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Greek Translation, Content Validity, Test-Retest and Inter-Rater Reliability of Swimming with Independent Measure (SWIM) Assessment Test for People with Disabilities Based on Halliwick Concept

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Abstract

Objectives: Halliwick-based hydrotherapy has become one of the most widespread approaches in the water environment for people with disabilities. The Swimming with Independent Measure (SWIM) test was developed by Peackok (1993) based on the need to create specific aquatic assessment tests for people with disabilities. The purpose of our study was its translation into Greek language and the investigation of its metric properties. **Methods:** A total of 40 children with cerebral palsy aged on average 7.36 years participated in the study: 20 children with GMFCS 1 - 5 and cognitive limitations, and 20 children with GMFCS 1 - 4 without cognitive limitations. Two physiotherapists with extensive experience in hydrotherapy and Halliwick philosophy participated in the test-retest and inter-rater reliability and validity assessment. **Results:** The test-retest and inter-rater reliability for the overall score was found to be high (ICC = 0.99). In terms of validity, a positive correlation was found between SWIM and GMFM (r = 0.59). **Conclusions:** The Greek translation of the SWIM test was found to be highly reliable for assessing mental adaptation and functionality in the aquatic environment for children with disabilities, so it is recommended to professionals.

Keywords

Hydrotherapy, Halliwick, SWIM, Cerebral Palsy

1. Introduction

Cerebral palsy (CP) is the most common physical disability in childhood [1]. Due to the wide variety of etiology, the exact numbers from the different studies do not completely agree. On average, it occurs in 2 - 3 cases per thousand live births [2] [3], but in recent times, there has been some evidence and discussions that prevalence is decreasing and so the severity [4] [5]. The number of people with CP is constantly increasing, possibly because more and more premature babies with various forms of CP survive over time due to improvements in medical, nursing, and obstetric care. Cerebral palsy affects both sexes and is relevant with nationality and socioeconomic status [6].

It is characterized by abnormal control of body movements and positions because of premature (pre-, peri-, post-natal) brain damage or dysfunction. Motor disorders are the result of a neurological deficit and include neuromuscular and musculoskeletal disorders: muscle tone disorder, abnormal muscle contraction (spasticity, dyskinesia, dystonia and atrophy), skeletal abnormalities, balance disorders and loss of selective motor control [7] [8]. Motor function disorders, the main symptoms of cerebral palsy, are frequently accompanied by other dysfunctions, such as: sensation, perceptual, cognitive, communication and behavioral disorders, epilepsy, and secondary musculoskeletal disorders [9] [10].

For the past 20 years, swimming and especially hydrotherapy have played an important role in the rehabilitation of people with disabilities [11]. Rehabilitation in water is based on the advantages of the unique properties of the water. Buoyancy helps to perform any movement that is difficult to perform on land due to the inability to overcome gravitational constraints, supports the body and facilitates the further development of balance [12]. The constant control of body positions required by the patient in the water is a direct result of the relationship between the two opposing forces of the center of gravity and the center of buoyancy and thus enhances the development of balance, while on land, the control of body is mainly affected only by the center of gravity. The hydrodynamic properties of buoyancy and hydrodynamic forces were well utilized for progressive weight-bearing, assisted standing without support, and challenging balance training [13]. Water pressure improves respiration and increases heart rate [14] and alterations in respiratory muscles functioning might produce variations of the pulmonary volumes. The temperature used in hydrotherapy is 32˚C - 33˚C and helps to relax the muscles, affecting muscle tone [15], while it can provide pain relief [16]. At the same time, the viscosity slows down the speed of movement, facilitating the analysis of activities in individual pieces and giving the patient's brain a slower and more suitable rhythm for the acquisition of motor landmarks.

Most hydrotherapy interventions in the water aim to teach independence in the water, following the guidelines of standard swimming lessons. Gelinas and Reid [17] studied the reliability of standard swimming lessons in children with disabilities and reported that the special skills taught in them were developmen-

tally appropriate for most children with physical disabilities. The Halliwick Concept was developed by the swimming instructor and engineer of hydromechanics James McMillan and his wife Phyl McMillan in the late 1940s and early 1950s and aims to teach water independence to people with disabilities, while considering the specific characteristics of the aquatic environment [18]. Specifically, Halliwick Concept includes a 10-point program based on a kinetic learning sequence that focuses on maintaining body position at different levels of movement, while using the unique properties associated with water. The 10 consecutive steps lead individuals, with or without disabilities, to experience and conquer a variety of unique movement patterns, with the aiming of functional swimming. One of the first studies of Halliwick concept aimed to improve the Halliwick approach by using both a personalized approach and activity adjustments based on people with Down syndrome [19].

The use of hydrotherapy to improve the functional level of performance on land requires that hydro therapists perform assessment both in the water and on land [20] [21]. The therapist provides a valid assessment with information about the patient's current condition and level of ability. This allows for future treatment sessions to be tailored to the patient's needs [20].

A review of the literature showed that the issue of assessment in the aquatic environment has been neglected compared to the assessment of on land treatment. Many tools for assessing adaptation and function in the aquatic environment have been reported. Most of them have failed to prove their reliability and validity. Although the Aquatic Adjustment Test (AAT) was found to be highly valid and reliable in measuring motor function in the aquatic environment, it is not based on a specific hydrotherapy method [22]. The Water Orientation Checklist test was found to be reliable but was only tested in children with mental problems and autism for reliability among assessors, without being evaluated for test-review reliability [23] [24]. In addition, validity data were not evaluated, and its sensitivity to measuring functional change over time [25].

On land therapy focuses on a functional intervention, an approach that necessitates a reliable assessment tool that is sensitive enough to measure functional change and motor progression over time. The Gross Motor Function Measure (GMFM) considered to be the most reliable and valid tool in detecting functional and motor changes over time [26]. The GMFM assesses the ability to perform a variety of gross motor activities. In the water, there are several assessment tests to assess swimming skills for children with physical disabilities or learning disabilities, based on Halliwick concept: Aquatic Independence Measure—AIM [22], Humphries' Assessment of Aquatic Readiness—HAAR [27], Swimming with Independent Measure—SWIM [28] and the Water Orientation Test Alyn 1 & 2—WOTA 1 & 2 [29].

2. Development of SWIM

Based on the extensive experience she gained while working in a swimming pool

where she applied the Halliwick Concept, Kim Peackok (1993) developed a new assessment test in water [28]. SWIM is based on Halliwick Concept and the ten-point program. It aims to assess the functionality and adaptation to any group with or no disabilities and at all ages. The results of a small recent study show that it is sensitive enough to assess and monitoring individuals or groups [30] [31]. It consists of 10 checkpoints rated 1 - 7 and concern the development of: 1) the water entry, 2) the adaptation to water, 3) the breathing control, 4) the balance, 5) the forward transversal rotation, 6) the backwards transversal rotation, 7) the sagittal rotation, 8) the longitudinal rotation, 9) the combined rotation and 10) swimming movements.

3. Purpose

The purpose of this study was to translate and assess the reliability and validity of the SWIM tool in the Greek population and especially in children with cerebral palsy, in order to be available to Greek experts.

4. Methods

4.1. Licensing

In the first phase, the Halliwick Association of Greece requested licence and the rights for Swimming with Independent Measure (SWIM), the assessment tool as well as the manual from the International Halliwick Association.

4.2. Required Approval from Institutions

Approval was required from the Internal Ethics Committee of the Department of Physical Education and Sports Science, University of Thessaly. The research sample was submitted and approved with protocol number 3-3/15/07/2015.

Parental consent was requested for the participation of children in the research. The children's parents or guardians filled out a parental consent form for their child on order to participate in the tests and video.

The research was conducted in accordance with the principles of the World Medical Association Declaration of Helsinki (1975), as revised in 2013, which sets out the ethical principles for medical research involving living subjects.

4.3. Translation

The translation process followed the guidelines for correct performance in other language and consisted of the following steps [32]: Two freelance translators, familiar with medical, physiotherapeutic hydrotherapy terminology, translated the scale from English Greek language and then they compared their translations. The common result obtained from the two translations was given to a third independent translator, equally familiar with the terminology, to translate again into English, without knowing the original foreign language version of the test. Then the three translators met with each other and discussed the result to agree on the final version of the test in the Greek language.

4.4. Participants

The study involved a total of 40 children with cerebral palsy, 2.8 - 14 years old, GMFCS 1 - 5, the 20 only with motor impairments and the other 20 with motor and cognitive impairments [33]. **Table 1** shows the characteristics of the children who participated.

4.5. Reliability study, Test-Retest and Inter-Rater

A physiotherapist with experience in both hydrotherapy and the Halliwick concept and working in a pediatric rehabilitation center for 15 years (Assessor A) participated in the Test-Retest reliability study.

Evaluator A received an "assessment guide package" for the test that included the assessment forms and the grading sheets that set out the different evaluation method for each item according to detailed guidelines. The assessor was asked to familiarize himself with the assessment form before the day of the assessment and then apply the test to children. The assessor was then asked to assess each child again at 3-day. Every child was asked to perform each task three times, and the best performance was used as the final score.

Another physiotherapist-hydrotherapist with knowledge of Haliwick concept and specialized in pediatric physiotherapy with 13 years of experience working with children (Evaluator B) participated in the Inter-Rater reliability test. For assessor B, the exact same familiarization and preparation process was followed as for assessor A and he assessed the children on the 1st day at the same time as A, also assessing the child 3 times and using the best performance as the final score.

4.6. Validity Test

The evaluation of the validity of the test consisted of two stages: The validity of the content in relation to the Halliwick concept was first checked with the help of two internationally recognized Halliwick Senior Lecturers belonging to the International Halliwick Association (IHA) with years of experience in Halliwick concept. Comments and corrections were requested regarding the validity and correctness of the content of the test and the English to Greek and back translation.

Table 1. Sample characteristics.

Characteristics of sample	
	N = 40
Age, years average	7.36
Sex	
Males	18
Females	22
Disability	
Congenital	37
Acquired	3

The second stage concerned the direct comparison of the performance of motor progress on land and in the aquatic environment. For this purpose, a sample of 17 children with cerebral palsy participated in the validation test and were evaluated by an experienced physiotherapist using the Gross Motor Function Measure (GMFM) [34].

4.7. Statistical Methods

Reliability study. Reliability was measured by calculating the intra-class correlation coefficient (ICCs) and 95% confidence interval for the total and individual score, and the kappa coefficient for each of the items. We set IICC and KAPPA values greater than 0.7 as highly reliable [35]. We used standard measurement error (SEM, based on the formula SEM = SD [1 - ICC] 0.5) to quantify the error measurement in the same units as the original measurement [36]. We calculated 95% confidence intervals for all ICCs and SEMs.

Validity Study. To evaluate the hypothesis that there is a positive correlation between motor progress on land and in the aquatic environment, the Pearson correlation coefficient was calculated between the overall SWIM scores and the GMFM scores of gross mobility. We accepted coefficient values ranging from 0.4 to 0.8 as evidence of a moderate degree of correlation [37].

5. Results

5.1. Test-Retest Reliability

The descriptive statistics for measuring the reliability test between the two test points of the 1st examiner are analyzed in **Table 2**.

The Test-Retest Reliability table shows the results of the reliability test using the Cohen's Kappa Coefficient.

- For the SWIM scale: The Kappa index is 0.576 which means that there is relatively good reliability between the two evaluators. In addition, the Pearson correlation coefficient at the 1% significance level is 0.994 which indicates an almost absolute linear correlation between the first and second evaluator measurements. (**Table 3**)

The Intraclass Correlation Coefficient **Table 4** gives the correlation coefficient within groups. We observe high values of the correlation coefficient within groups that indicate the existence of reliability between the 2 evaluators of evaluator 1 (SWIM: 0.991).

5.2. Agreement between 2 Assessors

The descriptive statistics for measuring the reliability test between the two examiners are analyzed in the **Table 5** below for SWIM.

The Inter-rater Reliability **Table 6** shows the results of the reliability test using the Cohen's Kappa Coefficient.

- For the SWIM scale: The Kappa index is 0.423 which means that there is relatively good reliability between the two evaluators. In addition, the Pearson

correlation coefficient at the 1% significance level is 0.992 which indicates an almost absolute linear correlation between the first and second evaluator measurements.

Intraclass Correlation Coefficient gives the correlation coefficient within groups. We observe high values of the correlation coefficient within groups that indicate the existence of reliability between evaluators (SWIM: 0.989) (Table 7).

5.3. Validity Test

A positive significant but moderate correlation was observed between the overall performance of gross mobility and the overall SWIM score (GMFM and SWIM score, $r_P = 0.59$, $p < 0.05$, GMFM 5) (Table 8).

Table 2. Reliability test-retest.

	SWIM						
Assessor 1	**Mean**	**95% Confidence Interval for Mean**		**Variance**	**Std. Deviation**	**Minimum**	**Maximum**
		Lower Bound	Upper Bound				
1st Day	30.45	27.94	32.96	61.79	7.86	19.00	49.00
3rd Day	30.05	27.66	32.43	55.48	7.45	19.00	49.00

Table 3. Test-retest reliability.

		Value SWIM
Measure of Agreement	Kappa	0.576
Correlation	Pearson's	**0.994**
N of Valid Cases		40

Table 4. Intraclass correlation coefficient.

	Intra-class Correlation	**95% Confidence Interval**	
		Lower Bound	Upper Bound
SWIM	0.991	0.981	0.996

Table 5. Reliability between 2 assessors.

	SWIM						
Assessor	**Mean**	**95% Confidence Interval for Mean**		**Variance**	**Std. Deviation**	**Minimum**	**Maximum**
		Lower Bound	Upper Bound				
1	30.45	27.94	32.96	61.79	7.86	19.00	49.00
2	31.05	28.63	33.47	57.49	7.58	19.00	49.00

Table 6. Inter-rater reliability.

		Value SWIM
Measure of Agreement	Kappa	0.423
Correlation	Pearson's	0.992
N of Valid Cases		40

Table 7. Intraclass correlation coefficient.

	Intra-class Correlation	95% Confidence Interval	
		Lower Bound	Upper Bound
SWIM	0.989	0.967	0.985

Table 8. Validity.

	SWIM
Concurrent validity: a positive correlation with motor abilities on land	0.59*
	GMFM

Note: *$p < 0.05$.

6. Discussion

When assessing patients with mobility problems in the aquatic environment, the responsible therapist (mostly the physiotherapist) is often required to respond to the patients' parents about the change in motor status and adaptation to water, which is observed after some time of therapeutic intervention. The objective assessment of the motor change and adaptation to water of patients with disabilities can only be done through a functional control test, before and after any therapeutic intervention. From all the functional tests that have been designed to date, always according to the review of the international literature, it seems that SWIM, Water Orientation test Alyn (WOTA-1, WOTA-2), SWIM and to a lesser extent HAAR are the most commonly applicable tests for changes of function and adaptation to the aquatic environment. The purpose of this study was to translate and to investigate the reliability and validity of SWIM. The test was designed to measure functional independence and competence in the aquatic environment according to Halliwick concept 10-point program. Based on the results of this study, SWIM is reliable and valid for evaluating performance in the aquatic environment for the intended populations. The reliability of the resulting scores was strong both in relation to the level of the individual scores and in relation to the overall score. This is a prerequisite for any assessment tool used to assess participants with physical and mental disabilities. It could be considered that the most important factor that contribute to the high level of reliability are the simple scoring technique, the detailed test instructions, and the extremely specific parameterized test results. It is important to emphasize that the reliability is equally high both for the test-retest process by the same assessor with an

interval of 3 days between the 2 evaluations, and for the inter-rater assessment process between 2 different assessors. The results of the present study are in line with the results of a team from Slovenia who also investigated the SWIM for validity and reliability [30] [31]. To validate, they used Slovenia's national swimming skills assessment system to investigate the content of the SWIM, which was found to be high ($p < 0.5$). During the control of the results between two evaluators, a very high level of reliability was found ($r = 0.996$, ICC > 0.96), which is in agreement with the results of the present study. This assessment tool has been tested by another team for its reliability in Portugal with similar results (test retest: 0.987, inter rater: 0.924, ICC > 0.96) [38]. The item that showed the least reliability was 4, and probably due to the difficulty of the activity and the difficulty of balance in water and this position is likely to cause insecurity to the examinee. It is also important to emphasize the usefulness of the test in setting therapeutic targets in the aquatic environment. The high degree of agreement between the scores given by the scorers A and B who gave a close score for the same items demonstrates the ability of the tests to guide the organization of the treatment plan, depending on the performance in each item. Therefore, they can be used by therapists so that they can set treatment goals by observing and assess without having to re-perform the assessment. The results of any reliability study in clinical practice can be generalized depends on how carefully the study conditions approach those in the clinical setting and in particular, the participants, the assessors, and the way the evaluations are conducted. Participants in this reliability study represent the distribution and range of disabilities commonly encountered in pediatric rehabilitation. As there is no standard for evaluating adaptation and function in the aquatic environment, we used the following methods to support SWIM validity. The validity of the content was based on the fact that the test was developed based on Halliwick concept. The existing aquatic assessment tests published for people with disabilities reported validity factors [22] [23] [24]. Most of the published water assessment tests are based on swimming and are specifically designed for children without disabilities. Instead, Halliwick concept was specifically designed to achieve balance control and functional independence in the aquatic environment for people with disabilities. The significant correlation found between SWIM and GMFM ($r_P = 0.59$) may suggest that both on land and aquatic interventions identify similar but different functional constraints on behaviors in aquatic and land environments.

In the present study, 40 children participated in the reliability test, a larger number than the existing studies. Also, the children who participated in the research came from different therapeutic environments and structures, which may generalize the application of the assessment to a larger population.

7. Limitations of the Study

The main limitation of the study was that children who had any type of surgery or botulinum toxin in the past year were excluded from participating. The study

Also excluded children with autism, children with severe vision problems, and children who could not follow verbal instructions or reproduce the test representation. Finally, another limitation was that during the study, it was not possible to limit the therapeutic involvement of parents with children at home. However, the above assessment tools can be applied to quite a large population making them particularly useful to aquatic rehabilitation professionals.

8. Conclusion

The SWIM test is an aquatic assessment tool that measures adaptation and function in the aquatic environment for children with cerebral palsy and neurodevelopmental disorders. This test is clinically important and is designed to evaluate and monitor the function of participants with both motor and cognitive deficits. The present study proves that this test is valid and reliable and therefore its use by professionals in rehabilitation in the aquatic environment is encouraged. The present research is of great value to Greek professionals involved in water therapy as it is a valuable and reliable tool for evaluating and organizing a treatment plan.

Clinical Messages

- Water assessment is especially important for monitoring the progress and organization of the treatment program.
- The SWIM TEST is reliable and valid for water assessment
- The translation into Greek allows Greek professionals to use a new reliable tool.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Rosenbaum, P.L., Palisano, R.J., Bartlett, D.J., Galuppi, B.E. and Russell, D.J. (2008) Development of the Gross Motor Function Classification System for Cerebral Palsy. *Developmental Medicine & Child Neurology*, **50**, 249-253. https://doi.org/10.1111/j.1469-8749.2008.02045.x

[2] Maenner, M.J., Blumberg, S.J., Kogan, M.D., Christensen, D., Yeargin-Allsopp, M. and Schieve, L.A. (2016) Prevalence of Cerebral Palsy and Intellectual Disability among Children Identified in Two U.S. National Surveys, 2011-2013. *Annals of Epidemiology*, **26**, 222-226. https://doi.org/10.1016/j.annepidem.2016.01.001

[3] Oskoui, M., Coutinho, F., Dykeman, J., Jett, N. and Pringsheim, T. (2013) An Update on the Prevalence of Cerebral Palsy: A Systematic Review and Meta-Analysis.

Developmental Medicine & Child Neurology, **55**, 509-519. https://doi.org/10.1111/dmcn.12080

[4] Sellier, E., Platt, M.J., Andersen, G.L., Krageloh-Mann, I., De La Cruz, J. and Cans, C. (2016) Decreasing Prevalence in Cerebral Palsy: A Multisite European Population-Based Study, 1980 to 2003. *Developmental Medicine & Child Neurology*, **58**, 85-92. https://doi.org/10.1111/dmcn.12865

[5] Reid, S.M., Meehan, E., McIntyre, S., Goldsmith, S., Badawi, N. and Reddihough, D.S. (2016) Temporal Trends in Cerebral Palsy by Impairment Severity and Birth Gestation. *Developmental Medicine & Child Neurology*, **58**, 25-35. https://doi.org/10.1111/dmcn.13001

[6] Strauss, D., Brooks, J., Rosenbloom, L. and Shavelle, R. (2008) Life Expectancy in Cerebral Palsy: An Update. *Developmental Medicine & Child Neurology*, **50**, 487-493. https://doi.org/10.1111/j.1469-8749.2008.03000.x

[7] Flett, P.J. (2003) Rehabilitation of Spasticity and Related Problems in Childhood Cerebral Palsy. *Journal of Paediatrics and Child Health*, **39**, 6-14. https://doi.org/10.1046/j.1440-1754.2003.00082.x

[8] Kriger, K.W. (2006) Cerebral Palsy: An Overview. *American Family Physician*, **73**, 91-100.

[9] Rosenbaum, P., Paneth, N., Leviton, A., Goldstein, M. and Bax, M. (2007) A Report: the Definition and Classification of Cerebral Palsy. *Developmental Medicine & Child Neurology*, **109**, 8-14.

[10] Cans, C., Dolk, H., Platt, M.J., Colver, A., Prasauskiene, A. and Krageloh-Mann, I. (2007) Recommendations from the SCPE Collaborative Group for Defining and Classifying Cerebral Palsy. *Developmental Medicine & Child Neurology*, **109**, 35-38. https://doi.org/10.1111/j.1469-8749.2007.tb12626.x

[11] Becker, B.E. and Cole, A.J. (2004) Comprehensive Aquatic Therapy. 2nd Edition, Butterworth-Heinemann, Philadelphia.

[12] Geigle, P.R., Cheek, W.L., Gould, M.L., Hunt, H.C. and Shafiq, B. (1997) Aquatic Physical Therapy for Balance: The Interaction of Somatosensory and Hydrodynamic Principles. *The Journal of Aquatic Physical Therapy*, **5**, 4-10.

[13] Becker, B.E. (2009) Aquatic Therapy: Scientific Foundations and Clinical Rehabilitation Applications. *PM&R*, **1**, 859-872. https://doi.org/10.1016/j.pmrj.2009.05.017

[14] Christodoulaki, E., Chandolias, K. and Hristara-Papadopoulou, A. (2018) The Effect of Hydrotherapy-Halliwick Concept on the Respiratory System of Children with Cerebral Palsy. *International Journal of Pediatrics*, **4**, Article No. 63.

[15] Biscarini, A. and Cerulli, G. (2006) Modeling of the Knee Joint Load in Rehabilitative Knee Extension Exercises under Water. *Journal of Biomechanics*, **40**, 345-355. https://doi.org/10.1016/j.jbiomech.2005.12.018

[16] Whitney, S.L. (1989) Physical Agents: Heat and Cold Modalities. In: Scully, R.M. and Barnes, M.R., Eds., *Physical Therapy*, Lippincott, Philadelphia, 856-857.

[17] Gelinas, J.E. and Reid, G. (2000) The Development of Traditional Learn-to-Swim Progressions for Children with Disabilities. *Adapted Physical Activity Quarterly*, **17**, 269-285. https://doi.org/10.1123/apaq.17.3.269

[18] McMillan, J. (1977) The Role of Water in Rehabilitation. *Fysioterapeuten*, **45**, 43-46, 87-90, 236-240.

[19] Kokaridas, D., Angelopoulou-Sakadami, N. and Walters, B. (2000) An Intervention in the Halliwick Method Procedures (Swimming) for a Group of Individuals with Down's Syndrome. *European Journal of Special Needs Education*, **15**, 218-231.

https://doi.org/10.1080/088562500361637

[20] Campion, M.R. (1997) Hydrotherapy: Principles and Practice. Butterworth-Heinemann, Oxford.

[21] Styer-Acevedo, J. and Curillo, J. (1994) Integrating Land and Aquatic Approaches with a Functional Emphasis. *Orthopedic Physical Therapy in North America*, **3**, 165-178.

[22] Chacham, A. and Hutzler, Y. (2001) Reliability and Validity of the Aquatic Adjustment Test for Children with Disabilities. *Movement*, **6**, 160-189.

[23] Killian, K.J., Arena, S.A. and Bruno, L. (1987) Refinement of Two Instruments That Assess Water Orientation in Atypical Swimmers. *Adapted Physical Activity Quarterly*, **4**, 25-37. https://doi.org/10.1123/apaq.4.1.25

[24] Killian, K.J., Joyce-Petrovich, R.A., Menna, L. and Arena, S.A. (1984) Measuring Water Orientation and Beginner Swim Skills of Autistic Individuals. *Adapted Physical Activity Quarterly*, **1**, 287-295.

[25] Lepore, M., Gayle, G.W. and Stevens, S. (1998) Adapted Aquatics Programming. Human Kinetics, Champaign.

[26] Ketelaar, M. and Vermeer, A. (1998) Functional Motor Abilities of Children with Cerebral Palsy: A Systematic Literature Review of Assessment Measures. *Clinical Rehabilitation*, **12**, 369-380. https://doi.org/10.1191/026921598673571117

[27] Humphries, K.M. (2008) Humphries' Assessment of Aquatic Readiness. Texas Woman's University, Department of Kinesiology, Denton.

[28] Peacock, K. (1993) Swimming with Independent Measurement: Manual for Evaluation. Halliwick Association of Swimming Therapy, London.

[29] Tirosh, R., Kats-Leurer, M. and Gettz, M. (2008) Halliwick-Based Aquatic Assessments: Reliability and Validity. *International Journal of Aquatic Research and Education*, **2**, Article No, 4. https://doi.org/10.25035/ijare.02.03.04

[30] Groleger Sršen, K., Vrečar, I. and Korelc, S. (2012) Content Validity and Inter-Rater Reliability of the Halliwick-Concept-Based Instrument "Swimming with Independent Measure". *International Journal of Rehabilitation Research*, **35**, 116-123. https://doi.org/10.1097/MRR.0b013e32835277ab

[31] Groleger Sršen, K., Vrečar, I. and Vidmar, G. (2010) The Halliwick Concept of Teaching Swimming and Assessment of Swimming Skills. *Rehabilitation* (*Ljubljana*), **9**, 32-39.

[32] Wild, D., Grove, A., Martin, M., Eremenco, S., McElroy, S., Verjee-Lorenz, A. and Erikson, P. (2005) Principles of Good Practice for the Translation and Cultural Adaptation Process for Patient Reported Outcomes (PRO) Measures: Report of the ISPOR Task Force for Translation and Cultural Adaptation. *Value Health*, **8**, 94-104. https://doi.org/10.1111/j.1524-4733.2005.04054.x

[33] Palisano, R., Rosenbaum, P., Walter, S., Russell, D., Wood, E. and Galuppi, B. (1997) Development and Reliability of a System to Classify Gross Motor Function in Children with Cerebral Palsy. *Developmental Medicine & Child Neurology*, **39**, 214-223. https://doi.org/10.1111/j.1469-8749.1997.tb07414.x

[34] Russell, D.J., Rosenbaum, P.L., Lane, M., Gowland, C., Goldsmith, C.H. and Boyce, W.F. (1994) Training Users in the Gross Motor Function Measure: Methodological and Practical Issues. *Physical Therapy*, **74**, 630-636. https://doi.org/10.1093/ptj/74.7.630

[35] Shrout, P.E. and Fleiss, J.L. (1979) Intraclass Correlations: Uses in Assessing Rater Reliability. *Psychological Bulletin*, **86**, 420-428.

https://doi.org/10.1037/0033-2909.86.2.420

[36] Stratford, P.W. and Goldsmith, C.H. (1997) Use of the Standard Error as a Reliability Index of Interest: An Applied Example Using Elbow Flexor Strength Data. *Physical Therapy*, **77**, 745-750. https://doi.org/10.1093/ptj/77.7.745

[37] Guyatt, G., Walter, S., Shannon, H., Cook, D., Jaeschke, R. and Heddle, N. (1995) Basic Statistics for Clinicians: 4. Correlation and Regression. *Canadian Medical Association Journal*, **152**, 497-504.

[38] Lima, A.A.R. (2016) Traducao adaptacao transculturar da escala Swimming with Intepentent Measure (S.W.I.M) para lingua portuguesa do Brasil e analise psicometrica. Disertacion de Maestria, Faculdate de Medicina, Universidad de Sao Paulo, Sao Paulo.