



Full length article

## Exclusive breastfeeding at three months and infant sleep-wake behaviors at two weeks, three and six months



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### ABSTRACT

This study assessed infant sleep-wake behavior at two weeks, three and six months as function of feeding method at three months (exclusively breastfed, partially breastfed, and exclusively formula fed infants). Mothers of 163 first-born, full-term, normal birth weight, healthy infants completed socio-demographic, depression, anxiety, and infant sleep-wake behavior measures. No effects were found for sleep arrangements, depression or anxiety, on feeding methods and sleep-wake behavior at three months. At two weeks exclusively breastfed infants at three months spent more hours sleeping and less hours awake during the 24-h period than partially breastfed infants. At three months, exclusively breastfed infants had a shorter of the longest sleep period at night than exclusively formula fed infants. At six months, exclusively breastfed infants at three months spent more hours awake at night than partially breastfed infants, awake more at night than exclusively formula fed infants, and had a shorter sleep period at night than partially breastfed and exclusively formula fed infants. This study showed differences in sleep-wake behaviors at two weeks, three and six months, when exclusively breastfed infants are compared with partially breastfed and exclusively formula fed infants at three months, while no effects were found for sleep arrangements, depression or anxiety.

### 1. Introduction

Public health authorities recommend exclusive breastfeeding for the first six months of infancy (American Academy of Pediatrics, 2012; World Health Organization, 2009). Breastfed infants are commonly reported to sleep less, wake more and show less prolonged sleep at night when compared with formula fed infants. Infant sleep has been associated with other conditions (sleep arrangements, maternal depression, anxiety) related to breastfeeding. This study is unique in studying the effects of exclusive breastfeeding on infant sleep-wake behavior at two weeks, three and six months, comparing infants who were exclusively breastfed, partially breastfed and exclusively formula fed at three months.

Breastfed infants have usually been reported as sleeping less than formula fed infants (e.g., Hughes, Gallagher, & Hannigan, 2015; Nevarez, Rifas-Shiman, Kleinman, Gillman, & Taveras, 2010), but more hours of sleep per day (Ramamurthy et al., 2012). Breastfed infants were found to sleep less during the night (e.g., Schwichtenberg & Poehlmann, 2009; Quillin, 1997), although a trend for longer nocturnal sleep duration was noted in at least one study (Engler, Hadash, Shehadeh, & Pillar, 2012). Several studies have associated breastfeeding with more night wakings (Galbally, Lewis, McEgan, Scalzo, & Islam, 2013; Hysing et al., 2014) and with a shorter continuous nighttime sleep period (Ramamurthy et al., 2012). Moreover, infants were more likely to be sleeping through the

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night at nine months when they were weaned before 12 weeks in one study (Morgan, Lucas, & Fewtrell, 2004), while another study showed that early weaning does not facilitate continuous night sleep (Yilmaz, Gürakan, Cakir, & Tezcan, 2001).

Interestingly, in a recent study exclusively formula fed infants presented the greatest sleep percentage per day and fewer night wakings, followed by exclusively breastfed infants and partially breastfed infants, suggesting that partial breastfeeding may be associated with less sleep in infants (Huang et al., 2016). The inclusion of partially breastfed infants in this study suggested that infant sleep-wake behavior may not benefit from partial breastfeeding, as these infants sleep fewer hours and have more night wakings when compared with exclusively breastfed infants (Huang et al., 2016).

Additionally, short outcomes and long-term effects of breastfeeding appear to differ. The differences in sleep percentage and night wakings frequency between exclusively formula fed and exclusively breastfed infants seem to weaken over time (Huang et al., 2016). For example, despite more night wakings at six months, no significant differences were found at 24 and 36 months (Weinraub et al., 2012). Moreover, breastfeeding was associated with night wakings in infants at six months, but was not related to night wakings at 18 months (Mindell, Du Mond, Tanenbaum, & Gunn, 2012; Hysing et al., 2014).

Breastfed infants are more easily aroused from active sleep at two-three months of age than formula fed infants and this easy arousal from sleep is believed to be an important survival mechanism to prevent Sudden Infant Death Syndrome (SIDS; Horne, Parslow, Ferens, Watts, & Adamson, 2004). Although breastfeeding also had a protective effect on wheezing, coughing, snoring and breathing problems in another study (Galbally et al., 2013), breastfeeding was reported to increase the odds of sleep problems in at least two other studies (Hughes et al., 2015; Schmid, Schreier, Meyer, & Wolke, 2011).

Infant sleep-wake behaviors also differ across cultures (Field, 2017; Mindell, Sadeh, Wiegand, How, & Goh, 2010; Nevarez et al., 2010) and appear to be shaped by multiple variables. A recent literature identified the different risk and protective factors associated with infant sleep (Field, 2017). Most of these factors have not shown independent effects on infant sleep (e.g., Yilmaz, 2001). Infant sleep-wake behaviors have been notably associated with sleep arrangements, maternal depression and maternal anxiety. Bed-sharing infants were reported to sleep less and awaken more during the night than infants who sleep alone (Huang et al., 2016; Hughes et al., 2015). Infants of depressed and anxious mothers show more night wakings and more sleep problems (e.g., Petzoldt, Wittchen, Einsle, & Martini, 2016; Sharkey, Iko, Machan, Thompson-Westra, & Pearlstein, 2016).

Findings from prior research into the effect of feeding methods on infant sleep are inconsistent regarding breastfed infant sleeping less time per day and during the night and more reported sleep problems in breastfed compared to formula fed infants. Previous results are more consensual for a higher number of awakenings during the night and shorter continuous nighttime sleep period in breastfed compared to formula fed infants. Nevertheless, some studies found no significant differences in sleep patterns between breastfed and formula fed infants (e.g., Demirci, Braxter, & Chasens, 2012), and more recent studies provided more consistent results on differences between exclusive breastfeeding and exclusive formula feeding, and partial breastfeeding methods (e.g., Huang et al., 2016).

In this study infant sleep-wake behaviors at two weeks, three and six months according to the feeding method at three months were compared for the exclusively breastfed, partially breastfed, and exclusively formula fed infants.

## 2. Methods

### 2.1. Procedures

The Ethical Commissions of University of Minho and Centro Hospitalar do Porto approved the research protocol. Women ( $N = 583$ ) were contacted at the hospital during the third trimester of pregnancy, informed about the purposes and procedures of the study and invited to participate. Women who did not read or write Portuguese, non-caucasian, multiparas and multiple births were excluded (31%). Women who agreed to participate (89%) signed an informed consent and 43 participants were excluded: nine infants with gestational age less than 37 weeks, three infants with low birth weight ( $< 2500$ ), 24 infants admitted to the intensive care unit during the first two weeks of life, and six exclusively breast-fed infants at three months who were introduced formula during the first days or weeks.

At two weeks ( $M = 3.60$  weeks,  $SD = 2.22$ ), three ( $M = 14.32$  weeks,  $SD = 2.18$ ) and six months ( $M = 27.92$  weeks,  $SD = 3.05$ ) postpartum the mothers completed on-line an Infant Sleep Chronogram and a Socio-demographic Questionnaire and measures of depression and anxiety at three months postpartum. Exploratory analyses were conducted to examine outlier values on the Infant Sleep Chronogram leading to the exclusion of 13 (7.4%) infants. Of the 163 included infants, 148 (90.8%) had completed data on the Infant Sleep Chronogram at two weeks, 162 (99.4%) at three months, and 123 (75.5%) at six months.

### 2.2. Participants

The sample included 163 first-born, full-term ( $\geq 37$  weeks of gestation), of normal birth weight ( $\geq 2500$  g) and healthy infants (no hospitalization or admission to the intensive care unit in the first two weeks post-birth). All mothers were Caucasian and more than half were 26–34 years old (68.1%). The majority of the mothers were married and cohabiting (79.8%), and more than half were employed (71.2%), and had more than 12 years of schooling (64.4%). The majority of the infants were not resuscitated at birth (91.4%). More than half were male (54.6%) and born by vaginal delivery (68.1%). Mean gestational age was 39.23 weeks ( $SD = 1.10$ ), birth weight was 3262.29 g ( $SD = 381.38$ ) and birth length was 48.94 cm ( $SD = 1.76$ ). At three months, 17.6% of the infants was bed sharing daily with the mother. The majority of the infants (77.7%) were exclusively breast-fed at two weeks, but only 59.9% at three months, and 20.3% at six months; 19.6% were partially breast-fed at two weeks, 21.0% at three months, and 50.4% at

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