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CONCURRENT VALIDITY AND RESPONSIVENESS OF THE ESCALA DE AVALIAÇÃO DE MOBILIDADE PARA EQUOTERAPIA

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Abstract: Purpose: To evaluate the concurrent validity and responsiveness of the *Escala de Avaliação de Mobilidade para Equoterapia* (EAMEQ) in children and adolescent hippotherapy treatment. Methods: A methodological study of the concurrent validity and responsivity of the EAMEQ, approved by the CEP n. 2.665.298: CAAE 82523118.9.0000.8093. For concurrent validity, both EAMEQ and Gross Motor Function Measure (GMFM) were used in 41 children with cerebral palsy, on the same day, by 2 independent examiners. The analysis was carried out using the Pearson correlation coefficient, *r*. In the responsivity study 41 children with different health conditions were evaluated using the EAMEQ, in three different moments, during 15 weeks of hippotherapy (3rd, 9th and 15th week) The Kolmogorov-Smirnov test was carried out to test the normality of the data, the ANOVA was used for repeated measures and the Sidak post-hoc test was used to verify the responsiveness. Results: There was strong and significant correlation between the EAMEQ and the GMFM scores (r=0,872; p<0,0001). There is also an effect of how long the children and adolescents were receiving the hippotherapy treatment for, evaluated through the EAMEQ. F (2,0, 80,0) = 56,00, p < 0,0001. Sidak's post-hoc showed that the hippotherapy treatments were different in all evaluation periods. Conclusions: The EAMEQ shows good concurrent validity with the GMFM, considered gold standard in mobility assessment of children with cerebral palsy. It is also responsive to changes in the mobility capacity of children with different health conditions on the horse. Also, the EAMEQ shows good responsivity over time regarding the hippotherapy patient's mobility on the horse.

Keywords: Evaluation process; Concurrent Validity; Responsiveness; Hippotherapy; Equine-assisted therapy.

INTRODUCTION

Hippotherapy is a therapeutic strategy that uses the movement of the horse as a treatment modality to treat individuals with different health conditions (*Professional Association of Therapeutic Horsemanship Intl.*, 2017). It has a positive effect on mobility tasks, such as moving or changing position (Finlayson & van Denend, 2003). This method can also improve mental functions, communication and learning, as well as stimulate social interactions and relationships (Prieto et al., 2020).

Hippotherapy has been increasingly widespread as a tool for rehabilitation of people with disabilities (Gonçalves Junior et al., 2020). Even though the effects of this method have been proven to increase functionality in daily life, it is observed that the individual shows constant improvement in actually riding the horse, what can evolve to the practice of equestrian sports. To quantify the increase of this ability and its effects in the daily life, instruments that evaluate the capacity of riding and leading the horse are needed (Prieto et al., 2020; Stergiou et al., 2017).

The *Escala de Avaliação de Mobilidade para Equoterapia* (EAMEQ) (Prieto et al., 2021) was elaborated to verify the improvement of on the horse motor abilities of patients submitted to the hippotherapy methods. It contains 20 items that evaluate the following aspects regarding mobility: riding and leading the horse; the need for support during hippotherapy sessions and changing positions on the horse. The EAMEQ contributed to the definition of therapeutic goals and therapeutic planning (Prieto et al., 2021). While developing the scale, the authors verified that the EAMEQ showed satisfactory inter-examiner reliability indices (intraclass correlation coefficient - ICC = 0,991-0,999) and intra-examiner reliability indices (ICC

= 0,997-1,0), as well as an excellent internal consistency (Cronbach's α = 0,937-0,999). The instrument's factorial structure classified its three factors into one greater general factor (Prieto et al., 2021).

Because it is a new instrument, it is necessary to verify the other psychometric properties of the scale, such as concurrent validity and responsiveness evidences (Pasquali, 2010). The concurrent validity is the correlation between the scores of the new instruments and the scores of a scale considered gold standard in the evaluation of the same construct (Streiner et al., 2015). The responsiveness is a property that describes the capacity of an instrument to detect changes in behavior over time. It is especially necessary in instruments that document progress resulting from interventions (Streiner et al., 2015). Therefore, the purpose of this study is to evaluate concurrent validity and responsiveness of the EAMEQ in children and adolescents in hippotherapy treatment.

METHOD

It is a methodological study, divided in two parts: concurrent validity evidences and responsiveness indicators. The study was approved by the University's Human Research Ethics Committee, report n. 2.665.298: CAAE 82523118.9.0000.8093. The parents and guardians that voluntarily accepted to participate in the study signed the Free and Informed Consent Form (FICF). Since there were children and adolescents involved, the Free and Informed Assent Form (FIAF) was also used.

CONCURRENT VALIDITY EVIDENCES

PARTICIPANTS

Forty-three children and adolescents in hippotherapy treatments from the Hippotherapy National Association – ANDE – Brazil, were included in a period from August 2018 and August 2019. They were between 2 and 18 years old, from both genders, all diagnosed with cerebral palsy (CP). Two children were excluded for not responding to basic verbal commands during the data collecting process.

DATA COLLECTING INSTRUMENTS AND PROCEDURES

The families answered a questionnaire about their child's age and gender, as well as their socio-economic status and how long has their child received hippotherapy intervention for.

The EAMEQ is a scale that evaluates the mobility of the individual on the horse and it is applied by an experienced examiner during a hippotherapy session. It has 20 items, that are classified in an ordinal scale, according to the individual's ability to perform each task. The points vary between 0 (less ability) and 4 points (more ability). The final score is the addition of the points from all items and can vary between 0 and 80 points. The higher the score, the better the mobility on the horse. For this reason, it was necessary to use the GMFM, gold standard instrument, to verify the mobility of children and adolescents (D. J. Russell et al., 2011).

The GMFM-66 is a quantitative instrument that evaluates the mobility of children with PC, developed from the GMFM-88. It has 66 items classified in five groups: 1) laying down and rolling; 2) sitting; 3) crawling and kneeling; 4) standing; 5) walking, running and jumping (Russell et al., 2011). The GMFM-66 has excellent validity, reliability and responsiveness indices and is the most used instrument in researches and in clinical practice to evaluate children with PC (Casady & Nichols-Larsen, 2004). Each item has four possible answers, according to the child's ability to perform the tasks, which can vary

from 0 (doesn't initiate) to 3 (completes the task) (D. J. Russell et al., 2011). Total score can vary between 0 and 100 points.

DATA COLLECTING PROCEDURE

The data was collected from August 2018 to December 2019.

The EAMEQ was applied by trained and experienced hippotherapy professionals (two physiotherapists, two physical educators and one psychologist). It was applied in a 30-minute hippotherapy session, with a pre-defined treatment protocol (supplementary material).

All the horses used in the treatments were docile and were approximately 1.43 meters tall. They were trained and prepared for hippotherapy by experienced equestrian professionals. During the treatment, each child was escorted by two specialized professionals, trained by ANDE – Brazil, one at each side. There was also a qualified guide that conducted the animal using appropriate equipment, such as a halter, a bit mouthpiece and a lead rope, providing greater control of the horse.

GMFM-66 was applied in a prepared evaluation room, equipped with the necessary elements, such as stools and batons. The examiner was a physiotherapist who had experience applying the GMFM-66, and was not aware of the EAMEQ's application procedure. The evaluation and the hippotherapy practice occurred in different days of the same week.

DATA ANALYSIS

The data was verified and the statistical assumptions for parametric analysis were assumed: normality, through the Kolmogorov-Smirnov test, homoscedasticity and linearity. The correlation between the total scores of the GMFM-66 and the EAMEQ was analyzed using the Pearson's linear correlation coefficient r. The closer the coefficient is to –1,0 or 1,0, the stronger the linear correlation between the variables is (Field, 2013). In order to test the hypothesis that the Pearson's correlation coefficient is above 6, considering a significance level of 0,05 and a power of 80%, 39 individuals were needed. The calculation required the SPSS (23.0 version) and the sample size calculation was done using the G*Power 3.1.9.2 software.

RESPONSIVENESS

PARTICIPANTS

The sample for this part of the study was composed by different participants from the previous part. The sample had, initially, 54 children and adolescents that started the hippotherapy treatment in the Hippotherapy Nacional Association social project.

The final sample was composed by 41 children and adolescents who were between two and 18 years old, from both genders, with different health conditions, such as: cerebral palsy, Down syndrome, brain stroke, head trauma and psychomotor development delays. The participants could be excluded from the study for the following reasons: not responding to basic verbal commands (n = 8); leaving the project (n = 2) and exceeding the number of absences stated the exclusion criteria (n = 3). The participants were included in the following inclusion criteria: to be enrolled in the Hippotherapy Nacional Association project, to follow basic verbal commands and to never have had hippotherapy treatments previously. The following aspects were considered exclusion criteria: wheighinging more than 70 kilograms; having a surgical or invasive procedure scheduled for the period of the study; having, during data collecting process, three consecutive absences or five alternated absences in the social project they were enrolled.

DATA COLLECTING PROCEDURE

The children evaluated were enrolled in a hippotherapy program of one session per week, for 15 weeks. The EAMEQ was applied in three distinct moments over time: in the third, nineth and fifteenth hippotherapy session, between August 2018 and December 2019.

The EAMEQ was applied by five professionals with experience in hippotherapy practice (two physiotherapists, two physical educators and one psychologist). Each child was always evaluated by the same professional. The hippotherapy sessions were 30 minutes long and happened once a week. The sessions had the same treatment protocol from the concurrent validity study. The horses were the same used in the previous part (concurrent validity) and the sessions were carried out by two professionals (one walking on each side of the horse) and one guide.

DATA ANALYSIS

To test the normality of the data, the Kolmogorov-Smirnov test was used. To evaluate the responsiveness of the scale, a repeated measures ANOVA was used, with Sidak's post-hoc. To test the hypothesis of instrument responsiveness, using a significance level of 0,05, an effect size of 0,25, one group, three measures and a power of 80%, 38 individuals were needed. The calculation was done using resources from the SPSS (23.0) version and the sample size calculation was done using the G*Power 3.1.9.2 software.

RESULTS

The Table 1 shows the participants characteristics (age, gender and health condition) for the concurrent validity and responsiveness study sample. Both studies finished with 41 different individuals, which makes a total of 82 children and adolescents.

	Concurrent validity (n= 41)	Responsiveness (n= 41)
Age (years)	7,73 ± 3,83	7,61 ± 4,08
Gender		
Male	29 (51,8%)	28 (68,3%)
Female	27 (42,2%)	13 (31,7%)
Health condition		
CP	41 (100%)	23 (56%)
DS		8 (19,5%)
BS		3 (7,4%)
HT		3 (7,4%)
PDD		4 (9,7%)

CP, Cerebral Palsy; DS, Down Syndrome; BS, Brain Stroke; HT, Head Trauma; PDD, Psychomotor Development Delays.

Table 1. Sample characteristics. Data expressed in mean ± standard deviation or absolute and relative frequency.

The means and the standard deviation (SD) of the scores obtained in the total population (n = 41) by the EAMEQ and the GMFM were 32,42 (DP = 29,6) and 38,16 (SD = 22,94), respectively. The correlation indices between the results of the two scales in the total population, obtained through the Pearson's correlation coefficient r, was r = 0,872 (p < 0,0001), which is considered a strong and significant correlation (Field, 2013). The scatter plot shows a linear relationship between the raw scores of the two scales, EAMEQ and GMFM, as shown in Figure 1.

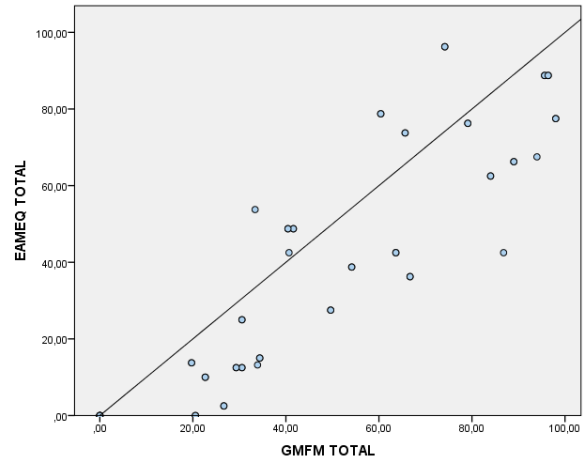

Figure 1 – Scatterplot of the EAMEQ and GMFM scores, obtained through the total scores of each scale.

RESPONSIVENESS

There were 123 longitudinal evaluations in total and 41 participants (Table 1). Table 2 shows the inclinations in the changes of the EAMEQ scores in the third, nineth and fifteenth hippotherapy sessions. The ANOVA demonstrated an effect of the time of hippotherapy in the mobility of children and adolescents evaluated through the EAMEQ, F (2,0, 80,0) = 56,00, $p < 0,0001$. The Sidak's post-hoc test indicated that the EAMEQ scores were different in each of the three evaluation periods: between the third and nineth evaluation, between the third and fifteenth evaluation and between the nineth and fifteenth evaluation. These results demonstrate a good responsiveness of the EAMEQ, which means that the EAMEQ is capable of detecting changes in behavior over time. The results can be observed in Table 2.

Hippotherapy sessions	3rd session	9th session	15th session	*p*
Mean and SD / value of p	50,20 ± 24,28	53,02 ± 23,47	58,37 ± 23,10	0,000
Confidence interval 95%	(42,52 – 57,86)	(45,61 – 60,43)	(51,07 – 65,65)	

EAMEQ: *Escala de Avaliação de Mobilidade para Equoterapia*, SD: standard deviation

Table 2. EAMEQ scores in the three periods of application of the scale.

DISCUSSION

This study had the purpose of obtaining concurrent validity evidences and responsiveness indicators of the EAMEQ for Brazilian children and adolescents in hippotherapy. The EAMEQ showed a good correlation with the GMFM-66 scores and was also capable of detecting changes in mobility of children and adolescents on the horse, over 15 weeks of hippotherapy sessions.

The variable measurement is an essential part of scientific research. The validity of the studies inferences directly depends on the quality of its measurement instruments. When planning the data collecting methods and procedures, it is necessary to use instruments that can guarantee reliable indicators (Alexandre & Coluci, 2011; Pasquali, 2009). Therefore, it is essential to adopt parameters and psychometric properties analysis in the validation of a new instrument, so that it is guaranteed it is actually evaluating the correct elements and that its results are reliable (Streiner et al., 2015).

The activities that take place during hippotherapy sessions are different according to the place, therapeutic goals and the population receiving the treatment (Prieto et al., 2020). Although hippotherapy is an intervention used for many decades, in different places, for people with different health conditions, its effects still lack evidences, mostly for the lack of its own evaluation instrument (Prieto et al., 2021; Stergiou et al., 2017). An extensive and detailed literature review confirmed the need to continue to verify the psychometric properties of the EAMEQ.

In the concurrent validity evidences study, there was a correlation between the EAMEQ and the GMFM-66. This last scale is considered gold standard in evaluating children and adolescents' mobility (D. J. Russell et al., 2011). A strong and significative correlation between the EAMEQ and the GMFM was observed, which means that the children and adolescents that have higher scores in the EAMEQ tend to also have higher scores in the GMFM. This finding can be explained by the fact that both scales are intended to evaluate

mobility, the EAMEQ being specifically about the mobility on the horse (Prieto et al., 2021). Therefore, the hypothesis of evidences of concurrent validity was confirmed.

Elaborated from the work by Russell and contributors (D. J. Russell et al., 1989), the GMFM went through many modifications over time and had its psychometric properties evaluated by other studies. This made the trustworthiness estimates, the validity evidences and the responsiveness indicators stronger for not only children with cerebral palsy (CP), but also children with other heath conditions, such as Down syndrome (D. Russell et al., 1998) and osteogenesis imperfecta (Ruck-Gibis et al., 2001). Because it is a largely used scale in the literature to evaluate gross motor function and mobility, other studies have also used the GMFM for the concurrent validity.

In the responsiveness study, the EAMEQ was responsive to the mobility improvement of the hippotherapy patients, over 15 weeks. This longitudinal study evaluated the participants on the third, nineth and fifteenth hippotherapy session. At all moments significative differences were observed. The responsiveness describes the capacity of a measure to detect changes in a group of individuals, regarding their response to different treatments or interventions over time (Streiner et al., 2015).

The responsiveness, also used in other mobility assessment instruments, was verified in individuals with brain stroke (BS) by Persson and contributors (Persson et al., 2013). The *Postural Assessment Scale for Stroke Patients* (SwePASS) was developed with the intention of estimating the change in postural control and showed good responsiveness over the first 12 months post stroke in 90 patients. The results, however, report that, even though it is a responsiveness scale, it can be used in the stroke rehabilitation, especially during the first three months, in which it showed best responsiveness.

Other study evaluated the responsiveness of the *Functional Mobility Scale* (FMS), which was specifically developed to verify the differences in mobility of children with PC. In this study (Harvey et al., 2009), 84 children with CP, from two to 16 years old were evaluated by the FMS before and after orthopedic surgery (after 3, 6, 9, and 12 months) or botulinum toxin injections (after 3, 6, 9, 12 and 24 weeks). The responsiveness of the FMS was most significant in children that underwent orthopedic surgery than the ones that got botulinum toxin. Different from the EAMEQ, that verified significant responsiveness at all moments of evaluation, the FMS only showed significant responsiveness between the period before the procedure and the first follow up evaluation, mostly on the children that got surgery.

GMFM had its psychometric properties evaluated in many studies (Alexandre & Coluci, 2011; Ko & Kim, 2013; Ruck-Gibis et al., 2001). A study compared the responsiveness of the first version of the GMFM-88 with its second version, the GMFM-66 (Wang & Yang, 2006). A total of 65 children with PC with na average age of 3.7 years old were recruited. Different from the EAMEQ, the responsiveness of the two versions of the GMFM was verified in only two moments, three months apart. An analysis of variance (ANOVA) was used to verify the changes in both versions of the GMFM over time, similarly to the EAMEQ study. About the results, both have a good responsiveness over time, but, for children with CP, the GMFM-66 is more responsive than the GMFM 88.

LIMITATIONS AND GUIDELINES FOR FUTURE RESEARCH

There are a few limitations in this study to point out. First, the responsivity and concurrent validity studies could be separated

by health condition, if the sample was larger. Also, we did not reach the necessary quantitative that was stated in the sample size calculation. Finally, the responsiveness could also be verified over a longer period of time, but the corona virus pandemic suspended the hippotherapy sessions and made us end the study in December 2019.

We recommend that the future researchers verify the responsiveness of the EAMEQ for a longer period of time and use a sample N that allows them to separate and analyze the results from children and adolescents by health condition. It can also be useful to adapt and validate the EAMEQ to other age groups, such as adults and the elderly. We also recommend the transcultural adaptation of this scale to other countries and languages so that more professionals can have a reliable and unified instrument to evaluate the mobility of hippotherapy patients.

CONCLUSION

In conclusion, both psychometric properties evaluated in this study regarding the EAMEQ were appropriate for their specific group and are now available to scientific and clinic use. Also, considering how easy and inexpensive it is to use the scale, it can be highly useful for hippotherapy professionals, once it can be used in a valid and reliable way to plan interventions and verify the progress of patients over time.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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