



## Family Functioning and Intelligence Quotient of Children Born Prematurely at 6 Years of Age

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### Abstract

**Background:** A premature birth alters the usual family situation, becoming a risk factor that can disturb the development of the child and parental functions. Families have to deal with and adjust to the evolution of prematurity and at the same are responsible for the child's skill development. Preterm infants have a higher risk of developing consequences in their cognitive development and intelligence quotient (IQ).

**Objective:** To learn about family functioning and IQ in children born prematurely at 6 years of age at the National Institute of Perinatology.

**Materials and Methods:** Analytical, non-experimental, cross-sectional study with purposive non-probabilistic sampling of two independent samples of parents and children with a history of prematurity.

**Results:** 124 cases were analyzed. The intelligence assessment of children at six years indicates that 62.7% have an average global IQ. There is a positive, low and statistically significant correlation between the weight of the premature and the global IQ ( $r_s = .229$ ,  $p \leq 0.05$ ). Significant statistical differences were only found regarding scores in the short-term memory area with respect to the area of a negative relationship with the partner corresponding to family functioning ( $\chi^2 = 7.52$ ,  $p = 0.05$ ).

**Conclusion:** The findings in this study refer to a global average IQ at 6 years of age in children with a history of prematurity. A relationship was found between weight and IQ in three assessed areas, except for Short Term Memory. No statistically significant differences were found between family functioning and IQ.

**Keywords:** Family Functioning; Intellectual Quotient; Prematurity; High Risk

## Introduction

A premature birth alters the usual family situation, becoming a risk factor that can disturb the development of the child and some parental functions. After facing the biological vulnerability of their newborn, families tend to adapt to the evolution of prematurity and at the same time are responsible for the child's skill development within the context of family life [1,2].

Prematurity is considered a high risk situation at birth because it encompasses pathologies, chronic disability, developmental consequences and therefore, a bad quality of life for newborns, with complications derived from prematurity [3] and low weight, amongst others [4].

The National Institute of Perinatology (INPer) reports more than 120,000 prematures born annually in Mexico. Of the total of attended deliveries in 2013 at INPer, 114 newborns were less than 28 weeks; 225 were born between 28 and 31.6 weeks of gestation and near 700 were late preterm [5].

Prematurity involves difficulties and developmental disorders of the child [6], specifically regarding cognitive development and its manifestation measured through intellectual quotient (IQ); extreme preterm and very low birth weight newborns have a higher risk of presenting cognitive disorders or poor cognitive functioning [6,7].

Therefore, IQ has a directly proportional relationship to the duration of the gestational period [8]. Although a neuropsychological assessment is necessary since birth, it is better to carry it out during school age from 6 and 7 years in order to identify disorders, especially in cognitive areas [6].

Studies point out that between 10 and 50% of premature children suffer from some degree of cognitive disability, the group mean of intelligence is located in low average, and the IQ of premature children born before 32 weeks of gestation reports significantly lower scores compared to children born at term [7,9]; although they are located within the normal range, there is difference of intelligence up to 10 points [10]. The same tendency is observed in children with an extremely low birth weight, showing significantly lower IQ scores compared to children born with a larger weight [11].

On the other hand, there are studies that report no statistical difference in the mental performance of children with or without

severe risk factors born prematurely [12]. Due to different study findings, it is concluded that cognitive development of preterm children is influenced by biological as well as socio-environmental factors [7]. Intelligence is linked to environmental aspects, highlighting the role of education, family environment, environmental risks and parenting [13,14].

This means that other than the biological risk factors derived from prenatal, perinatal and postnatal conditions that have a high probability of resulting in physical or cognitive developmental delay, there is a group of environmental risk factors associated to sociocultural aspects related to the family, the environment and the community. These are factors related to the environment in which the child grows up, determined by the quantity and quality of opportunities and limitations during developmental processes that define a minor or major delay in children. Cognitive aspects have also been associated with emotional states that the child may experience during development, such as anxiety [15,16].

Consequently it is important to emphasize the influence of the family in comprehensive development of preterm children, taking into account that from pregnancy and birth a non-normative, unexpected crisis occurs in family functioning [17,18].

The emotional impact the family experiences, mainly through the stressing situation of the arrival of a premature child, becomes chronic in the short and medium term, and may result in poor family structure thus generating environmental risk factors that determine the high risk child's cognitive, behavioral, emotional and social development more than biological factors such as low weight or neonatal morbidity [2].

Family structure and parental roles must be established in order to face the child's demands: attention, care and nutritional needs. As a consequence, partner relationships are usually affected or fractured by emotional distancing [1]. In this way, family functioning will be the capacity that the family has to remain consistent and stable in the presence of disrupting changes or events that may cause disease in members of the family system [19].

Identifying the risk and protective factors of family functioning in preterm compared with healthy term neonates, prematurity was found to be a risk factor because it causes a great deal of parental stress [20]. Family functioning suffers disturbances in a similar manner due to a history of high risk at birth, as well as the possible consequences of developmental disorders in children, and the diffi-

cult experience from the beginning of life, as the child will demand more time and attention from the parents [21,22].

The objective of this study was to learn about family functioning and the intellectual quotient in children born prematurely at 6 years of age at the National Institute of Perinatology.

### Materials and Methods

We used intentional non probabilistic sampling of two independent samples comprised of father-mother and children seen at the Department of pediatric follow-up of the National Institute of Perinatology Isidro Espinosa (INPer); for this purpose we designed an analytical, non-experimental cross-sectional study covering the period between March 2017 and December 2018.

We used the Family Functioning Inventory (Montiel 1997) [23].

Evaluates interactions, organization and the way in which families function. Reliability obtained for the Family Value subscale was  $\alpha = 0.49$  and for the four relationship subscales it fluctuated between  $\alpha = 0.73$  y  $0.89$ . It measures using 76 items and 5 factors being:

- Positive relationship with partner and children
- Negative relationship with children
- Negative relationship with partner
- Positive relationship with children
- Orientation of family values.

For the intellectual quotient we used the Stanford-Binet Intelligence Scale 4<sup>th</sup> Ed. (1996) [24]

- Battery comprised of 15 subtests that cover a range of ages from 2 to 23 years.
- Evaluates reasoning and knowledge of abstract concepts, practical judgment, visual and auditory memory, spacial and visomotor abilities, and verbal skills that prevail in higher mental functions.
- The total reliability of the scale is  $\alpha .98$  with a reasonable validity.
- The four areas assessed are:
- Verbal Reasoning
- Visual Abstract Reasoning

- Numerical Reasoning
- Short Term Memory

Fathers and mothers of 6-year old children with a history of premaure birth (according to gestational age or low birth weight) were invited to participate in the study. They were invited when they attended an appointment for psychological assessment at IN-Per. They received a thorough explanation of the objective and the scope of the investigation. If they willingly accepted to participate, they were given an informed consent to sign. All ethical requirements for investigation in humans were followed. We proceeded by applying the inventory to parents and assessing the children.

We used SPSS Software for the statistical analysis. A descriptive analysis was used to obtain rates, measures of central tendency and variability. To know the relationship between the weight of pre-mature children and the total IQ by areas at 6 years of age, an analysis was executed using Spearman's Rank Correlation Coefficient. To determine the differences in IQ of children at 6 years depending on their level of Family Functioning, the Chi square test was used.

### Results

The sample was comprised of 124 parents and 118 children. The relationship was not one to one since not always both parents responded to the functioning inventory; similarly there are cases where children were twins, triplets or quadruplets.

Concerning the parent's sociodemographic characteristics, there were 92 women and 32 men (74.2% and 25.8%, respectively) with an age range between 21 and 60 years ( $M = 39$ ,  $D.E. = 7.55$ ). The majority of parents had a level of schooling of middle or high school (26.6% each). 47.5% indicated being economically active while 51.6% stayed at home. 67.7% reported between 1 and 20 years of living together; 58.9% were married and 41.1% in consensual union.

Of the 118 children assessed at 6 years of age, 57 were female and 61 male (48.3% and 51.7%, respectively). 80.6% were singleton pregnancies, 10.5% were twins, 7.3% triplets and 1.6% quadruplets. Regarding prematurity according to weeks of gestation, 8.5% were extremely preterm (<28 weeks of gestation), 63.6% moderately preterm (28.1 to 33.6 weeks of gestation) and 28% were late preterm (34.0 to 36.6 weeks of gestation). The range of weight at birth went from 550g to 2425g ( $M = 1395$ ,  $D.E = 402.73$ )

According to the scores established by the intelligence scale used, IQ was classified in three groups for statistical purposes: Below average IQ ≤ 88, Average IQ 89-110 and Above average IQ ≥ 111.

Regarding global scores and scores by area, the results show that 62.7% of children have an average IQ (89-110). For Verbal Reasoning, 60.2% of the sample lies in the average level (89-110); for Visual Abstract Reasoning 41.5% is located at average level (89-100). For Numerical Reasoning 51.7% have an average IQ (89-110), while in the Short Term Memory area 60.2% are located within average (89-110) (See Table 1).

n = 118	Below Average ≤ 88		Average 89 -110		Above Average ≥ 111	
	F	%	F	%	F	%
IQ	14	11.9	74	62.7	30	25.4
VR	19	16.1	71	60.2	28	23.7
VAR	24	20.3	49	41.5	45	38.1
NR	9	7.6	61	51.7	48	40.7
STM	30	25.4	71	60.2	17	14.4

**Table 1:** Global and area IQ for children.

Note: Intellectual Quotient: IQ, Verbal Reasoning: VR, Visual Abstract Reasoning: VAR, Numerical Reasoning: NR, Short Term Memory: STM.

Based on the results obtained from the sum of each one of the five factors of the Family Functioning Inventory, the cut-off point was determined to form two groups classified into greater or lesser, referring to the greater or lesser presence of the indicator measured by each factor.

As to the characteristics of family functioning, descriptive results indicate that 82.5% of parents manifest having a positive relationship with their partner and children, 81.8% report having less of a negative relationship with their children, 60.4% report having less of a negative relationship with their partner, while 79.2% report having more a positive relationship with their children and 84.4% have more orientation towards family values.

On the other hand, it is important to point out that in relation to the classification of prematurity by weeks of gestation at birth: <28 weeks of gestation, extremely preterm, 28.1 to 33.6 weeks of

gestation, moderately preterm, 34.0 to 36.6 weeks of gestation, late preterm, there was no statistically significant correlation with global IQ nor any of the four areas assessed by the scale of intelligence.

There is a low, positive, statistically significant correlation between the weight of the premature child and the global Intellectual Quotient. This means that in a sample, the greater the weight at birth, the greater the global IQ at 6 years of age.

Similarly, there is a low, positive, statistically significant correlation between the weight of the premature child and cognitive ability in the areas of Verbal Reasoning (rs = .270, p = 0.01), Visual Abstract Reasoning (rs = .172, p = 0.05) and Numerical Reasoning (rs = .172, p = 0.05). This means that the greater the weight at birth, the better the performance in Verbal Reasoning, Visual Abstract Reasoning and Numerical Reasoning.

The results indicate that there are no statistically significant differences in relation to the children's global or area intellectual quotient and family functioning. Statistical differences were only found at 6 years of age in relation to scores of the Short Term Memory area and the area of negative relationship with a partner corresponding to family functioning ( $\chi^2 = 7.52$ , p = 0.05). Children with family functioning involving a greater negative relationship between the parents present a greater percentage of scores below average in the area of Short Term Memory (57.98%) than those with a lesser negative relationship in their family functioning (42.10%) Table 2).

**Discussion and Conclusion**

The study allows us to learn about family functioning and intellectual quotient at 6 years of age in children with a premature birth. The results obtained regarding intelligence match those reported in the literature, which locate these children's global intelligence at the group mean average [7].

Likewise, the study allowed us to know the relationship between the intellectual quotient at six years of age and the weight of children with a history of low birth weight. A low, positive, statistically significant correlation was found between birth weight and global IQ, the Verbal Reasoning area, Visual Abstract Reasoning area, and Numerical Reasoning area. This means the greater the weight at birth, the greater the global and area IQ at six years of age. The above results agree with the study that reports an IQ in the normal range for children with a low birth weight [10]. Likewise,

	Short Term Memory IQ						$\chi^2$	p
	Below Average		Average		Above Average			
Negative relationship with a partner	f	%	f	%	f	%		
Lesser negative relationship with a partner	16	42.1	63	66.3	14	66.6		
Greater negative relationship with a partner	22	57.8	32	33.6	7	33.3	7.052	.029
Test $\chi^2$								

**Table 2:** Negative relationship with the partner and classification of Short Term Memory.

the relationship is confirmed between a low weight and a low IQ in premature children [11]. It is important to note that the present study did not find statistically significant differences between IQ and prematurity in relation to the weeks of gestation of children at birth, result that does not match the study reporting a lower IQ in premature children born with less than 33 weeks of gestation [13].

On the other hand, no statistically significant differences were found between the factors of family functioning and the IQ of children at 6 years of age, except in the Short Term Memory area and the negative relationship with a partner factor, meaning there are statistically significant differences in these children’s attention and concentration abilities, leading to memory failure; this difference could be explained by the component of anxiety. In this respect, literature reports that memory can be diminished when anxiety increases; this could explain the results obtained in this sample of families where the parent’s relationship style is characterized by disagreeable physical, emotional and communicational approaches [1,16].

There is evidence supporting that IQ is influenced by environmental risk factors known as social health determinants. Ac-

ordingly, it is acknowledged that family factors may strengthen difficulties in the interaction pattern of parents-children and consequentially contribute to children with perinatal risk of prematurity presenting low IQ; therefore the family may be a protective factor of the child’s cognitive abilities [10,13].

To finish it is important to make some final comments. This study matches the revised literature in emphasizing the importance and need to periodically assess cognitive and family function of children with a high risk birth [2]. In this sample, all children are part of a disciplinary team that promotes surveillance, diagnosis, early and timely intervention through a longitudinal follow-up in all spheres of development with the objective of preventing risks and improving the quality of life of these children.

In this way the assessment and surveillance of neurodevelopment through an interdisciplinary team seeks a healthy and protective environment for biological risks, as well as monitoring that the family environment is not an additional risk factor for the cognitive development of premature children.

The lack of studies regarding the family sphere of children with high risk at birth promotes further investigations to examine this poorly studied area in Mexican population. For further investigations it is recommended to consider morbidity at birth in order to relate it to integral neurodevelopment of these children. In conclusion the findings in this study report an average global IQ at 6 years of age in children with a history of prematurity. A correlation was found between weight and IQ. Statistically significant differences were found between one factor of family functioning and one area of IQ.

**Bibliography**

1. Gómez EC., et al. “Dificultades biosociales de la gran prematuridad”. *Sociedad Española de Neonatología* (2012).
2. Beláustegui CA., et al. “La familia y los programas de seguimiento”. *Neonatología centrada en la familia* (2016).
3. Romero S., et al. “Morbilidad del recién nacido prematuro tardío durante su primer mes de vida comparado con el recién nacido de término”. *Perinatología y reproducción humana* 27.3 (2013): 161-165.

4. Ríos-Flórez JA, *et al.* "Procesos de aprendizaje en niños de 6 a 10 años de edad con antecedente de nacimiento prematuro". *Revista Latinoamericana de Ciencias Sociales, Niñez y Juventud* 14.2 (2016): 1071-1085.
5. Instituto Nacional de Perinatología Isidro Espinosa de los Reyes. "La Prematurez en México el Gran Reto". Noticias (2016).
6. Arraguin-González J, *et al.* "Alteraciones neuropsicológicas en escolares con bajo peso al nacer (BPN) y / o muy bajo peso al nacer (MBPN) en México". *Archivos de Neurociencias* 22.2 (2017): 38-52.
7. Torres-González C, *et al.* "Inteligencia general en niños nacidos prematuramente." *Cuadernos de Neuropsicología Panamerican Journal of Neuropsychology* 10.2 (2016): 142-164.
8. Fondo de las Naciones Unidas para la Infancia [UNICEF]. "Aprendizaje y Escolaridad del niño Prematuro. Desafíos para los niños, desafíos para nuestras escuelas". *Semana del Prematuro* (2010).
9. Voigt B, *et al.* "Cognitive development in very vs. moderately to late preterm and full-term children: can effortful control account for group differences in toddlerhood?" *Early Human Development* 88 (2012): 307-313.
10. Gu H, *et al.* "Gradient relationship between low birth weight and IQ: A meta-analysis". *Scientific Reports* (2017).
11. Martínez-Cruz CF, *et al.* "Association between intelligence quotient scores and extremely low birth weight in school-age children". *Archives or Medical Research* 37.5 (2006): 639-645.
12. Bos A and Roze E. "Neurodevelopmental outcome in preterm infants". *Developmental Medicine and Child Neurology* 53.4 (2011): 35-39.
13. Turpin H, *et al.* "The interplay between prematurity, maternal stress and children's intelligence quotient at age 11: A longitudinal study". *Scientific Reports* (2019).
14. Sternberg R. "Intelligence". *Dialogues in clinical Neuroscience* 14.1 (2012): 19-27.
15. Confederación Nacional de Pediatría de México. Manual neurodesarrollo y estimulación temprana en pediatría (2014).
16. Zapata KM. "Relación entre memoria de trabajo, ansiedad y rendimiento académico en estudiantes de un ISTP en el distrito de San Martín de Porres". Tesis de Maestría. Universidad Peruana Cayetano Heredia, Lima, Perú (2018).
17. Scarpati M, *et al.* "Límites, reglas, comunicación Familia monoparental con hijos adolescents". *Diversitas* 10.2 (2014): 225-246.
18. Torres J, *et al.* "Diseño y pilotaje de un protocolo de acompañamiento psicológico para padres y madres con neonatos prematuros fases II". *Cuadernos Hispanoamericanos de Psicología* 5.2 (2005): 175-193.
19. García-Madrid G, *et al.* "Funcionalidad familiar y capacidad física de los adultos mayores en una comunidad rural". *Revista de Enfermería del Instituto Mexicano del Seguro Social* 15.1 (2007): 21-26.
20. Delgadillo-Hernández AO, *et al.* "Funcionamiento familiar de adolescentes con leucemia". *Psicología iberoamericana* 20.1 (2012): 48-62.
21. Escartí A, *et al.* "Estudio piloto sobre el estrés y la resiliencia familiar en recién nacidos". *Anales de Pediatría* 84 (2016): 3-9.
22. Núñez B. "Familia y discapacidad de la Vida Cotidiana a la Teoría". Lugar Editorial. Buenos Aires; (2007).
23. Montiel M. "Pautas de Funcionamiento en familias reconstituidas y en familias intactas". Tesis Doctoral. UNAM, México, D.F (1997).
24. Torndike R, *et al.* "The Stanford-Binet Intelligence Scale: Fourth Edition". The Riverside Publishing Company (1986).

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