn conveniently and consisted of athletes from the same club. In the future, it would be interesting to extend our sample to other athletic clubs and children, as there are variables that could have an important influence, such as the type of training and sporting context, which have not been taken into account.

Author Contributions

All the authors participated in the design, documentation, development, and writing of the manuscript. This paper was reviewed by all the authors, and all of them are responsible for its contents and providing them with the final version.

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The Study Ethical Considerations

The study was conducted in accordance with the Declaration of Helsinki for research involving human participants (World Medical Association 2013). Before data collection, ethical considerations for the study were obtained from the ethical commission of University of Extremadura. The nature, ethics, and data-collection protocols of the project were presented during this meeting. Following this phase, parents or legal tutors signed informed consent forms for their children and adolescents to participate voluntarily in this research.

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