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REVISIONES

The very premature newborn: difficulties in the school

Los recién nacidos muy prematuros: dificultades en la escuela

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ABSTRACT:

Introduction: Premature birth implicitly involves a situation of immaturity that affects all the anatomical and functional systems of the newborn, a condition of special vulnerability, with a frequent association with other pathologies and / or alterations in child development.
Objetive: To know the difficulties in school that children born very premature can present
Material and Methods: Bibliographic review in databases such as Pubmed, Medline, Scielo, Cochrane; selecting scientific articles in both Spanish and English for the last 10 years.
Results: Children born very premature and / or with low birth weight, have a higher risk of presenting difficulties that may impair their proper development in childhood and adolescence. Some of the needs evidenced at the motor level are simple motor delay and cerebral palsy; at sensory-cognitive level, there were learning problems and major sensory alterations; and at a social-emotional level, there are behavioral disorders such as hyperactivity and emotional disorders such as depression, somatic complaints, fears and phobias.
Conclusions: Health professionals, education and families must know the risk presented by large premature children to present difficulties and / or alterations that may interfere with school life, in order to work together in the prevention of such difficulties with a early intervention. Nursing care must go far beyond the acute situation of the newborn, being a promoter of health in all stages of the child's life.

Keywords: prematurity, neurodevelopmental alterations, difficulties in childhood, prematurity in school age.

RESUMEN:

Introducción: El nacimiento prematuro lleva implícito una situación de inmadurez que afecta a todos los sistemas anatómicos y funcionales del recién nacido, condición de especial vulnerabilidad, con una frecuente asociación con otras patologías y/o alteraciones del desarrollo infantil.
Objetivo: Conocer las dificultades en la escuela que pueden presentar los niños y niñas nacidos muy prematuros.
Material y Métodos: Revisión bibliográfica en bases de datos como Pubmed, Medline, Scielo, Cochrane; seleccionando artículos científicos tanto en español como en inglés de los últimos 10 años.

Resultados: Los niños y las niñas que nacen muy prematuros y/o con bajo peso al nacer, tienen un mayor riesgo de presentar dificultades que pueden perjudicar su correcto desarrollo en la infancia y la adolescencia. Algunas de las necesidades evidenciadas a nivel motor son el retraso motor simple y la parálisis cerebral; a nivel sensorio-cognitivo, fueron los problemas de aprendizaje y alteraciones sensoriales mayores; y a nivel socioemocional, se evidencian trastornos comportamentales como es la hiperactividad y trastornos emocionales como son la depresión, quejas somáticas, temores y fobias.
Conclusiones: Los profesionales de salud, de la educación y las familias, deben conocer el riesgo que presentan los grandes prematuros de presentar dificultades y/o alteraciones que pueden interferir en la vida escolar, con el fin de trabajar conjuntamente en la prevención de dichas dificultades con una intervención temprana. El cuidado de enfermería debe ir mucho más allá de la situación aguda del recién nacido, siendo agente promotor de salud en todas las etapas de la vida del niño/a.

Palabras clave: prematuridad, alteraciones neurodesarrollo, dificultades en la infancia, prematuridad en la edad escolar.

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INTRODUCTION

When the fetus reaches the end of gestation, the growth and development of its brain takes place in the context of the protection offered by the mother through the uterine environment, where temperature, nutrition and other regulatory systems are constantly provided. The preterm newborn, on the other hand, must face this brain growth in the environment offered by the Intensive Care Unit, completely different from the uterine environment, being the convincing evidence that it causes a sensory overload that negatively impacts the developing neurological system [(1)].

Prematurity is one of the most prevalent health problems among children in developed countries. Between 8 and 10% of births occur before 37 weeks of gestation and account for 75% of perinatal mortality and 50% of childhood disability [(2)].

So much so that among survivors, up to 10% subsequently develop major neurological and sensory impairments, including spastic motor impairments, mental retardation, cerebral palsy [(3)], visual or auditory impairment [(4)], and 50% to 60%, cognitive, behavioral, and learning disabilities [(5)].

Early detection of developmental anomalies allows for early intervention that can favourably modify the future of the child suffering from them and improve his or her social and family adaptation [(6)].

In our study we try to know which are the alterations that can develop the children who were born very prematurely, with the purpose that all the professionals and the family that are in the environment of the child, know these alterations to be able to detect them in an early way and to initiate all the pertinent mechanisms to offer an early intervention that diminishes and/or eliminates the possible difficulties that can develop in the school, and therefore, in his life until the adulthood.

The specific objectives of the study are to know and describe the development of alterations in the following areas involved in school life:

- Alterations and/or difficulties at motor level.
- Alterations and/or difficulties at the sensory-cognitive level.
- Alterations and/or difficulties at a social-emotional and behavioural level.

MATERIAL AND METHODS

A bibliographic review was carried out through databases such as Pubmed, Medline, Scielo, Cuiden and Cochrane; selecting those studies with relevant scientific evidence, both in Spanish and English, published in the last 10 years.

As fundamental pillars in the adequate development of the child and the premature girl in the school age, we consider fundamental areas the motor, as area of the integral development of the individual; the sensorio-cognitiva, necessary for the learning of the person; and the socioemotional and behavioral, as basic area in the capacity to establish social relations and to live in community.

From the articles reviewed, those were selected whose object of study was developed from the first month of corrected age to the adolescence of very preterm infants. At the motor level, "motor development AND premature" was used as concepts to search for articles; at the sensory-cognitive level the concepts of "sensory development AND premature" and "cognitive development AND premature" were used; finally, at the social-emotional and behavioural level "social AND emotional development AND premature" and "behaviors AND premature" were used.

The articles selected in our review were those shown in the table below:

Table I. Items selected for review with their main results. Own elaboration

AUTHORS AND YEAR	PLACE	TYPE OF STUDY, SUBJECTS AND AGE CORRECTED	ALTERATIONS OF NEURODEVELOPMENT IN CHILDHOOD. MAIN RESULTS
Spittle et al (2016)	Australia	Cohort study. 150 premature (<30 sg). 5 years.	Motor disturbances in the neonatal period were evaluated as a predictor of severity of motor impairment at 5 years.
Demesi et al (2016)	Europe	Cohort study. 206 children with cerebral palsy	More than half (54.4%) of those with CP had been born prematurely, with this ratio being higher when the gestational age at birth was lower ($p<0.001$). Bilateral spastic paralysis was the most frequent among preterm infants.
Fuentefria, Silveira y Procianoy (2017)	Latin America	Systematic review. 23 articles premature follow-up of 6 to 18 months of CD	In the period of 6 to 18 months of corrected age, a gross engine performance is observed lower.

Sá y De Castro (2012)	Latin America	Longitudinal observational study. 30 premature (28-32 sg). 12-18 months CD	At 18 months CD significant differences in gross (p<0.001) and fine (p<0.001) motor development and functional skills were found compared to term infants. They comment on the possibility of increased risk due to environmental factors.
Maggi, Magalhäes, Campos y Bouzada (2014)	Latin America	Cross-sectional study. 124 premature (<34 sg). 4 years	Children born prematurely had worse motor performance, with 29% having a motor coordination disorder compared to those born at term. Low socioeconomic status is associated with greater impairment.
De Kieviet, Piek, Aarnoudse y Oosterlaand (2009)	Europe	Meta-analysis. 9653 premature (<32 sg and/or with <1500 gr). Up to 16 years of age.	Premature birth and/or low birth weight is associated with lower motor development values throughout childhood.
Schmidt, Davis, Asztalos, Solimano y Roberts (2014)	North America	Cohort study analysis. 1582 premature (95 with severe ROP). 5 years	The development of severe retinopathy was associated with the presence of some non-visual disability. Cognitive, motor and hearing impairment is 3 to 4 times greater in premature infants with severe ROP.
Chorna, Solomon, Slaughter, Stark y Maitre (2014)	North America	Prospective observational study. 72 premature infants. 4-12 months CD.	Eighty-two percent of premature infants presented sensory alterations, the younger gestational age being associated with abnormal reactivity to deep pressure and vestibular alterations. Poor motor function after tactile stimuli was associated with worse motor development at 2 years CD.
Wickrema singhe, Rogers, Johnson, Shen, Barkovich y Marco 2013)	North America	Cross-sectional study. 107 premature babies (≤ 32 sg). 1 to 8 years.	In 39% of the participants, sensory alterations were evidenced, with low registration predominating.

Rahkonen, Lano, Pesonen, Heinonen et al (2015)	Europe	Prospective study. 44 very premature. 2 years of EC	The 50% of the very premature ones presented sensory alterations, being the register under the most common behavior.
Gu, Wang, Liu, Luo, Wang et al (2017)	China	Meta-analysis. 12,137 children born underweight.	IQ appears to decrease as birth weight decreases.
Allotey, Zamora, Cheong-See, Kalidindi et al (2017)	Europe	Meta-analysis. 64,000 premature babies. Until adolescence.	In primary education, lower scores were observed in reading, mathematics and spelling, keeping the scores low in reading and spelling in secondary education.
Aarnoudse-Moens, Duivenvo, Weisglas-Kuperus, Van y Oosterlaan (2011)	Europe	Cross-sectional study. 200 very premature (<28 sg). From 4 to 12 years..	In preterm infants, greater impairments in executive function were observed, such as deficits in verbal fluency, inhibitory response, planning, and verbal and spatial working memory; compared with term infants.
Serenius, Källén, Blennow, Ewald, et al (2013)	Europe	Cohort study. 491 very premature (<27 sg). 2.5 years.	Lower scores in cognitive, language and motor development were obtained in very preterm infants compared with the control group of term infants. Moderate or severe mental retardation was observed in 20% of the preterm population with 7% cerebral palsy.
Ríos-Florez, Marulanda, Ruiz-Piedrahita y Jiménez-Zuluaga (2016)	Latin America	Cross-sectional study. 80 premature babies. Between 6 and 10 years.	A lower performance of verbal function, comprehension of spoken speech and semantic verbal fluency was found in preterm infants. The lower the gestational age at birth, the lower the performance.
De Schuymer, De Groote, Desoete y Roeyers (2012)	Europe	Cross-sectional study. 20 premature babies. From 4 to 6 months EC.	The results show slow withdrawal of care in a non-social environment and more frequent deviation of gaze in a social context compared to those born at term.

Spittle, Treyvaud, Doyle, Roberts, et al (2009)	North America	Cross-sectional study. 188 very premature (<30sg and <1250 gr). 2 years CD.	Very preterm infants showed higher scores for internalizing behaviours and deregulation compared to term infants, being higher in female sex, lower birth weight, white matter lesion and corticosteroid treatment.
Mulder, Pitchford y Marlow (2011)	Europe	Cross-sectional study. 56 premature (<31 sg). Between 9 and 10 years.	Greater behavioural problems with parental difficulties, hyperactivity, emotional problems, peer problems, impulsive behaviour and inattention were observed in preterm babies compared with term babies.
Bhutta, Cleves, Casey, Cradock y Anand (2002)	North America	Meta-analysis. Premature babies from 5 to 10 years old.	In 81% of the studies evaluated, externalizing and internalizing behaviors were evidenced in preterm babies, with twins 2.64 more at risk of developing them. In 69% of the studies reference is made to the presence of alterations in socialization.
Johnson, Hollis, Kochhar, Hennessy, et al (2010)	Europe	Cohort study. 219 premature. Up to the age of 11.	Those born extremely preterm (<26 weeks gestation) had an increased risk of developing TDAH, emotional disturbance, and TEA.
Johnson y Marlow (2011)	Europe	Systematic review. Premature to adulthood.	A "phenotype of premature behavior" is described that is characterized by an increased risk of manifesting symptoms and disorders associated with inattention, anxiety, and social difficulties.

RESULTS

A) At engine level

A recent systematic review conducted by Fuentefria, Silveira and Procianoy in 2017, in which articles related to gross motor development in preterm infants were analyzed using the AIMS (Alberta Infant Motor Scale) scale, reveals how there is a statistically significant lower gross motor performance in the 6 to 18 month corrected age period in relation to developmental outcomes obtained in term born infants [7]. These differences are not only evident in the development of gross motor skills, but also affect the development of fine motor skills and motor functionality, with environmental factors being a conditioner of the evolution and motor development of premature infants in the first two years of corrected age [8,9]. In later ages, a meta-analysis carried out in 2009

stands out, in which articles were analysed on follow-up studies evaluating, among others, the motor development of children born prematurely up to the age of 15. After the analysis, the authors concluded that there was a motor delay maintained throughout all the years in comparison with a group of term born, motor deficits that were observed in balance skills, ball skills, manual dexterity and gross and fine motor development [10].

Up to 15 percent of children born less than 30 weeks gestation develop cerebral palsy, and 50 percent have a developmental progression to motor impairment ranging from mild to severe at school age [11]. The data reflected in a Serbian study carried out in 2016 stands out, where it is shown that more than half (54.4 percent) of the children with cerebral palsy were born prematurely [12].

Cerebral palsy, in addition to having an inseparable motor pathology, can be associated with other difficulties such as sensory alterations, communication and behavioral disorders, and perceptual deficits, such as problems in the proprioceptive establishment of the body schema and spatial orientation, among others [13]. The sum of all or part of it turns out to be a compendium that will lead the child with cerebral palsy to possess or to be at greater risk of developing learning problems.

B) At the sensory-cognitive level**:**

Through a cohort study, which followed premature children who developed retinopathy up to 5 years of age, it was observed how there is a three to four times greater risk of developing motor, cognitive and auditory impairment compared to premature children who did not develop retinopathy [14].

Likewise, in the first three years of a child's life, any degree of hearing impairment will lead to difficulties in linguistic development, affecting personality, behaviour, school performance and social relations [15].

The sensory disorders that prematurely born children may develop go beyond visual and auditory deficits, as sensory processing also includes tactile, tactile-oral, vestibular and proprioceptive sensations. Gestational age, male gender, white matter lesions and low parental education have been identified as risk factors for developing sensory disorders [16].

In 2014, Chorna and collaborators conducted a prospective cohort study where children born prematurely up to the first 12 months of corrected age were followed, observing that there was a high prevalence of sensory disorders (82 percent of 72 participants), related to abnormal sensory reactivity. They showed that lower gestational age was related to abnormal reactivity to deep pressure and vestibular stimulation, and that an abnormal adaptive motor response to tactile stimuli is related to worse motor and language development scores [16].

Wickremasinghe and colleagues, in 2013, observed how there was a high prevalence of sensory disorders in children born very prematurely, after follow-up until the age of 4 years, observing that the areas most affected were auditory, tactile and vestibular processing. In addition, these authors showed that the most affected quadrant was low registration [17], results coinciding with those obtained in a more recent study, where follow-up was carried out up to two years of age corrected for extreme prematurity

(<25 weeks of gestation), also obtaining atypical results in sensory processing, the most common behavior being low registration [18].

Deterioration in the ability to receive and integrate sensory information and to adapt seems to interfere with motor, cognitive and language development, as well as behaviour [16].

Entering the cognitive area, low birth weight has been described as a predisposing factor for developing a low IQ [19].

This difficulty in achieving good academic performance translates into possible learning problems, as reflected through an international meta-analysis, which included the monitoring of a total of 64,000 children who were born prematurely. It was observed how they had lower scores in reading, mathematics and spelling in primary education, keeping the scores low in reading and spelling in secondary education [20].
In terms of executive function, significant deficits in verbal fluency, inhibition of response, planning and verbal and spatial work memory were found in a group of 200 children born prematurely at the age of 4 to 12 years, compared with a control group of children born at the same age at the same time [21].

However, the greatest neurocognitive compromise related to prematurity is considered to be attentional difficulties. Referring again to the meta-analysis carried out in 2017 by Allotey and collaborators, the studies show a higher percentage of behavioral problems in children born prematurely at school age compared to those born at term. It is also estimated that premature babies born less than 32 weeks gestation are three times more likely to be diagnosed with TDAH [20].

Language is another major cognitive skill, where prematurity can also become a handicap in neurolinguistic development.

As evidenced by a study carried out in Sweden in 2013, after following 456 children born extremely prematurely (<27 weeks of gestation), at 2 and a half years of life, 9.4% had a moderate language disability, compared to 2.5% for those born at term; 6.6% of the population studied had a severe language disability, the latter being non-existent in the group of those born at term. Significant differences were also found between boys and girls born extremely prematurely, with boys registering lower language scores than girls [22]. At school, at the age of 6 to 10, Ríos-Flórez and collaborators compared the language skills of 80 children born prematurely with 80 born at term, concluding that language is compromised in the premature group, with the lowest gestational age being related to lower performance in verbal designation, comprehension of spoken speech and semantic verbal fluency [23].

C) <u>Socio-emotional and behavioral alterations:</u>

Already at the early age of 4 and 6 months of corrected age, in those born prematurely, aversion and withdrawal of gaze have been observed in social interactions, remaining attentive in a shorter time than children born at term [24]. Likewise, at 2 years of corrected age, greater behavior problems are described in boys and girls with less than 30 weeks of gestation at birth, particularly in internalizing and deregulating behaviors, in comparison with those born at term, being these alterations more significant in the female sex, in low birth weight, in alterations of the white substance and treatment with corticoids [25].

In older ages, it is worth noting the results found through a British study which assessed behavioural difficulties in premature births at the age of 9 and 10 years. In the same study, in addition to finding a greater proportion of children born prematurely with problems of inattention and hyperactive and compulsive behaviors, was observed in school age, greater problems with parents and among peers, emotional problems and greater antisocial behaviors, compared with children born at term [26].

In addition to hyperactivity, a greater risk has been described for other externalizing problems such as passivity and instability; and internalizing problems such as anxiety, depression, somatic complaints, fears and phobias [27]. Specifically, in a meta-analysis conducted by Bhutta, Cleves, Casey, Cradok and Anand on behavioural problems, it was found that boys and girls with a history of prematurity have a higher risk of presenting them compared to those born at term, and it was also found that, 81 percent of the studies reviewed that included premature infants between the ages of 5 and 14 showed a higher prevalence of so-called internalized disorders such as anxiety, depression and deprivation symptoms, and 69 percent of the studies refer to the presence of sociabilization disorders [27]. Along the same lines, a large cohort study conducted in the United Kingdom and Ireland, under the name EPICURE, concluded that at 11 years of age, children who were born extremely preterm (<26 weeks of gestation), had a higher risk of developing TDAH, emotional disturbance and TEA [28].

Although there are many studies that relate prematurity to an increased risk of developing TEA, Hernandez and colleagues consider this relationship complex, since prematurity and associated problems can lead to false positives in current screening for interferences with the signs of TEA, so they advise monitoring and prospective screening with detection tools adapted and validated to the characteristics of the premature population [29]. This fact was already mentioned in 2011 by Johnson and Marlow, where they described a "phenotype of premature behavior" that includes symptoms and disorders that can interfere and lead to a greater allocation of psychiatric problems in premature children [30].

CONCLUSIONS

As we have been able to observe in the articles reviewed, the child who has been born very prematurely should be understood as an integral being, knowing the possible alterations that can develop in each of its areas. At the motor level, since through it the child develops and communicates with his environment and society; at the sensory-cognitive level, because through the senses the person knows and interacts with the environment, acquiring and learning knowledge of what surrounds him; and last but not least, the socio-emotional and behavioural area, essential to achieve optimum mental and social health.

The school, together with the family, are the environments that surround the child and the girl who has been born great prematurely once she leaves the hospital, being therefore, precursor of the correct growth and development towards a childhood and adolescence of quality.

Professionals in health, education, early care and family, must have knowledge about the different paths that can take the development of a child who has been born

premature, to have the opportunity to act on time building new roads and bridges to overcome future obstacles and maximize the skills and capabilities of each person.

As nursing professionals, we must act looking for the quality of life in the future of the person, developing interventions with the family and the school that allow to lessen the possible difficulties in the learning and in the behavioral control, given its repercussion at personal, family, school and social level in the life of the child.

Knowing the needs presented by these children and their families can be the key tools to promote the development of preventive programs where appropriate early stimulation is encouraged.

REFERENCES

1. Egan F, Quiroga A, Chattás G. Cuidado para el neurodesarrollo. Rev Enfer Neo. 2012;(14): 1-14.
2. Pallás CR, Valls A, Perapoch J. Cuidados Centrados en el Desarrollo Unidades de Neonatología ¿Cuál es su situación en España?. Madrid: Ministerio de Sanidad y Política Social; 2010.
3. Oskoui, M; Coutino, F; Dykeman, J; Jette, N; Pringsheim, T. An update on the prevalence of cerebral palsy: a systematic review and meta-analysis. Dev. Med, Child, Neurol. 2013; 6 (55): 509-519.
4. Leversen K. T, Sommerfelt K, Ronnestad A, Kaaresen PI, Farstad T, Skranes J, Markestad T. Prediction of neurodevelopmental and sensory outcome at 5 years in Norwegian children born extremely preterm. Pediatr. 2011; 3 (127): 630-638.
5. Kinney HC, Haynes RL, Xu G, Andiman SE, Folkerth RD, Sleeper LA, Volpe JJ. Neuron deficit in the white matter and subplate in periventricular leukomalacia. Ann Neurol. 2012; 3 (71): 397-406.
6. Torres MJ, Gómez E, Medina MC, Pallás CR. Programas de seguimiento para neonatos de alto riesgo. Madrid: Asociación Española de Pediatría; 2008. Disponible en *www.aeped.es/protocolos/*
7. Fuentefria R, Silveira R, Procianoy R. Motor development of preterm infants assessed by the Alberta Infant Motor Scale: systematic review article. Jornal de Pediatria. 2017; 93 (4): 328-342.
8. Sá E, De Castro L. Motor and fuctional development in infants born preterm and full term: influence of biological and environmental risk factors. Rev Pau Pediatr. 2012; 30 (4): 462-470.
9. Maggi EF, Magalhäes LC, Campos AF, Bouzada MC. Preterm children have unfavorable motor, cognitive, and functional performance when compared to term children of preschool age. Jornal de Pediatria. 2014; 90 (4): 377-383.
10. De Kieviet JF, Piek J, Aarnoudse-Moens CS, Oosterlaan J. (2009). Motor development in very preterm and very low-birth-weight children from birth to adolescence. A Meta-analysis. JAMA. 2009; 302 (20): 2235-2242.
11. Spittle A, McGinley JL, Clark R, Thompson D, FitzGerald TL, Mentiplay BF, Lee K, Olsen J, Burnett A, Treyvaud K, Josev E, Alexander B, Kelly CE, Doyle L, Anderson P, Cheong J. Motor trajectories of children born <30 weeks' gestation from birth to five years: early predictors and functional implications - protocol for a prospective cohort study. Journal of Phisiotherapy. 2016; 62 (4): 222-223. Disponible en https://www.ncbi.nlm.nih.gov/pubmed/27634166

12. Demesi C, Mikov A, Filipovic K, Tomasevic S, Knezevic A, Krasnik R. Cerebral palsy in preterm infants. Vojnosanitetski Pregled. 2016; 73 (4): 343-348.
13. Navarro AM, Restrepo AP. Consecuencias neuropsicológicas de la parálisis cerebral. Estudio de caso. Universitas Psychologica. 2004; 4 (1): 107-115.
14. Schmidt B, Davis P, Asztalos EV, Solimano A, Roberts R. Association Between Severe Retinopathy of Prematurity and Nonvisual Disabilities at Age 5 Years. JAMA. 2014; 311 (5): 523-525.
15. Henríquez S, González D, Pérez G. Caracterización de recién nacidos, evaluados con audiometría de potencial auditivo evocado en el Hospital Hernán Henríquez Aravena, periodo 2007-2011, y alcances al protocolo GES. Rev Chil Salud Pública. 2014; 17 (3): 255-260.
16. Chorna O, Solomon JE, Slaughter JC, Stark AR, Maitre NL. (2014). Abnormal sensory reactivity in preterm infants during the first year correlates with adverse neurodevelopmental outcomes at 2 years of age. British Med Journal. 2014; 99 (6). Disponible en http://dx.doi.org/10.1136/archdischild-2014-306486
17. Wickremasinghe AC, Rogers EE, Johnson BC, Shen A, Barkovich AJ, Marco EJ. Children born prematurely have atypical Sensory Profiles. Journal of Perinatology. 2013; 33 (8): 631-635. Disponible en doi:10.1038/jp.2013.12.
18. Rahkonen P, Lano A, Pesonen A, Heinonen K, Raikkonen K, Vanhatalo S, Autti T, Valanne L, Andersson S, Metsäranta M. Atypical sensory processing is common in extremely low gestational age children. Acta Paediatrics. 2015; 104 (5): 522-528. Disponible en https://doi.org/10.1111/apa.12911
19. Gu H, Wang L, Liu L, Luo X, Wang J, Hou F, Denis P, Li J, Liu G, Meng H, Zhang J. A gradient relationship between low birth weight and IQ: A meta-analysis. Scientific Reports. 2017; 7 (18035). Disponible en doi.org/10.1038/s41598-017-18234-9
20. Allotey J, Zamora J, Cheong-See F, Kalidindi M, Arroyo-Manzano D, Asztalos E, Van J, Mol BW, Moore D, Birtles D, Khan KS, Thangaratinam S. Cognitive, motor, behavioural and academic performances of children born preterm: a meta-analysis and systematic review involving 64061 children. Int Journal of Obstetrics and Gynaecology. 2017; 125: 16-25. Disponible en DOI: 10.1111/1471-0528.14832
21. Aarnoudse-Moens C, Duivenvo HJ, Weisglas-Kuperus N, Van JB, Oosterlaan J. The profile of executive function in very preterm children at 4 to 12 years. Dev Med & Child Neurology. 2011; 54: 247-253. Disponible en DOI: 10.1111/j.1469-8749.2011.04150.x
22. Serenius F, Källén K, Blennow M, Ewald U, Fellman V, Holmström G, Lindberg E, Lundqvist P, Marsál K, Norman M, Olhager E, Stigson L, Stjernqvist K, Vollmer B, Strömberg B. Neurodevelopmental outcome in extremely preterm infants at 2.5 years after active perinatal care in Sweden. JAMA. 2013; 309 (17): 1810-1820. Disponible en doi:10.1001/jama.2013.3786
23. Ríos-Flórez JA, Marulanda V, Ruiz-Piedrahita PA, Jiménez-Zuluaga PY. Neuropsicología del lenguaje de niños entre 6 y 10 años de edad con antecedente de nacimiento prematuro. Rev Chil Neuropsicología. 2016; 11 (2): 6-12. Disponible en DOI: 10.5839/rcnp.2016.11.02.02
24. De Schuymer L, De Groote I, Desoete A, Roeyers H. (2012). Gaze aversion during social interaction in preterm infants: a function of attention skills?. Inf Behav & Dev. 2012; 35: 129-139. Disponible en doi:10.1016/j.infbeh.2011.08.002
25. Spittle AJ, Treyvaud K, Doyle LW, Roberts G, Lee KJ, Inder TE, Cheong J, Hunt RW, Newnham CA, Anderson PJ. Early emergence of behavior and

social-emotional problems in very preterm infants. JAMA Psychiatry. 2009; 48 (9): 909-918. Disponible en https://doi.org/10.1097/CHI.0b013e3181af8235
26. Mulder H, Pitchford NJ, Marlow N. Inattentive behaviour is associated with poor working memory and slow processing speed in very pre-term children in middle childhood. Brit Journal Educational Psychology. 2011; 81 (1): 147-160. Disponible en https://doi.org/10.1348/000709910X505527
27. Bhutta AT, Cleves MA, Casey PH, Cradock MM, Anand KJS. Cognitive and behavioral outcomes of school-aged children who were born preterm. A Meta-analysis. JAMA. 2002; 288 (6): 728-737.
28. Johnson S, Hollis C, Kochhar P, Hennessy E, Wolke D, Marlow N. Autism spectrum disorders in extremely preterm children. Journal Pediatr. 2010; 156 (4): 525-531. Disponible en https://doi.org/10.1016/j.jpeds.2009.10.041
29. Hernández A, Canal R, Magán M, De la Fuente G, Ruíz-Ayúcar I, Bejarano A, Janicel C, Jenaro C. Trastorno del espectro autista y prematuridad: hacia un programa de cribado prospectivo. En F. Mulas. XX Congreso Internacional de actualización en Trastornos del Neurodesarrollo. Valencia: Ilustre Colegio Oficial de Médicos de Valencia; 2018.
30. Johnson S, Marlow N. (2011). Preterm birth and childhood psychiatric disorders. Pediatr Research. 2011; 69 (5): 11-18. Disponible en doi: 10.1203/PDR.0b013e318212faa0

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