



BAYLEY SCALES OF INFANT AND TODDLER DEVELOPMENT - A STATE OF THE ART

Maria Nascimento Cunha	PhD, ISEC Lisboa – Instituto Superior de Educação e Ciências de Lisboa CIAC Centro de Investigação em Artes e Comunicação
Sandra Romeira	Universidade Fernando Pessoa
Gonçalo Cardoso Moreira	Universidade Fernando Pessoa

ABSTRACT The first years of a child's life are fundamental to child development. The physical growth and development of the accelerated psychomotor skills characteristic of early childhood, as well as the motor experiences of the child, are decisive in the progressive elaboration of the structures that will give rise to the higher forms of reasoning. In these cases the evaluation is done by parents or "significant person", educators and health professionals. In older children and young people the assessment is often based on self-evaluation. Subjective evaluation, using scales, has proved to be an asset in the evaluation of individual health. The Bayley Child Development Scale, also known as the Bayley Scales of Infant and Toddler Development, is a widely used assessment tool for measuring children's development. In order to understand this phenomenon, a search was carried out in several electronic databases (PubMed, Scopus, EBSCO and Web of Science) and in clinical trial databases, in addition to manual research to add information relevant to the subject.

KEYWORDS : Children; Psychological Assessment; Bayley III Scale.

INTRODUCTION

The Bayley Child Development Scale, also known as the Bayley Scales of Infant and Toddler Development (Bayley-III), is a widely used assessment tool for measuring the development of children from 1 month to 42 months of age.

BDSI was developed by Nancy Bayley, a renowned developmental psychologist, and has been used since the 1960s to assess various areas of child development, such as cognition, language, motor and social skills (Pereira, Saccani, Valentini, 2016).

According to the Literature Review, the BDSI presents three editions:

- BSID First edition 1969
- BSID 2nd edition 1993
- BSID 2nd edition 2006

According to the authors Silveira et al. (2018) the scale was translated and adapted to the Portuguese language making its application easy and fast. However, it was not possible to find any information about the Bayley Scale to be validated for the population of Portugal. To mention the existence of a directory of scales validated for European Portuguese in 2020. According to a careful reading of the mentioned report, it was noticed that the Bayley Scales of Child Development, Third Edition (Bayley-III), were translated, adapted to Portuguese and tested in 207 children from 12 to 42 months, but in Brazil (Ferreira et al. 2014; Capelas & Ferreira, 2021)

Brief Historical Overview

The Bayley Scale, officially known as the Bayley Scales of Infant and Toddler Development (BSITD), is a widely used assessment tool for measuring the development of infants and young children. More precisely from children between 1 month and 42 months of age.

It was developed by Nancy Bayley, a developmental psychologist, born in 1899 and deceased in 1994, who made significant contributions to research in child psychology (Viana et al. 2014).

The history of the Bayley Scale underwent an early development in the 1930s, at which time under the guidance of renowned developmental psychologist Arnold Gesell of the University of Iowa, he began work on the Bayley Scale. Gesell pioneered the observation and study of child behavior and significantly influenced Bayley's work. The first edition of the Bayley Scale was published in 1969. The original scale, known as the Bayley Scales of Infant Development (BSID), was designed to measure the development of children from 1 to 30 months of age. It was conceived primarily as an assessment tool for children with disabilities or developmental delays (Cavaggioni & Benincasa, 2017).

The Bayley Scale has gone through several revisions and updates over

the years always with the ultimate aim of improving its accuracy and relevance. The Bayley-III, the third edition of the scale, was published in 2006 and is one of the most recent and widely used versions. It expanded the assessment age range for children from 1 month to 42 months of age and included subscales that assess various areas of development, such as cognition, language, motor and social skills.

The Bayley III Scale

The Bayley III Scale is composed of three subscales performed by the child: Cognitive Scale, Language Scale (receptive communication and expressive communication) and Motor Scale (motor areas fine and thick). It is also composed by the Social Emotional Scale and the Adaptive Behavior Questionnaire that is answered by those responsible for the child.

The subscales mentioned measure several skills, commenting:

- **Cognition:** Evaluates the child's ability to solve problems, learn concepts and understand the environment around him.
- **Language:** Measures communication skills, including comprehension and verbal expression.
- **Motor Skills:** Evaluates the child's motor development, including gross motor skills (such as crawling and walking) and fine motor skills (such as picking up small objects).
- **Social and Emotional Skills:** Examines the child's ability to interact with others and regulate his own emotions.
- **Self-care Skills:** Assess the child's ability to perform simple self-care tasks such as dressing and eating.

The scale therefore offers a comprehensive evaluation in five distinct domains, thus allowing comparison of child development among the 4 areas evaluated, constructed and differentiated by age group (September et al. 2016).

The scale is often used by health professionals, psychologists, educators, and researchers to help identify developmental delays and determine children's needs in terms of early intervention.

It is a playful instrument, flexible, easy to apply, with excellent indices of validity and reliability, extensively used in research. In addition, it is useful for early identification of developmental risk, development of intervention projects, as well as to provide guidance to parents and inform them about the evolution of the child when there is a need for intervention. It is considered an eclectic evaluation, which addresses the concepts of both neuromaturation theory and social interactionist theories (Cavaggioni & Benincasa, 2017).

As previously mentioned, the main objective of the Bayley III scale is to evaluate children who have some delay in their development process and, from the results of these evaluations, planning interventions that

may favor its development process. One of the techniques used is the filmage of the child in controlled situations and that stimulate the emission of behaviors that, usually, may indicate the presence of disorders, such as little eye contact, non-identification when called and low receptivity. Subsequently, these filmagens are evaluated. This assessment identifies early global delays in development, enabling interventions in these cases (Carson et al. 2015).

Study Conducted

As mentioned earlier, Bayley Scales of Infant and Toddler Development (BSITD) is a widely used assessment tool for measuring the development of infants and young children.

In this sense it is possible to verify that several studies were performed. It seems important to mention some of the studies found, in order to understand the wide use of the Scale:

- The use of Bayley-III scales as a guide for intervention protocol in the treatment of a child with cerebral palsy and autism spectrum disorder. A study by Valentini & Scheidt (2022).
- Evaluation of the applicability of the Bayley Development Scale as an auxiliary instrument in the early detection of childhood autism by Alves et al. (2021).
- Evaluation of psychomotor development of children with Down Syndrome by Hendges et al. (2021)
- Gender-specific associations between maternal phthalate exposure and neurological developmental outcomes in 2-year-old children in the Cohort appron of the authors Dewey et al. (2023).
- Effect of prenatal exposure to maternal cortisol and psychological distress on child development in Bengaluru, southern India: a prospective cohort study by Nath et al. (2017).

There are obviously a lot of studies. Future research may embrace new studies dedicated to other disorders, disorders or spectra.

Composition of the Complete Kit

The Bayley Scales of Infant and Toddler Development, third edition - Bayley III - is an individually administered instrument that assesses the functioning of the development of infants and young children. It is about identifying delays in development and providing information for planning interventions.

The Bayley Scales of Infant and Young Child Development, third edition - Bayley-III are widely used to identify possible problems of child development. The evaluation enables the identification of deficits in development, as well as the planning of interventions.

Target Population

Babies and small children, from 1 to 42 months old.

Application Context

Instrument not restricted to psychologists, the scales are indicated for specialists in early intervention, early childhood or child development, interdisciplinary professional, school psychologist and evaluation specialists.

Composing

- Administration manual contains the information necessary to administer the subtests, punctuate responses and complete the registration form.
- Technical manual is composed of basic psychometric, technical and interpretive information, including theoretical bases, review process, scale organization, evidence of reliability and validity, and interpretative considerations and procedures.
- Screening test manual, contains the information required for administration, scoring and interpretation of Bayley III screening test items.
- Stimulus book and stimulus book of screening test are the stimulus materials that are needed for proper administration of certain items.
- Registration form aims to inform when the stimulus book is necessary for the administration of the item and the page number on which the stimulus is located.
- Observation checklist can be used to provide applicator familiarity with Bayley-III Screening Test items that can be scored through accidental observation, as well as the screening test observation checklist. The picture book is a material for manipulation of the child, on specific items.
- Document for the caregiver contains the explanation of items that facilitate the interpretation of the results of Bayley III to the

caregivers. Provides information that caregivers can use to facilitate children's development. The social-emotional and adaptive behavior questionnaire contains questions about the scales (social-emotional and adaptive behavior), and the items must be completed by the caregiver.

- Cognitive, language, motor and screening test record forms are the tools in which the examiner records the child's responses and score for each item of each scale. They thus provide important information about the administration and Manipulable Items

Set I

- 1 Doll;
- 2 red beaded rings;
- 1 rattle;
- 1 bottle with lid;
- 1 the squeezing toy;
- 1 bell;
- 1 transparent box;
- 3 plastic cups;
- 2 red crayons;
- 3 spoons;
- 1 Shoelace.

Set II

- 2 towels;
- 12 red blocks (8 with holes, 4 without holes);
- 5 discs (1 red, 1 green, 1 black, 1 blue, 1 yellow);
- 1 floor mat;
- 16 coloured pins (4 blue, 4 red, 4 yellow);
- 9 blue blocks (4 round, 5 square);
- 1 Book of stories.

Set III

- 1 Safe;
- 1 pouch with drawstring;
- 6 pieces of mounting block (1 large green, 1 large yellow, 1 small green, 1 small yellow, 1 small blue, 1 small red);
- 1 Trolley;
- 1 bracelet;
- 1 small ball;
- 1 comb;
- 1 bear;
- 1 Set of memory cards;
- 1 Puzzle 2 parts ice cream;
- 1 Puzzle 2 parts ball;
- 1 Puzzle 3 parts dog;
- 1 lacing card;
- 2 pencils;
- 1 sleeve with button;
- 1 Set of red blocks (1 square, 1 triangle and 1 circle);
- 1 Mirror;

Other Items

- 3 large plastic ducks (1 blue, 1 red and 1 yellow);
- 1 heavy plastic duck;
- 3 small plastic ducks (1 blue, 1 red and 1 yellow);
- 1 Puzzle board (pink/blue);
- 1 tray of pins;
- 1 large ball;
- 1 cup with handle;

Printed Items

- 1 Manual of administration;
- 1 Technical manual;
- 1 Screening test manual;
- 1 book of stimuli;
- 1 Screening test stimulus book;
- 25 Forms of registration;
- 1 Observation checklist;
- 1 Screening test observation checklist;
- 1 book of figures;
- 25 Reports for the caregiver;
- 25 social-emotional and adaptive behaviour questionnaires;
- 25 Cognitive scale registration forms;
- 25 Language scale registration forms;
- 25 Motor scale registration forms;
- 25 Screening test registration forms.

Concluding

The scale is often used by health professionals, psychologists, educators and researchers to help identify developmental delays and determine children's needs in terms of early intervention (Cunha et al. 2016).

It is important to note that Bayley-III is an updated version of the scale, and there are earlier versions such as Bayley-II and Bayley-I. The choice of version to be used may depend on the age of the child and the needs of the assessment. In addition, child development scales are continually reviewed and updated to reflect the latest findings from child development research (Arias et al. 2015).

In terms of clinical and research use, the Bayley Scale is used primarily by health professionals, psychologists, educators, and researchers to assess child development and identify possible developmental delays or problems. It plays a key role in early identification of intervention and support needs for young children (Alcantud et al. 2015).

The Scale is widely recognized and respected worldwide as a valuable tool for assessing child development. It has influenced research in developmental psychology and has been an important reference for understanding how children develop and reach important milestones in their lives.

In summary, the Bayley Scale is the result of Nancy Bayley's pioneering work in observing and evaluating child development. It remains an important tool for health professionals and researchers working with young children (Cardoso, 2017; Capelas & Ferreira 2021).

REFERENCES

- Alcantud, F. M., Esteban, Y. A., Bañón, D. R. (2015). Sistema de Detección Precoz de Trastornos del Desarrollo (SDPTD) Construcción, Validación y Manual de Uso (versión 1) Madrid, España: Real Patronato sobre Discapacidad & Ministerio de Sanidad, Servicios Sociales e Igualdad.
- Arias, A. V., Campos, D., Campos-Zanelli, T. M., Souza, D. S. D., Peralta, C. F. A., Guerreiro, M. M. (2015). Twin-twin transfusion syndrome: neurodevelopmental screening test. *Arquivos de Neuro-Psiquiatria*, 73(3), 194-199. doi: 10.1590/0004-282X20140237 » <https://doi.org/10.1590/0004-282X20140237>
- Capelas, L. M., Ferreira, R. C. (2021). *Directorio de Escalas Validadas para Português Europeu 2020*. Universidade Católica Editora. ISBN 9789725407837
- Cardoso, Fernanda Guimarães Campos (2017). Validação concorrente da Escala Brunet-Lézinecom a Escala Bayley para avaliação do desenvolvimento de bebês prematuros de pré-termo de até dois anos. *Rev. Paul. Pediatr.* v. 35, n. 2, p. 144-150, abr./jun.
- Cavaggoni, Ana Paula Magosso; MARTINS, Maria do Carmo Fernandes; BENINCASA, Miria Benincasa. (2020). A influência da via de parto no desenvolvimento infantil: comparação por meio da Escala Bayley III. *Hum. Growth Dev.* v. 30, n. 2, São Paulo, mai./ago.
- Carson, V., Kuzik, N., Hunter, S., Wiebe, S. A., Spence, J. C., Friedman, A., ... & Hinkley, T. (2015). Systematic review of sedentary behavior and cognitive development in early childhood. *Preventive Medicine*, 78, 115-122. doi: 10.1016/j.ypmed.2015.07.016 » <https://doi.org/10.1016/j.ypmed.2015.07.016>
- Cassiano, R. G. M., & Linhares, M. B. M. (2015). Temperamento, prematuridade e comportamento interativo mãe-criança. *Psicologia: Reflexão e Crítica*, 28(2), 416-424. doi: 10.1590/1678-7153.201528222 » <https://doi.org/10.1590/1678-7153.201528222>
- Castelli, R. D., Quevedo, L. D. Á., Coelho, F. M., Lopez, M. A., Silva, R. A. D., Böhm, D. M., ... & Pinheiro, R. T. (2015). Association between perception of maternal bonding styles and social anxiety disorder among young women. *Revista Brasileira de Psiquiatria*, 37(4), 331-333. doi: 10.1016/j.eearhumdev.2015.10.002 » <https://doi.org/10.1016/j.eearhumdev.2015.10.002>
- Coppede, A. C. de Campos, A. C., Santos, D. C. C., Rocha, N. A. C. F. (2012). Desempenho motor fino e funcionalidade em crianças com síndrome de Down. *Fisioterapia e Pesquisa*, 19(4), 363-368. doi: 10.1590/S1809-29502012000400012 » <https://doi.org/10.1590/S1809-29502012000400012>
- Cunha, R. D. S., Filho, F. L. Rafael, E. V., Lamy, Z. C., Queiroz, A. L. G. (2016). Breast milk supplementation and preterm infant development after hospital discharge: a randomized clinical trial. *Jornal de Pediatria*, 92(2), 136-142. doi: 10.1016/j.jped.2015.04.004 » <https://doi.org/10.1016/j.jped.2015.04.004>
- Dornelas, L. F., Duarte, N. M. C., & Magalhães, L. C. (2015). Atraso do desenvolvimento neuropsicomotor: mapa conceitual, definições, usos e limitações do termo. *Revista Paulista de Pediatria*, 33(7), 88-103. doi: 10.1016/j.rpped.2014.04.009 » <https://doi.org/10.1016/j.rpped.2014.04.009>
- Eickmann, S. H., Malkes, N. F. D. A., Lima, M. D. C. (2012). Psychomotor development of preterm infants aged 6 to 12 months. *São Paulo Medical Journal*, 130(5), 299-306. doi: 10.1590/S1516-31802012000500006 » <https://doi.org/10.1590/S1516-31802012000500006>
- Fernandes, L. V., Goulart, A. L., Santos, A. M. N. D., Barros, M. C., Guerra, C. C., & Kopelman, B. I. (2012). Neurodevelopmental assessment of very low birth weight preterm infants at corrected age of 18-24 months by Bayley III scales. *Jornal de Pediatria*, 88(6), 471-478. doi: 10.1590/S0021-75572012000600005 » <https://doi.org/10.1590/S0021-75572012000600005>
- Ferreira, R. C., Mello, R. R., & Silva, K. S. (2014). Neonatal sepsis as a risk factor for neurodevelopmental changes in preterm infants with very low birth weight. *Jornal de Pediatria*, 90, 293-299. doi: <https://doi.org/10.1016/j.jped.2013.09.006>
- Góes, F. V. D., Méio, M. D. B., Mello, R. R. D., Morsch, D. (2015). Evaluation of neurodevelopment of preterm infants using Bayley III scale. *Revista Brasileira de Saúde Materno Infantil*, 15(1), 47-55. doi: 10.1590/S1519-38292015000100004 » <https://doi.org/10.1590/S1519-38292015000100004>
- Guerra, C. C., Moraes Barros, M. C., Goulart, A. L., Fernandes, L. V., Kopelman, B. I., dos Santos, A. (2014). Premature infants with birth weights of 1500-1999 g exhibit considerable delays in several developmental areas. *Acta Pediátrica*, 103(1). doi: 10.1111/apa.12430 » <https://doi.org/10.1111/apa.12430>
- Hentges, C. R., Silveira, R. C., Procianny, R. S., Carvalho, C. G., Filipouski, G. R., Fuentefria, R. N., ... & Terrazan, A. C. (2014). Association of late-onset neonatal sepsis with late neurodevelopment in the first two years of life of preterm infants with very low birth weight. *Jornal de Pediatria*, 90, 50-57. doi: <https://doi.org/10.1016/j.jped.2013.10.002>
- Javanbakht, A., King, A. P., Evans, G. W., Swain, J. E., Angstadt, M., Phan, K. L., & Liberzon, I. (2015). Childhood poverty predicts adult amygdala and frontal activity and connectivity in response to emotional faces. *Frontiers in Behavioral Neuroscience*, 9 (154). doi: 10.3389/fnbeh.2015.00154. » <https://doi.org/10.3389/fnbeh.2015.00154>
- Madaschi, V., Mecca, T. P., Macedo, E. C., Paula, C. S. (2016). Bayley-III scales of infant and toddler development: transcultural adaptation and psychometric properties. *Paidéia (Ribeirão Preto)*, 26, 189-197. doi: <https://doi.org/10.1590/1982-43272664201606>
- Milne, S., McDonald, J., & Comino, E. J. (2012). The use of the Bayley scales of infant and toddler development III with clinical populations: A preliminary exploration. *Physical & Occupational Therapy in Pediatrics*, 32(1), 24-33. doi: 10.3109/01942638.2011.592572
- Miquelote, A. F., Santos, D. C., Caçola, P. M., Montebelo, M. I. D. L., & Gabbard, C. (2012). Effect of the home environment on motor and cognitive behavior of infants. *Infant Behavior and Development*, 35(3), 329-334. doi: 10.1016/j.infbeh.2012.02.002
- Moore, T., Johnson, S., Haider, S., Hennessy, E., & Marlow, N. (2012). Relationship between test scores using the second and third editions of the Bayley Scales in extremely preterm children. *The Journal of Pediatrics*, 160(4), 553-558. doi: 10.1016/j.jpeds.2011.09.047
- Neves, K. R., Morais, R. L. S., S. Teixeira, R. A., & Pinto, P. A. F. (2016). Crescimento e desenvolvimento e seus determinantes ambientais e biológicos. *Jornal de pediatria*, 92(3), 241-250. doi: 10.1016/j.jped.2015.08.007
- Oliveira, C. D., Castro, L. D., Silva, R., Freitas, I., Gomes, M., & Cândida, M. (2016). Fatores associados ao desenvolvimento global aos 4 e 8 meses de idade corrigida de crianças nascidas prematuras. *Journal of Human Growth and Development*, 26(1), 41-47. doi: 10.7322/jhgd.110024 » <https://doi.org/10.7322/jhgd.110024>
- Pedroso, J. S., Dias, G. B., Magalhães, C. M. C., & Cruz, E. J. S. (2015). Exploratory Study on Infant Development under Institutional Sheltering in the North Region of Brazil. *Psychology*, 6(04), 305. doi: 10.4236/psych.2015.64031
- Pereira, K. R. G., Saccani, R., Valentini, N. C. (2016). Cognição e ambiente são preditores do desenvolvimento motor de bebês ao longo do tempo. *Fisioterapia e Pesquisa*, v. 23, n. 1, p. 59-67, mar.
- Quevedo, L. A. Silva, R. A., Godoy, R., Jansen, K. Matos, M. B., Tavares Pinheiro, K. A., Pinheiro, R. T. (2012). The impact of maternal postpartum depression on the language development of children at 12 months. *Child: Care*, 27. doi: 10.1111/j.1365-2214.2011.01251.x » <https://doi.org/10.1111/j.1365-2214.2011.01251.x>
- Rushton, F. E., & Kraft, C. (2014). Building brains, forging futures: the pediatrician's role. *International Journal of Pediatrics and Adolescent Medicine*, 1(1), 3-7. doi: 10.1016/j.ijpam.2014.09.006 » <https://doi.org/10.1016/j.ijpam.2014.09.006>
- Santos, M. M., Corsi, C., Marques, L. A., & Rocha, N. A. (2013). Comparison of motor and cognitive performance of children attending public and private day care centers. *Brazilian Journal of Physical Therapy*, 17(6), 579-587. doi: 10.1590/S1413-3552012005000126
- September, S. J., Rich, E. G., & Roman, N. V. (2016). The role of parenting styles and socio-economic status in parents' knowledge of child development. *Early Child Development and Care*, 186(7), 1060-1078. doi: 10.1080/03004430.2015.1076399
- Silveira, K. A., & Enumo, R. F. S. (2012). Riscos biopsicossociais para o desenvolvimento de crianças prematuras e com baixo peso. *Paidéia*, 22(53), 335-345. doi: 10.1590/S0103-863X2012000300005 » <https://doi.org/10.1590/S0103-863X2012000300005>
- SILVEIRA, R. C., Mendes, E. W., Fuentefria, R. N. (2018) Programa de intervenção precoce para prematuros de muito baixo peso e seus pais: um protocolo de estudo. *BMC Pediatr* 18, 268. » <https://doi.org/10.1186/s12887-018-1240-6>
- Souza, J. M., Verissimo, M. D. L. O. R. (2015). Desenvolvimento infantil: análise de um novo conceito. *Revista Latino Americana de Enfermagem*, 23(6), 1097-1104. doi: 10.1590/0104-1169.0462.2654
- Toro-Ramos, T., Médio, M. D. B. B., Morsch, D. S., Moreira, M. E. L., Carmo, M. D. G. T. D., Sichieri, R., & Hoffman, D. J. (2013). Preterm infant language development: a role for breast milk fatty acids. *Journal of Human Growth and Development*, 23(3), 270-275. doi: 10.7322/jhgd.69499
- Viana, T. P., Andrade, I. S. N. D., Lopes, A. N. M. (2014). Desenvolvimento cognitivo e linguagem em prematuros. *Audiologia - Pesquisa de Comunicação*, 19(1), 1-6. doi: 10.1590/S2317-64312014000100002 » <https://doi.org/10.1590/S2317-64312014000100002>