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Adaptation of the Aquatic Functional Assessment Scale for Babies – AFAS-BABY©

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ABSTRACT

Despite the increasing use of the aquatic environment (AE) as a therapeutic option for activities with infants and toddlers and the increasing number of assessment instruments for land-based physical therapy, no instrument addresses the characteristics of the aquatic environment regarding babies. This study aimed to adapt the aquatic behaviors of the Aquatic Functional Assessment Scale (AFAS) for babies, encompassing infants and toddlers aged three to 24 months (AFAS-Baby). First, a child was observed in the AE by two experts, with adjustments being made by three professionals with experience in the scale. Second, 5 children were evaluated to verify both the scale's applicability and the need for adjustments in it. Lastly, 6 professionals/experts validated the content of the scale. Hence, the AFAS-Baby comprises 61 behaviors: 8 in the Adaptation (A) phase, 14 in Mastering of the water environment (D), 35 in Specialized Therapeutic Exercises (E), and 4 in Global fitness (Cd). The score remained unchanged, following the original scale. The AFAS-Baby enables the assessment of specific aquatic motor behaviors for infants and toddlers, as well as assists professionals in the aquatic stimulation of babies.

KEYWORDS: infant development, physical therapy, hydrotherapy, motor skill, evaluation.

INTRODUCTION

Aquatic physical therapy is widely used for pediatric interventions because, when immersed, the body is influenced by hydrostatic, hydrodynamic, and thermodynamic factors, with repercussions on the child's neuropsychomotor development (NPMD) (Becker, 2009; García et al., 2016).

Although the aquatic environment in all age groups is widely used, whether in health promotion (such as the stimulation of NPMD), rehabilitation, or performance, the functional motor behaviors in water-immersed bodies are scarcely described (Israel & Pardo, 2014; Santos et al., 2017). Several factors (such as the body's shape and density, the movement's intensity, rhythm, and speed) influence the body's behavior when immersed (Barbosa et al., 2006). Thus, it is important to understand how the immersed body behaves to better understand its aquatic activity.

A complete assessment leads to an adequate intervention with good results, justifying the need for a scientifically-based, systematic, and well-elaborated aquatic assessment (Barbosa et al., 2006). This environment has specific physical and thermal properties that act on the immersed body, and it is necessary to know them to improve the aquatic interventions and its benefits on land functions (Israel & Pardo, 2014). Moreover, there is a preference for the aquatic environment in some cases, which results in greater adherence (Güeita-Rodríguez et al., 2017; Muñoz-Blanco et al., 2020).

This is particularly the case of neuromotor potentials for children/babies who are in their full NPMD, who can benefit from playing and stimulating their aquatic skills in the heated pool, later transferring such learning to land-based activities (Muñoz-Blanco et al., 2020).

The literature is scarce regarding instruments that evaluate aquatic functional movements, especially in babies. Thus, the study of the movements of babies and preschoolers in the aquatic environment is an investigation field to be explored (Veloso et al., 2007; Santos et al., 2017) because it provides the basis for interventions in this age group, both for typical babies and those at risk and/or with developmental delays.

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Barbosa et al. (2006) developed a road map for physiotherapeutic assessment of water and land-based therapies, approaching adults with musculoskeletal disorders. Israel and Pardo (2014) described the application of the AFAS (Aquatic Functional Assessment Scale) for motor skills learning in adults with neurological sequelae.

Santos et al. (2017) developed a system for assessing the development of displacements in the aquatic environment for children, pointing out the need to expand to other behavioral dimensions in water immersion. Veloso et al. (2007) developed a system to categorize the baby's motor behavior for respiratory control and underwater orientation. Murcia and Pérez (2008) developed and validated a scale to measure four- to five-year-old children's perceived motor competence in aquatic environment.

As yet, no functional assessment instrument for the aquatic environment adapted for infants and toddlers has been found. The aquatic environment has been increasingly used as a therapeutic resource to stimulate the activities of typical, atypical, and/or at-risk babies for developmental delay. Despite the numerous assessment instruments for land-based physical therapy, there is a need to develop a scale that encompasses the aquatic environment's specific characteristics and its influences on the baby's water-immersed body.

To this end, it is necessary to investigate and systematize aquatic skills in babies in order to improve the underwater physical practice, aiming to improve the outcomes in the domains of activity and participation in children, as proposed by the International Classification of Functioning, Disability and Health (ICF) (Longo et al., 2018; Mélo et al., 2019; Novak et al., 2013).

This study aimed to adapt the aquatic behaviors of the Aquatic Functional Assessment Scale (AFAS) (Israel & Pardo, 2014) for babies from three to 24 months old (AFAS-Baby).

METHODS

This cross-sectional study was approved by the Research Ethics Committee of the Federal University of Paraná under CAAE: 57193516.6.0000.0102, nº 3.715.672.

The methodology consisted of two stages. In Stage I, the scale items were developed and adapted based on the motor behaviors described in the original AFAS (Israel & Pardo, 2014). This resulted in the first version of the scale for infants and toddlers up to 24 months old – considering the target population, the age range was standardized with the term "babies". Initially, two experts (one with 25 and the other 10 years of experience in the field) observed a baby 24 months old in the aquatic environment. Then, three professionals with six years of experience in applying the AFAS analyzed and discussed the original scale to determine its necessary adjustments for the adaptation of motor skills assessment for babies three to 24 months old. Also, five babies of different ages were assessed to verify the applicability of the whole scale, as well as the need for adjustments. The babies were selected by convenience, for the sample to be representative of each age group; therefore, one baby was selected out of each of the following age groups: three to six months, six to nine months, nine to 12 months, 12 to 18 months, and 18 to 24 months, with age the, 3, 7, 11, 16 and 23 months, respectively. Thereby, in this first Stage, the AFAS (Israel & Pardo, 2014) was adapted for babies, creating the Aquatic Functional Assessment Scale - Baby (AFAS-Baby). The parents and/or legal representatives interested in participating in the study signed an Informed Consent Form authorization.

Stage II consisted of the content assessment by experts/experienced researchers in the field, based on the degree of agreement (Alexandre & Coluci, 2011). The AFAS-Baby was submitted to evaluation by a committee of expert judges of Pediatric Neurofunctional Physical Therapy and/or Aquatic Physical Therapy for the analysis and assessment of the content. Fourteen experts who had not participated in Stage I were selected; however, only six of them accepted to participate in this study in Stage II and returned the material on time.

All the 6 experts who evaluated the scale were physical therapists, with an average of 8.83 years (±5,91) of clinical experience and 7.83 years (±1,94) of research in Neurofunctional Physical Therapy and/or Aquatic Physical Therapy, as well as familiarity with child assessment instruments and/or aquatic environment assessment.

These experts assessed the scope of the instrument, the characteristics of the target population, clarity and relevance of the items. After the analysis, they made suggestions for changes in the items, as well as inclusions or exclusions.

An email was sent to the selected experts inviting them to participate in the research, explaining the objectives of the study and the participation expected of each of them, as well as the deadlines for submission. A new email was sent to those who accepted the invitation, containing the Informed Consent Form for them to sign, a small questionnaire about their curriculum vitae, and a version of the AFAS-Baby. They were asked to analyze each item's semantics, content, comprehensiveness, scope, and relevance. The document described the objective of the study, the instrument, its score, and the interpretation of both the original and the adapted scales.

The questionnaire consisted of 49 items, each with the following four subitems: name of the motor behavior, its description, the scoring criteria, and the age range to which

each behavior apply. The questionnaire also had three items to evaluate the instructions, the required materials, and the general score. There were also general instructions for filling out the questionnaire, blank space for suggestions and observations, and two columns to indicate each subitem's relevance and understanding. Some examples of the questionnaire sent to the experts are presented in Table 1.

Based on the expert's assessments, a data-sheet with all the answer options was developed, scoring 1 for "in agreement" and 0 for "not in agreement". The degree of agreement between the judges was calculated based on its percentage – a 90% agreement rate between the judges was considered acceptable. The following formula was used (Alexandre & Coluci, 2011):

$$\%\ agreement = \frac{number\ of\ participants\ who\ agreed \times 100}{total\ participants}$$

Thus, behaviors with less than 90% of relevance were excluded, whereas adjustments were made to items with less than 90% of agreement.

After the analysis, adjustments were made to the AFAS-Baby, considering the results of the agreement percentage method, as well as the experts' suggestions and observations.

RESULTS

All experts reported they knew and/or to had used the original AFAS scale. They also reported they were unacquainted with any specific aquatic behavior assessment instrument for babies.

The percentage of agreement in the experts' evaluations of the general items of the scale (instructions, required materials, and general score) are shown in Table 2. Of the three items evaluated, some adjustments were made to the description of the instructions, as suggested by the evaluators, to make the information clearer.

In this first Stage of the experts' evaluation, only the understanding of the instructions had a percentage of agreement lower than 90%, which led to adjustments in its description.

In the second Stage of the evaluation, the 49 water environment behaviors approached in the scale were separately analyzed in the phases demonstrated in table 3. Regarding both the assessment of the scale and the understanding of the items, in most of them, the name of the behavior, its description, and score presented high relevance, as well as the procedures of the score.

In the adaptation (A) phase, of the nine initial behaviors, one was excluded, and two had their description adjusted,

Table 1. Example of the scale organization for expert evaluation

A1 = (a) enters the pool by the edge (b) on the lap (c) or walking	( ) Relevant ( ) Not relevant Justification / Suggestion: ( ) Understandable ( ) Not Understandable Justification / Suggestion:
Description: (a) places the child sitting on the edge of the pool, calls the baby to enter, observes the child's response; b) in the lap of the person in charge, enters by the horizontal ladder, physical therapist calls into the pool, observes the child's response; (c) a child enters the pool by walking down the ramp or stairs.	( ) Relevant ( ) Not relevant Justification / Suggestion: ( ) Understandable ( ) Not Understandable Justification / Suggestion: ( ) 0-3m ( ) 3-6m ( ) 6-9m ( ) 9-12m ( ) 12-18m ( ) 18-24 m Justification / Suggestion:
Score: 1 - does not perform; 2 - performs with full support, needs support in more than 2 parts of the body and/or goes in the lap and/or shows no interest in entering the pool and/or cries; 3 - performs with partial support, needs support in 1 or 2 parts of the body, 4 - performs without support, with motor domain and partial coordination; 5 - performs without support, with full motor domain and coordination, with interest and/or leads the upper limbs towards the water and/or smile.	( ) Relevant ( ) Not relevant Justification / Suggestion: ( ) Understandable ( ) Not Understandable Justification / Suggestion:

Table 2. Results of items evaluated by experts in the general items of the scale

	Evaluated items	Relevance	Understanding
		% agreement	
General items	Orientations	100%	83.33%
	Materials required	100%	100%
	General score	100%	100%

resulting in eight behaviors. Regarding the mastering of the water environment, there were initially eight behaviors. Two of them were excluded, and another eight were added to allow for separate scoring of right and left side performance (when the behavior had this peculiarity) or when the movement was fragmented. Hence, it totaled 14 behaviors. As for the 28 behaviors described in specialized therapeutic exercises, three were excluded, 14 had their description adjusted, nine underwent changes in their scoring, and another 10 were added to allow separate scoring in the right and left side performance and/or peculiarities suggested by the experts – it totaled 35 behaviors. The four behaviors were maintained in the global fitness phase, with only some adjustments to make their descriptions clearer.

There was no consensus between the experts when choosing the age group to which each behavior applies. Moreover, they suggested not to divide the behaviors by age group.

The scale scoring remained the same as that of the original scale, which ranges from 1 to 5 – the higher the score, the better the baby's motor skills and independence in the water.

As suggested by the experts, the behaviors were sequentially numbered to make them easier to be applied. Thus, the final version of the AFAS-Baby scale, available in Appendix 1, has 61 behaviors.

DISCUSSION

This study aimed to adapt the aquatic behaviors of the assessment AFAS for babies three to 24 months old (AFAS-Baby). The adjustments suggested by the experts were relevant not only to improve the understanding of the scale but also to allow a comprehensive approach to aquatic motor behaviors since the aquatic environment has been considered beneficial for the performance of exercises and stimulation of

Table 3. Results of the items evaluated by experts in the phases

Phases	Number of items	Name		Description		Score	
		% agreement					
		Relevance	Understanding	Relevance	Understanding	Relevance	Understanding
Adaptation (A)	6	100%	100%	100%	100%	100%	100%
	2	100%	83.33%	100%	100%	100%	100%
	1	83.33%	100%	100%	100%	100%	100%
Mastering of the water environment (D)	6	100%	100%	100%	100%	100%	100%
	1	83.33%	100%	100%	100%	100%	100%
	1	83.33%	100%	83.33%	100%	100%	83.33%
Specialized Therapeutic Exercises (E)	4	100%	100%	100%	100%	100%	100%
	5	100%	100%	83.33%	100%	100%	100%
	4	100%	100%	100%	83.33%	100%	100%
	4	100%	100%	100%	100%	100%	83.33%
	2	100%	100%	83.33%	100%	100%	83.33%
	1	66.66%	100%	100%	100%	100%	100%
	1	100%	100%	100%	66.66%	100%	100%
	1	100%	100%	100%	100%	100%	66.66%
	1	100%	83.33%	100%	83.33%	100%	100%
	1	100%	83.33%	100%	100%	100%	83.33%
	1	100%	100%	83.33%	83.33%	100%	100%
	1	83.33%	100%	83.33%	100%	100%	100%
	1	83.33%	66.66%	100%	83.33%	100%	100%
	1	100%	100%	100%	66.66%	100%	83.33%
Global fitness (Cd)	1	100%	100%	100%	100%	100%	100%
	3	100%	100%	100%	66.66%	100%	100%

different populations, including babies and children (García et al., 2016; Mcmanus & Kotelchuck, 2007).

The great number of recreational activities in the aquatic environment is beneficial due to the physical and thermal water properties (Becker, 2009). However, studies with aquatic interventions in babies and young children are scarce, and evaluations using specific instruments, as the scale proposed in this study, can assist in data collection to support more studies with these interventions.

In the literature, the outcomes in the available studies are related to land-based therapy and usually do not carry out standardized assessments in the aquatic environment (Araujo et al., 2020). This limits the possibility of extending the results, hampering the comparison between studies and narrowing, not only, the intervention strategies but also the results in the evaluated outcomes. There is a consensus on the need for standardized and systematic evaluations to measure results in order to establish the repercussions on intervention effectiveness (Barbosa et al., 2006), as well as the need for adequate instruments to plan specific actions and support public policies (Araujo et al., 2018). Despite the wide variety of evaluation instruments for land exercises, aquatic instruments are still scarce. Therefore, this study contributed to the development of an aquatic instrument, which was widely accepted by experts and minutely elaborated by different professionals with experience in this area.

The study by Yamaguchi et al. (2020) used the original AFAS (Israel & Pardo, 2014) to verify the effects of an aquatic physical therapy program on the acquisition of aquatic motor skills in adults with Parkinson's disease. The authors verified that training inside the pool improved the aquatic skills, as well as the land functional motor skills. The research by Israel (2018) used the same scale on muscular dystrophy, which enabled each participant's progress and performance in aquatic functional motor skills to be monitored. Hence, assessing the acquisitions made in the water and their transfer for use outside the aquatic environment allows for a greater understanding of the neuroplastic changes brought about by the aquatic exercise. Consequently, light is shed on how these modifications are transferred to a real environment and how the child participated in it.

Evaluations in the aquatic environment are necessary since it has specific characteristics, which makes different motor behaviors to be observed in it in comparison with those in land-based therapy (Becker, 2009; Iucksch et al., 2020). Instruments like the AFAS-Baby scale, proposed in this study, can improve the knowledge of the water-immersed body. They facilitate the development of more specific therapeutic strategies according to the needs and objectives established for the babies and provide a follow-up tool to observe the evolution in this environment, with repercussions that extend to daily life activities.

Each item's tiered score, as adopted in other studies with assessment instruments (Mancini et al., 2016; Russell et al., 2011), allows for a better acquaintance with the child's learning and motor gesture in the water, not limiting whether they performed the task or not. This scoring encompasses the independence in the behavior – with an analysis of the coordination and control, the need for supports, the number of supports they need, and the dependence or nonperformance. When the child does not perform the task, it is possible to define what were the reasons for it, whether the child refused to do it, or the professional did not manage to observe the item to be assessed. Furthermore, the total score of the phase and the scale makes it possible to quantify the child's progress. Therefore, it is a quantitative scale that allows for a qualitative analysis of the child's aquatic motor behavior.

Noticeably, for some children with neurodevelopmental delays and/or neuromotor impairments, water is an environment that makes it possible to perform motor skills (mobility) and learn behaviors, which are hampered or altogether impossible in land-based exercises (Araujo et al., 2020; Iucksch et al., 2020). Thus, the analysis and monitoring of motor behaviors in the aquatic environment are essential to evidence-based intervention protocols (Güeita-Rodríguez et al., 2019).

Through this research, various professionals who work with children in the aquatic environment will have access to an instrument that will aid in the systematic assessment, covering a wide age range and useful in different health conditions. The scale assesses the aquatic motor skills based on the child's/baby's development according to their neuromotor potential. Consequently, this will allow better oriented and more specific interventions according to the needs of each case.

The intervention program is part of following up on the progress process of the child's NPMD. Hence, based on the assessment, it is possible to know their history and health from the contextual/ecological BPS model's perspective and then establish an action plan with functional goals and objectives (Angeli et al., 2019). The aquatic assessment also makes it possible to develop and select the complexity of the tasks and aquatic exercises based on the child's potentials, allowing for repercussions in the participation of the child and relatives. Moreover, through a periodical assessment and reassessment process, it is possible to systematically control the child's progress with records, develop the aquatic stimulation program, and plan their discharge and/or referral for other activities (Yamaguchi et al., 2020).

The present research also provides a low-cost, easily accessible instrument. It is similar to the notes in the study by Mélo et al. (2019), which highlights that the use of low-cost evaluation scales, developed specifically for the child population and freely available in the literature, can assist professionals in the survey of more specific actions for the specificities of each child. Also, they provide the basis for early interventions to reverse or minimize damage to the neuropsychomotor development. This corroborates studies (Araujo et al., 2017; Araujo et al., 2019; Yamaguchi et al., 2019) that identified the need for programs to stimulate children with established developmental risks, especially under unfavorable conditions.

The assessment of learning and motor behaviors in the water can provide quantitative as well as qualitative data on the child's motor behavior with the scale's scoring system, which considers not only whether the child managed to execute the item or not but also how it was performed and what amount of support was needed. This allows the child's progress to be stratified within the same behavior, thus improving a specific item. This greater possibility of experiences provided by a stimuli-abundant environment (Morgan, Novak & Badawi, 2013) allows the child's maximum potential to be better explored, developing the baby's functioning, activity, and participation, as proposed in the biopsychosocial model (BPS) of the International Classification of Functioning (ICF) (Longo et al., 2018; Mélo et al., 2019; Novak et al., 2013; WHO, 2015;).

The limitation of this study is the scale not being validated. Hence, future studies are necessary to widen the scale's use and verify its validation with representative sample size, and stratify the expected score for each age group and/or health condition.

CONCLUSION

This study made it possible to consider specific aquatic motor behaviors for infants and toddlers aged three to 24 months, an age group not included in the original scale (AFAS) developed for adults.

The data presented in this paper can support the professional's activities in aquatic therapy with babies, both for clinical and research use. It can also support the assessment and identification of specific objectives and monitoring the progress with both qualitative and quantitative aspects in aquatic physical therapy.

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