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Influence of breastfeeding and iron status on mental and psychomotor development during the first year of life.

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ABSTRACT

Breastfeeding (BF) confers numerous benefits on the developing infant in both the short and the long term including psychological development, but there are multiple other factors that must be taken into account when these relationships are studied. To analyse how breastfeeding during the first 4 months of life affects infant mental and psychomotor development (MPD) at 6 and 12 months in a group of healthy infants from a Mediterranean Spanish city considering many important potential confounds. This is a longitudinal study conducted on infants from birth until the age of 12 months. A total of 154 healthy infants were evaluated by Paediatric Unit of Sant Joan University Hospital in Reus, Spain. Type of feeding, clinical history, anthropometry, iron status and mental and psychomotor development were assessed and analysed. At 4 months, 24% of infants received BF and 26% received mixed feeding (MF). Multiple Linear Regression models were applied adjusting for potential prenatal, perinatal and postnatal confounds showing that infants who received BF for at least four months presented higher psychomotor development index (PDI) at 6 and at 12 months of age. Also, gestational age and BMI at 6 m were associated positively with PDI at 6 m, and haemoglobin levels at 12 m and birth height were associated with PDI and MDI at 12 m (respectively).

In conclusion, after the adjustment of important potential confounds, BF during at least four months and adequate infant iron status are related to better psychomotor development during the first year. No associations were found between BF and mental development.

Abbreviations: AA, Arachidonic Acid; AAP, American Academy of Paediatrics; BF, Breastfeeding; BMI, Body Mass Index; BSID, Bayley Scales of Infant Development; DHA, Docosahexaenoic Acid; ESPGHAN, European Society of Paediatric, Gastroenterology, Hepatology and Nutrition; IF, Infant formula; LCPUFA, Long chain polyunsaturated fatty acids; MDI, Mental development index; MPD, Mental and psychomotor development; MF, Mixed feeding; MLR, Multiple linear regression; PDI, Psychomotor development index; WHO, World Health Organization

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1. INTRODUCTION

The World Health Organization (WHO), the American Academy of Paediatrics (AAP) and the European Society of Paediatric, Gastroenterology, Hepatology and Nutrition (ESPGHAN) recommend that mothers worldwide should exclusively breastfeed during their child's first six months in order for them to achieve optimal growth, development and health. Thereafter, they should be given nutritious complementary foods, while breastfeeding should continue until the age of two years or more (WHO, 2011). However, breastfeeding rates have decreased and in the developing world only 39% of children under the age of six months are exclusively breastfed (UNICEF, 2015). Global data for Spain show that the prevalence of exclusive breastfeeding (BF) at 3 months of age is 53.5% while at six months of age it is 28.5% (Ministerio de Sanidad y Consumo, 2006MSSSI, 2006). In our population (Catalonia, Spain), the rates are rather higher: 80.9% of children receive exclusive BF at birth, 50.6% for up to 6 months, and 24% receive non-exclusive BF, because they received complementary feeding, for over a year or more (ASPCAT, 2015).

BF confers a range of benefits, in both the short and the long term, on the developing infant. These include lower allergic sensitivity, greater immunity, decreases in infectious morbidity and sudden death, and protection against chronic diseases such as diabetes mellitus, Crohn's disease, obesity and cardiovascular disease (Eidelman, 2013; Gertosio, Meazza, Pagani, & Bozzola, 2016; DHH, 2011).

Several studies, the first of which is from 1929 (Hoefer & Hardy, 1929), relate BF with better mental and psychomotor development (MPD) in both the short and the long term (Anderson, Johnstone, & Remley, 1999; Angelsen, Vik, Jacobsen, & Bakketeig, 2001; Belfort et al., 2013; Belfort et al., 2016; Bernard et al., 2013; Cai et al., 2015; Golding, Rogers, & Emmett, 1997; Gómez-Sanchiz, Cañete, Rodero, Baeza, & Avila, 2003; Hoque et al., 2012; Horta, Bahl, Martinez, & Victora, 2007; Horwood & Fergusson, 1998; Julvez et al., 2014; Kramer et al., 2008; Leventakou et al., 2015; Nyaradi, Oddy, Hickling, & Foster, 2015), though others have found no relationship between these variables (Bouwstra et al., 2005; Burruchaga, Sanz, Zubizarreta, Benito, & Sanjurjo, 2000). This subject has therefore continued to cause considerable debate. Even today, studies with large samples are showing these relationships (Lee et al., 2016; Peyre et al., 2016). Conclusions are difficult to draw because of the wide variability in the sample sizes used, the kind of samples used (most studies are conducted in developing countries on preterm very-low-weight infants), the age at which the children are administered the cognitive assessment test, the duration of BF, and the confounding variables used to adjust relations. Walfisch, Sermer, Cressman and Koren (2013), conducted an extended meta-analysis of BF and MPD by comparing studies that either found or did not find relationships. From this meta-analysis, which took into account the general quality of the studies, the populations studied (developed/developing countries) and the ages of the children, they concluded that the studies initially found that BF had a positive effect on MPD but that this relationship disappeared or diminished after multivariate analysis controlled for a significantly greater number of potential confounds. Many results reported that the effects of BF on child MPD were due to maternal cognitive and socioeconomic effects. In fact, BF ratios are higher in older women with a higher educational and socioeconomic status (Angelsen et al., 2001), so it is highly recommended to include these variables (Gertosio et al., 2016; Walfisch et al., 2013). However, early key studies showed that the beneficial effect of BF (controlled by social class and education) disappeared after the inclusion of maternal general and verbal intelligence and parenting skills (Jacobson, Jacobson, Dobbing, & Beijers, 1992; Jacobson, Chiodo, & Jacobson, 1999). In fact, the maternal decision to breastfeed seems to be related to higher maternal intelligence (Jacobson et al., 1992). Moreover, multiple other prenatal, perinatal and postnatal factors, such as maternal prenatal drugs consumption (nicotine, alcohol and other drugs), infant nutrition and infant physical growth status, have also been described as possible factors related to MPD (Anderson et al., 1999; Conroy et al., 2012; Golding et al., 1997; Kiechl-Kohlendorfer et al., 2010; Mortensen, Michaelsen, Sanders, & Reinisch, 2002; Nyaradi et al., 2013), but these variables are not normally included as confounds in the analysis. Some studies have shown that MPD, nutritional status and physical growth are associated with infant head circumference, which is also associated with BF (Ferreira et al., 2013Ferreira, de Assunção, dos Santos, & Horta, 2013). Nyarady et al. (2013) found that infant nutrition during the first year of life is a good predictor of later MPD and that iron is the nutrient that is most related to it (Low, Farrell, Biggs, & Pasricha, 2013; Lozoff, 2007; Maggi, Magalhãesb, Camposc, & Bouzadad, 2014).

In our society, as in many other developed countries, the incorporation of women to work takes place around the child's 4 months of age, which is one of the main reasons for the early abandonment of BF. Furthermore, there are few prospective longitudinal studies of healthy infants in developed countries that evaluate the association of BF and MPD adjusting by multiple potential confounds, and according to our knowledge, there is no one that evaluates this association at 4 months, when maternity leave ends in our country and most mothers return to work. So, in order to adjust to the social reality of our environment and, probably, to other similar countries in socioeconomic and work level.

The aim of our study was to analyse the association between BF during the first 4 months of life and infant MPD at 6 and 12 months in a group of healthy infants from a Mediterranean Spanish city adjusting by important potential confounds such as maternal age, maternal education and socioeconomic status, prenatal nicotine exposure, infant gender, gestational age, anthropometric measurements, and infant iron status.

2. MATERIAL AND METHODS

2.1. Design and setting

This is a prospective longitudinal study. The infants were recruited at birth in the public Hospital Universitari Sant Joan de Reus (Tarragona, Spain) and followed for 12 months. Most children were from families with a medium or high socioeconomic level. The participation was offered to all parents, during the course of the first day of life of the children born in University Hospital Sant Joan