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ORIGINAL

VALIDATING OF THE BATTERY OF SKILL TESTS FOR WHEELCHAIR HANDBALL ATHLETES

VALIDACIÓN DE TESTS PARA ATLETAS DE BALON-MANO EN SILLA DE RUEDAS

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ABSTRACT

The Wheelchair Handball is opportunity of sport practice to people with physical disabilities. The aim of this study was to evaluate the validity and the reliability of a battery of skills tests to assess skills of wheelchair handball athletes.

29 physical disable athletes were assessed by the following tests: accuracy of passes, performance of block, ball conduction and 20 meters speed.

Our results have shown that the 20 meters speed, performance of block and ball conduction tests can be applied to the evaluation of wheelchair handball athletes.

KEYWORDS: Assessment; Tests; Disability; Wheelchair Handball; Adapted Sports, Parasports, Adapted Physical Activity.

RESUMEN

El balonmano en sillas de ruedas es un deporte adaptado que ofrece una oportunidad de actividades deportivas para personas con discapacidad física. El objetivo de este estudio fue evaluar la validez y la confiabilidad de una batería de tests de habilidad para el balonmano en silla de ruedas.

Los tests de precisión de pases, desempeño en el bloqueo, conducción de la pelota y velocidad en 20 metros fueron administrados en 29 atletas con discapacidades físicas.

Los resultados indican que los tests de velocidad de 20 metros, de desempeño en el bloqueo y de conducción de la pelota pueden ser aplicados para la evaluación de atletas de balonmano en silla de ruedas.

PALABRAS CLAVE: Evaluación; Tests; Discapacidad; Balonmano en Silla de Ruedas, Deporte Adaptado, Paradesporto, Actividad Fisica Adaptada.

1 INTRODUCTION

Wheelchair Handball (WH) is an adapted sport and provides an opportunity of sports activities for people with physical disabilities. The original study that led to rules standardization and allowed the competitive practice of this sport in Brazil was Calegari, Gorla, and Carminato (2005). These rules were adopted by several countries and the sport is in full development in Argentina, Brazil, Bolivia, Chile, Colombia, Uruguai and Venezuela (in South America), Portugal, France, England, Austria and Sweden (Europe), Japan (Asia) and Australia (Oceania). There are two rules applied: the WH7 it is an adaptation of the standard rules of handball to seven players on the court and, WH4 which is an adaptation of beach handball for four players. Apart from these adjustments, the main modifications of the rules are due of the wheelchair (chairs similar to wheelchair basketball) to displacement with the ball and the inclusion of a plaque reduction of goal that has 48 centimeters wide (goal remains 160 centimeters wide) to give conditions to the goalkeeper to play in a wheelchair (CALEGARI, 2010).

The use of physical skill tests to assess motor performance in wheelchair sports it's important to diagnose the status of the athletes' ability and monitor and planning progress in the training program (Brasile, 1990; Groot, Balvers, Kouwenhoven, & Janssen, 2012; Yilla & Sherrill, 1998). Over time, researchers began to focus on the use of measures for monitoring training in wheelchair handball athletes. The instruments used by Cardoso (2010) case were generalized tests and Oliveira (2011) developed a rating scale of the activities performed during training. However, none of the cited studies provided information about the instruments validity for application in wheelchair sports and although some studies are being carried out, there are only a few specific measures for wheelchair handball assessment, and they have not gone through a validation process, which makes their use questionable.

Costa e Silva, Calegari, Costa, and Gorla (2010) used five measures of the sport: a) Shooting Effectiveness (SE) evaluates the effectiveness of throws; b) Pass Performance (PP) to evaluate the performance passes for one minute; c) Blocking Performance (BP) that evaluates the athlete's ability to make stops with the wheelchair during the displacement speed , as in the case of the blockades, which the athlete uses to prevent displacement of the opponent, d) Ball Handling (BH) that evaluates the performance when moving driving the ball, and e) 20-Meter Sprint (20mS) that evaluates the displacement speed with wheelchair.

These authors used these skills tests to evaluate wheelchair handball athletes and, these measures were constituted the battery of skill tests for wheelchair handball. Based on this preliminary investigation, the present study focused on the validating and reliability evaluation of four tests of that battery. Shooting Effectiveness was not included here because in the pilot study, the values obtained did not indicate suitable reliability. Thus, the present study aimed

to contribute to the motor assessments of the sport as well as to the development of wheelchair handball overall.

2 METHODS

2.1 PARTICIPANTS

The study population consists of wheelchair handball players, with a physical disability that causes limitation in the ability to move and thus prevents them to participate in the conventional handball. At the time of writing this paper, as a way to encourage the participation of female athletes, women have been accepted to participate with the men (Calegari, 2010). Sampling was by convenience, given the limited number of practitioners. Their participation was voluntary and all of them were members of three teams of handball.

To participate in the study, all individuals could not present illnesses that would affect their motor performance likes pressure ulcers, authonomic disreflexia, between others. Initially 33 subjects took part in the sample, however, because it was a test re-test designed study, four subjects missed the re-test and were excluded. Thus, the final sample was composed of 29 players (21 males and eight females).

Of the 29 athletes, seven were lower limb amputees below the knee, seven were paraplegics with injuries between thoracic and lumbar spine, 13 presented poliomyelitis sequelae, one had Charcot-Marie-Tooth syndrome causing muscle atrophy, and one had Cerebral Palsy. In addition to participating athletes, three researchers with experience in wheelchair handball and with the battery protocol took part in the study as scorers.

The athletes were divided into four groups, according to the functional classification of wheelchair handball (Calegari, 2010). Group 1 (G1) was composed by athletes of Functional Class (FC) 1.0 and 1.5; Group 2 (G2) by athletes classified as 2.0 and 2.5; Group 3 (G3), for athletes CF 3.0 and 3.5; and Group 4 athletes CF 4.0 and 4.5.

Another classification of the participants was made by years of experience. The athletes were divided into two groups for this classification: "Apprentice" and "expert." While the apprentice level was related to athletes without competitive experience in BSR and less than a year of practice, the panel was composed of athletes with over a year of practice and participation in competitions BSR.

All participants were informed about the research purpose and conditions of their participation according to the consent form, which the participants read and signed. The study received the approval of the Research Ethics Committee, Faculty of Medical Sciences, UNICAMP, protocol number 228/2009.

Table 1. Characteristics of participants.

Nº	Sex	Club	Age	Disability	Classification	Level

1	Male	1	35	Poliomyelitis	4.5	apprentice
2	Male	1	47	Amputation above the knee	2.5	apprentice
3	Male	1	31	Poliomyelitis	2.5	expert
4	Male	1	38	Incomplete tetraplegia – C7	1	apprentice
5	Male	1	47	Complete paraplegia - T8	3	apprentice
6	Male	2	39	Complete paraplegia - T11	1.5	expert
7	Male	2	20	Complete paraplegia - T10	2	apprentice
8	Female	2	38	Poliomyelitis	2	apprentice
9	Female	2	19	Charcon Marie Toth	2	apprentice
10	Female	2	43	Poliomyelitis	1	apprentice
11	Male	2	32	Amputation above the knee	3	expert
12	Male	2	33	Amputation above the knee	4	apprentice
13	Male Male	3	39	Amputation above the knee	4.5	expert
14	Male	3	60	Amputation above the knee	4.5	apprentice
15	Male	3	12	Complete paraplegia - T10	2	expert
16	Male	3	19	Complete paraplegia - T3	1.5	expert
17	Female	3	22	Congenital malformation	5	apprentice
18	Male	3	37	Poliomyelitis	1.5	apprentice
19	Male	3	31	Amputation above the knee	3.5	expert
20	Female	3	44	Poliomyelitis	2	apprentice
21	Male	3	16	Amputation above the knee	3.5	expert
22	Male	3	37	Poliomyelitis	2	expert
23	Female	3	32	Poliomyelitis	3.5	apprentice
24	Male	3	38	Dislocation of the hip	5	expert
25	Female	3	34	Poliomyelitis	5	expert
26	Male	3	25	Congenital malformation	1	apprentice
27	Male	3	22	Amputation above the knee	4.5	expert
28	Female	3	32	Dislocation of the hip	5	expert
29	Male	3	43	Poliomyelitis	3.5	apprentice

2.2 DESIGN

Two trials of field tests was conducted to analyze reliability of battery. The trials were administered in two separate days at same time of the day, with 48 hours between tests. The four tests were administered in approximately 60 minutes for four players. Three scorers, coaches of wheelchair handball, with experience in the battery protocol collected the tests measurements (in both, test and retest assessments), for analysis of the inter-rater reliability.

Reliability was assessed to correlate the two attempts of the same test and evaluate the test-retest reliability measures of two different tests were correlated. Prior to each test, the athletes were given one practice attempt after the researcher explained about the protocol. This action was taken in order to minimize mistakes during the tests executions. The data collection was performed during one single execution of each test, conducted by the study's primary author and one of the three raters.

Each scorer had a spreadsheet with the names of the participants, where there was space for registering the test results. The administering sequence was: passes accuracy, block performance, ball handling, and 20 meter-sprint. This sequence was kept for the re-test and for all participants. All the athletes performed the first test, and then the subsequent was initiated.

Passes Performance (PP). This test assesses passing and catching abilities while throwing passes against the wall in one minute. The athlete must stay two meters from the wall, where he or she will shoot passes to himself, as fast as possible, using the wall during one minute period. For every pass/reception performed, one point is scored. Scoring is not considered if: the player drops the ball after the reception, if he crosses the 2-meter area. This test score will be the sum of the points scored in one minute.

Block Performance – (BP). This test aims to measure the ability to block and involves agility and speed components. Two trials are considered, and the best result is computed for analysis. Four cones are placed along a 9.75 m straight line. The athlete moves sprinting and simulates a block at the second cone. Next the individual spins and does the same in the first cone. Then he blocks at the third cone, spins and blocks at the second, goes to the fourth cone, returns to the third and after passing the fourth cone, he completes the course. A displacement of 27 meters is performed during the test due to changes in direction. Scoring for each trial is the total time taken to complete the entire course.

Ball Handling – (BH). This measure was adapted from a specific test for wheelchair basketball (Brasile, 1986; Brasile, 1990) and aims to assess the conduction of the ball. The athlete must maneuver through the course with the ball as quickly as possible in accordance with the WH rules (Calegari, 2010) within the path marked by the six cones. Material: 06 (six) cones and a standard course (the size of the

cones) ranging from 18 to 20 meters for the entire course. A distance of 3 meters between cones (figure 1.b). The athlete must be positioned before the test baseline and at the scorer signal, he must start dribbling in zig-zag around the cones, as fast as possible. If the athlete touches the cone or violates the WH dribble rule, it will be added 1 (one) second in the final time. There are two trials and the best result is computed for analysis.

20 meter-sprint – 20mS. This instrument used in other modalities (Yilla & Sherrill, 1998; Vanlandewijck, Daly & Theisen, 1999; Doyle, et al., 2004), consists of evaluating the athlete sprint in 20-meter distance. This test is proposed to assess the speed of displacement in a 20-meter course. Material: straight course of 22 meters placed at the base and finish lines with 4 cones; 01 (one) chronometer, 01 masking tape. The athlete begins positioned behind a taped baseline. At the rater's command, the player will sprint to the finish line as fast as possible. There are two trials and the best result is computed for analysis. The test result is the time spent to complete the course. The rater will be positioned at the finish line to record the test time. The assistant rater will be at the baseline to inform the rater of the moment the athlete begins and also to monitor if the athlete is not positioned over the line, gaining advantage.

2.3 ANALISIS

Data normality was assessed using the Shapiro-Wilk test. To diagnose the possible existence of inter-rater error, the best results of each subject were used in the test session and were used boxplot graphical analysis (McGill, Tukey, & Larsen, 1978) and also the one way analysis of variance (one way ANOVA)(Moore, McCabe & Craig 2012). For further analysis of the data rater 1 were used. The sample was described (mean and ± standard deviation) and Bland-Altman analyzes of agreement, the variance components (participants, trial and error), the intraclass correlation coefficient (test-retest, intra-test), standard error measurement (test and, test-retest) and smallest detectable difference (test and, test-retest) were used for reliability analysis (Altman, Bland 1995, Müller, Büttner 1994, Harvill 1991). The Pearson correlation was used to determine the dimensions of the test. Confidence intervals were calculated for the data of athletes separated by level of functional class and skill level. (Gardner, Altman 1986).

Then were performed Student t test to diagnose the ability of tests to determine differences arising from these two categorical variables. Two-way analysis of variance was used to evaluate interaction between functional classification and skill level. The analyzes were performed in the R statistical package (R Development Core Team, 2011) with R Studio interface and the level of significance was $p \leq 0.05$.

3 RESULTS

3.1 RELIABILITY

The inter-rater error evaluation not showed significant differences which evidences the inter-rater reliability for the four tests ($p \leq 0.05$, Figure I). The 20mS, block performance and ball handling presented acceptable values of agreement by Bland Altman analysis which were confirmed by intraclass correlation values, which were excellent for testing 20mS and ball conduction ($r > 0.91$) and, for good performance block performance ($r = 0.82$). Despite the test passes performance provide strong value intraclass correlation ($r = 0.80$) showed no satisfactory agreement between the measurements (95% LoA) and the values of standard error of measurement (SEM) were high for this test. The results for Test and re-test are shown in Table II.

Figure I. Analysis of the intra-rater reliability. One-Way ANOVA showed no significant difference - significant level ($p \leq 0.05$).

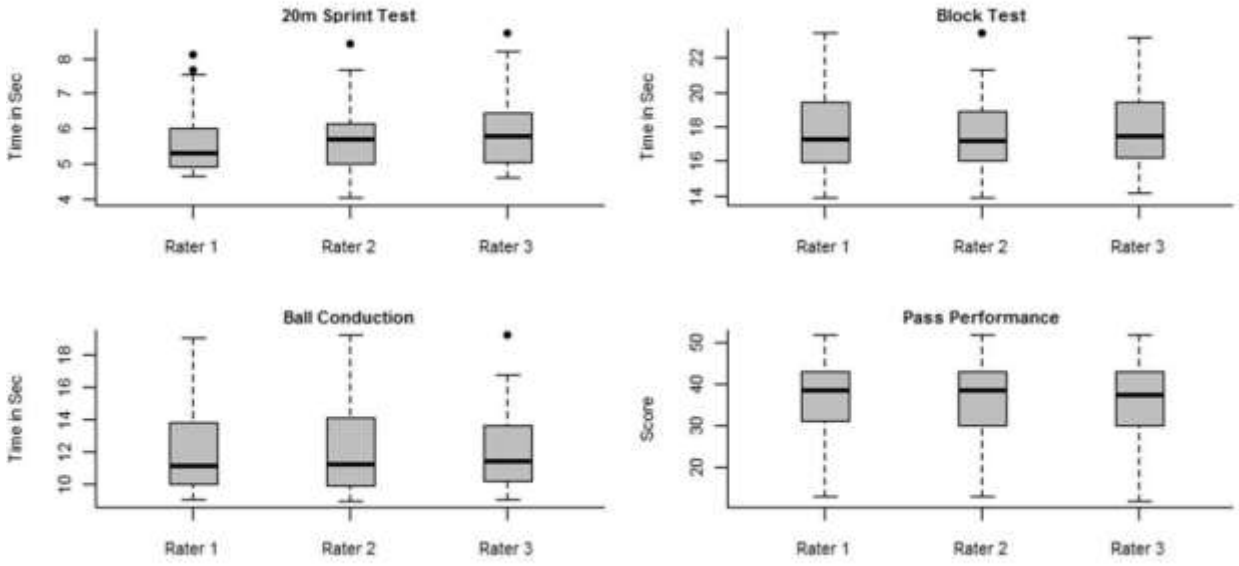

Table II. Descriptive statistics (mean ± standard deviation) and reliability measures from wheelchair handball skill tests on the two trials.

	test	re-test	95% LA	VAR (per)	VAR (int.)	VAR (error)	CCI (CI) (int. 1)	CCI (CI) (TR)	EEM (int 1)	EEM (TR)	SDD (trial 1)	SDD (TR)
Sprint 20m (s)	5.67 (±0.91)	5.70 (±0.90)	-0.44 a 0.38	0.83	0.11	0.84	0.94* (0.87-0.97)	0.97* (0.95 – 0.99)	0.03	0.00	0.08	0.02
Bloq (s)	17.54 (±2.30)	16.88 (±2.14)	-1.75 a 3.06	5.31	1.37	5.28	0.88* (0.77-0.94)	0.82* (0.65 – 0.91)	0.48	0.61	1.32	1.70

Cond (s)	12.00 (±2.76)	11.63 (±2.58)	-1.85 a 2.58	7.64	1.35	8.06	0.91* (0.82-0.96)	0.91* (0.80 – 0.96)	0.39	0.37	1.09	1.03
Pass	37.27 (±8.90)	40.85 (±9.44)	-13.14 a 5.99	79.24	27.54	72.89	0.83* (0.67-0.92)	0.80* (0.61 – 0.90)	11.22	10.23	31.10	28.38

95% LA = 95% Limits of agreement; VAR - variance; ICC - intraclass correlation coefficient; per - person; int. - Attempt; CI - Confidence Interval; SEM - standard error of measurement; MDD - smallest detectable difference (1.96 * √ 2 * SEM); TR - test re-test reliability of better results (int. 1 e 2). * Statistical significance p ≤ .05.

3.2 DIMENSIONS

The tests can be divided into essential components to the performance in wheelchair handball as a) pitch: passes performance, b) speed (sprint): 20 meters Sprint, c) Agility: blocking performance, ball conduction. The tests of sprint and agility were carried to seek similarity to that observed in court during the game. Despite constantly pass conducted in dynamic movement patterns, passes test here was designed as static, seeking greater control and best possibility to measure this ability.

The correlation between the tasks are described in Table III. It was observed that the 20mS showed moderate correlation (r = 0.78, p ≤ 0.05) with the block performance and an negative relationship with the passes performance (r = -0.78, p ≤ 0.05). Despite the observation of statistical significance (p ≤ 0.05). The correlation of the block performance when correlated with the ball conduction and passes performance was poor (r = 0.46 and r = -0.56).

3.3 VALIDITY

When the player's results have been divided according to functional classification we found significant differences between classes to 20mS and block performance. When the participants were divided according to skill level, we observed significant differences between groups to 20mS, block performance and ball conduction tests (Table IV). There were no significant differences in comparison to teams. The two-way analysis of variance not showed interaction between functional classification and skill level.

Table III. Discriminant analysis of tests (n = 29). Mean (± standard deviation).

Tests	Classification Level						Level of Practice		
	G1 (n=3)	G2 (n=9)	G3 (n=8)	G4 (n=9)	*F*	p	App (n=16)	Exp (n=13)	*p*
20mS (s)	7.05 (±0.95)*†#	6.01 (±1.12)‡	5.66 (±0.62)	5.25 (±0.50)	10.00	0.00	6.08 (±0.98)	5.16 (±0.45)	0.00

Block (s)	20.76 (±2.49)*†#	18.85 (±2.35)‡	17.94 (±1.64)¡	16.21 (±1.47)	12.77	0.00	18.68 (±2.10)	16.14 (±1.74)	0.00
Ball cond (s)	-	11.65 (±2.36)	11.97 (±3.21)	12.33 (±3.02)	0.89	0.12	13.58 (±2.76)	10.41 (±1.69)	0.00
Pass (score)	-	33.22 (±10.95)	40.12 (±8.32)	38.78 (±6.16)	3.81	0.06	34.30 (±8.61)	40.23 (±8.48)	0.08

*Statistical significance $p \leq .05$. App –Apprentice; Exp. –Expert; Statistical differences (ANOVA) between groups: *G1>G2; †G1>G3; #G1>G4; ‡G2>G4; ¡G3>G4.

4 DISCUSSION

The main objective of this research was to evaluation of reliability of the Battery Skill Tests for Wheelchair Handball Athletes due to the need of consistent instruments to assess in this modality and therefore meet the principle of assessment according to the sport training specificity. Given the small range of specific evaluation possibilities the present study is relevant for involving the first effort of validating specific instruments for WH. No significant differences in the error analysis between evaluators, demonstrating that the measures are reliable in assessing the specific motor skills WH.

The Passes Performance test was an useful instrument for evaluating determinant skills in this modality performance: passing. The PP test is of easy administration and understanding by the assessed subjects. The test values were homogeneous regarding the range. Table II shows the median values, ranging from 37.3 (±8.9) to 40.9 (±9.4) points. Although there was no significant difference between trials, there was a greater dispersion of values in the retest, which can be related to the influence of many passes performed for the first time (Table II). Furthermore, the result from the limits of agreement between moments in PP showed wide dispersion, assuming no agreement between measurements. Thus, the test does not show consistency, despite moderate values for CCI ($r = 0.80$, $p \leq 0.05$) between trials.

Regarding the test methodology, it was observed that besides the lack of a fixed target at the contact surface of the ball (wall), the time interval was relatively high for the measurement of a technical ability (one minute), in which the physical capacity of resistance may have influenced negatively the consistency test. Yilla & Sherrill, (1998) proposed a test for measurement of motor skill to pass in wheelchair rugby with the use of a fixed target and score which ranged from 1 to 10 according to the accuracy level with respect to the target. The test showed consistency and reproducibility for measuring this ability. As the wheelchair handball and rugby exhibit similarity with respect to this technical point, the test can be used and included in the test battery.

The Block Performance test quantifies an important skill for WH. The block is an action where the player stops the opponent, positioning himself in front his chair, it

can be either defensive or offensive and it is considered an action that can be performed by any field players.

As for the Block and Ball handling specific skills, there are no previous tests for assessing these skills specifically, which corroborates with the importance of validating these instruments. Both skills demand agility for maneuvering the chair and the instruments available for assessing this ability are not related to this modality requirements (Calegari, Gorla & Carminato 2005; Gorgatti, Bhome, 2003).

The Block Performance test also allows to evaluate agility, defined as a fast change in movement direction (Gorgatti, Bhome, 2003). In this study, the authors validated an agility test for wheelchair basketball players, which consists of a zig-zag path adapted from the Texas Fitness Test. The test is valid to assess agility, however it is of long administration (five trials per athlete). Thus, the test represents an excellent alternative to evaluate agility in WH, for giving scorers more time to assess.

The Ball Handling test measures this modality specific motor skill and also motor coordination, which is important due to the lack of instruments evaluating this variable in wheelchair athletes. For a perfect performance in this task, is it necessary to coordinate ball movement and driving wheelchair alternately, and also deviate from obstacles. The non-alternate ball handling does not constitute an error, although it impairs the task performance.

In the 20-meter sprint test, we observed that the test course is specific according to the game court dimensions, as well as the efforts made within WH matches. The sprint has been studied in wheelchair basketball frequently (Brasile, 1986, 1990; Doyle et al., 2004; Vanlandewijck, Daly & Theisen, 1999) and also in Wheelchair Rugby (Yilla & Sherrill, 1998). The 20-meter distance for the test course is considered ideal for this modality, according to the principle of sport training specificity (Platonov, 2008) there is no reason to assess the subjects in distances they do not move during a match. Analyzing the court dimensions, we note the frequent distance the player travels is approximately 28 meters (subtracting the two goal areas, 6 meters). Vanlandewijck, Daly & Theisen, (1999) reported values to 20m Sprint test as 5.93 s (±0.21). Recently Molik et al. (2010) reported that values under “good patern”, for this authors the reference in wheelchair basketball for “good” is 5.1 to 5.6 seconds. For wheelchair rugby the reference for Brazilian players is 6.57 s in 20m Sprint test (Gorla, Costa e Silva, Costa, & Campos, 2011).

The results of this paper are specific to WH athletes and suggest that athletes presenting lower values than the wheelchair basketball and rugby players. However, the difference between the values of basketball and handball is minimal. The difference between handball and rugby is logical because the functional limitation of wheelchair rugby athletes is greater than WH athletes, especially in the subjects in this study.

Until recently there were no studies or proposals of specific assessment of motor skills in this modality. Thus, the present study has innovative character and its comparison with other references is impaired due to the lack of literature. On Wheelchair basketball, some instruments have been used and deserve attention from researches that study WH to verify its adaptation. One of them consists of a protocol developed for the observation of this modality specific motor skills (Zwakhonven, Evaggelinou, Daly, & Vanlandewijck, 2003). Other studies (Brasile, 1986, 1990; Doyle et al., 2004) about basketball field tests have been developed.

Throughout this study, the scientific authenticity criteria for testing were verified to consolidate the battery applicability. All tests have satisfied the scientific authenticity criteria and, thus can be considered valid and applicable in assessing this modality athletes. The values reported in this study, specially for Brazilian athletes, are primary values of reference for the sport. Additional research, in other populations, will should focus on the development of normative values for the skills in question, and the construct validity of battery.

In the present study, the four tests have not presented inter-rater error, however, only 20mS, block performance and ball handling tests showed a good reliability and sensitivity related to the ability level of the players. Also, the factor analysis has shown that the main factor of these tests battery is speed. The results indicate that 20mS, block performance and ball handling tests can be applied for assessing wheelchair handball athletes.

5 REFERENCES

Brasile, F. (1986). Wheelchair basketball skills proficiencies versus NWBA classifications. Adapted Physical Acta Quartely, 3, 6–13. DOI: http://dx.doi.org/10.1123/apaq.3.1.6.

Altman, D. G, Bland, J. M (1999). Measuring agreement in method comparison studies. Stat Meth Med Res,8 (2), 135–60. DOI: https://doi.org/10.1191/096228099673819272

Brasile, F. (1990). Performance evaluation of wheelchair athletes: more than a disability classification level issue. Adapted Physical Acta Quartely, 7, 289–97. DOI: http://dx.doi.org/10.1123/apaq.7.4.289

Calegari, D. R. (2010). Adaptação do Handebol para a Prática em Cadeira de Rodas. Tesis de Doctorado. Universidade de Campinas – Unicamp, Campinas.

Calegari, D. R., Gorla, J. I., & Carminato, R. A. (2005). Wheelchair Handball. Proceedings of Brazilian Congress of Sports Sciences. Fortaleza-CE. (p. 50).

Cardoso, V. D. (2010). Avaliação da Composição Corporal e da Aptidão Física relacionada ao Desempenho de Atletas de Handebol em Cadeiras de Rodas. Tesis de Maestría. Universidade do Porto.

Costa e Silva, A.A., Gorla, J.I., Calegari, D.R., Costa, L. T. (2010). Adapting a battery of skills tests for wheelchair handball. Brazilian Journal of Science and Movement, 18(4), 73–80. [texto en portugués]. DOI: http://dx.doi.org/10.18511/rbcm.v18i4.2060

Doyle, T. L. A., Humphries, B., Dugan, E. L., Horn, B. G., Shim, J. K., & Newton, R. U. (2004). Further Evidence to change the Medical Classification System of the National Wheelchair Basketball Association. Adapted Physical Acta Quartely, 21(1), 63–70. DOI: http://dx.doi.org/10.1123/apaq.21.1.63

Gardner, M. J.; Altman, D. G. (1986). Confidence Intervals rather than P values: estimation rather than hypothesis testing. Brazilian Medicine Journal, 292(6522), 746-750. DOI: doi.org/10.1136/bmj.292.6522.746

Gorgatti, M.G., Bohme, M.T.S. (2003). Scientific Authentic of an agility test to wheelchair users. Revista Paulista de Educaçao Física, 17(1), 41–50. [texto en portugués].

Gorla, J. I., Costa e Silva, A. de A., Costa, L. T., & Campos, L. F. C. C. (2011). Validation of beck battery of skills tests to Brazilian players of wheelchair rugby. Braz Journal of Physicall Education and Sport, 25(3), 473–486. [texto en portugués]. DOI: 10.1590/S1807-55092011000300011

Groot, S. De, Balvers, I. J. M., Kouwenhoven, S. M., & Janssen, T. W. J. (2012). Validity and reliability of tests determining performance-related components of wheelchair basketball. Journal of Sports Science, 30(9), 879-87. DOI: 10.1080/02640414.2012.675082 react-text: 70

Harvill, L. M. (1991). Standard Error of Measurement. Educ Meas:Issues and Prac., 10(2), 33-41. DOI: 10.1111/j.1745-3992.1991.tb00195.x

McGill, R., Tukey, J. W., & Larsen, W. A. (1978). Variation of Boxplots. T Americ Stat, 32(1), 12–16. https://doi.org/10.2307/2683468

Molik, B., Kosmol, A., Laskin, J. J., Morgulec-Adamowicz, N., Skucas, K., Dabrowska, A., Gajewski, J., et al. (2010). Wheelchair basketball skill tests: differences between athletes' functional classification level and disability type. Fiz Rehab, 21(1), 11–19.

Moore, D.S.; McCabe, G.P.; Craig, B. (2012). Introduction to the Practice of Statistics. (7 ed.). W.H Freeman: New York.

Oliveira, A. C. S. (2010). Adapted handball: pedagogic approach and assessment at view point of disable persons. Tesis de Maestría. Universidade Federal de São Carlos.

Platonov, V. N. (2008). General Treated on sports training. São Paulo: Phorte. (p. 887

R Development Core Team. (2011). R: A language and environment for statistical computing. R Foundation for Statistical Computing. Vienna, Austria.

Müller, R., Büttner, P. (1994). A critical discussion of intraclass correlation coefficients. Stat Med, 13 (23-24): 2465–2476. DOI: https://doi.org/10.1002/sim.4780132310

Vanlandewijck, Y. C., Theisen, D. M. (1999). Field test evaluatin of aerobic, anaerobic, and wheelchair basketball skill performances. International Journal of Sports Medicine, 20, 548–54. DOI: https://doi.org/10.1055/s-1999-9465

Yilla, A. B., Sherrill, C. (1998). Validating the Beck Battery of Quad Rugby Skill Tests. Adapted Physicall Acta Quartely, 15(2), 155–167. DOI: https://doi.org/10.1123/apaq.15.2.155

Zwakhonven, B., Evaggelinou, C., Daly, D., & Vanlandewijck, Y. C. (2003). An observation protocol for skill proficiency assessment in male whellchair basketball. European Bulletin of Adapted Physical Activity, 2(3).

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