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Full Length Article

Breastfeeding and motor development: A longitudinal cohort study

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ABSTRACT

Background: While there is a large body of work supporting the importance of early feeding practices on cognitive, immunity, behavioural and mental outcomes, few longitudinal studies have focused on motor development. The relationship between duration of breast feeding and motor development outcomes at 10, 14, and 17 years were examined.
Methods: Data were obtained from the Western Australian Pregnancy (Raine) Study. There were 2868 live births recorded and children were examined for motor proficiency at 10 (M = 10.54, SD = 2.27), 14 (M = 14.02, SD = 2.33) and 17 (M = 16.99, SD = 2.97) years using the McCarron Assessment of Neuromuscular Development (MAND). Using linear mixed models, adjusted for covariates known to affect motor development, the influence of predominant breast feeding for <6 months and ⩾6 months on motor development outcomes was examined.
Results: Breast feeding for ⩾6 months was positively associated with improved motor development outcomes at 10, 14 and 17 years of age ($p = 0.019$, β 1.38) when adjusted for child's sex, maternal age, alcohol intake, family income, hypertensive status, gestational stress and mode of delivery.
Conclusion: Early life feeding practices have an influence on motor development outcomes into late childhood and adolescence independent of sociodemographic factors.

1. Introduction

Breastfeeding has been linked to a number of positive developmental outcomes including optimal neural (McCroy & Murray, 2013) and early brain development (Herba et al., 2013), improved immunity (Oddy & Rosales, 2010), mental health (Oddy et al., 2010), language ability (Dee, Li, Lee, & Grummer-Strawn, 2007; Whitehouse, Robinson, Li, & Oddy, 2010), cognitive function (Anderson, Johnstone, & Remley, 1999; Oddy et al., 2003) and academic achievement (Oddy, Li, Whitehouse, Zubrick, & Malacova, 2011). In additional breast feeding has been reported to decrease the risk of asthma (Scholtens et al.,

Abbreviations: MAND, McCarron Assessment of Neuromuscular Development; NDI, Neuromuscular Development Index; BP, Blood Pressure; APGAR, appearance pulse, grimace, activity, respiration; SRM, spontaneous rupture of membranes; LC-PUFA, long chain polyunsaturated fatty acids; AA, arachidonic acid; DA, docosahexaenoic acid.

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2009) and obesity (Chivers et al., 2010; Oddy et al., 2014). While there is a large body of work that has reported outcomes of breastfeeding in these domains fewer have focused on motor development. Previous research, including several international cohort studies (Dee et al., 2007; McCroy & Murray, 2013; Oddy et al., 2011; Sacker, Quigley, & Kelly, 2006; Thorsdottir, Gunasdottir, Kvaran, & Gretarsson, 2005; Vestergaard et al., 1999) have reported benefits of breastfeeding on motor development however there remains a paucity of research reporting outcomes beyond early childhood and into adolescence.

Current recommendations for breastfeeding according to the World Health Organization (WHO, 2003) and the National Health and Medical Research Council (National, Health, & Medical, Research, & & Council, 2012) in Australia are for exclusive breastfeeding until 6 months of age and beyond. Some socio-demographic factors can affect the decision to breastfeed and the duration of breastfeeding, including maternal age, education and socioeconomic status (Scott, Binns, Oddy, & Graham, 2006). Breastfeeding in western populations is reportedly higher in older mothers who have a greater level of education and socioeconomic status (Scott et al., 2006). Researchers who have previously focused on cognitive development suggested improved outcomes among breastfed children may be due to the benefits of having a more favorable home environment and socioeconomic status rather than the breast milk itself (Zhou, Baghurst, Gibson, & Makrides, 2007). In contrast other researchers have reported developmental outcomes to be significantly better in breastfed infants after controlling for confounders such as income, maternal age and sociodemographic information (Oddy et al., 2003, 2011, 2011; Vestergaard et al., 1999). What still remains to be explored is whether predominant breastfeeding for at least six months has a long term effect on motor development and how these socio-demographic confounders influence that relationship.

2. Methods

2.1. Participants

Participants were from the Western Australian Pregnancy Cohort (Raine) Study. Pregnant women (N = 2900) were recruited during routine antenatal appointments through the main obstetric hospital in Perth, Western Australia, King Edward Memorial Hospital (KEMH) from May 1989 to November 1991 at a rate of approximately 100 per month. Study requirements included a gestation between 16 and 20 weeks (M = 18 weeks), sufficient English speaking skills to understand what the study entailed, expectation to deliver at KEMH and an intention to reside in Perth to facilitate future data collection. There were 2868 live births, with extensive obstetric, health, socioeconomic, demographic and medical data collected during gestation and subsequent follow up phases (Newnham, Evans, Michael, Stanley, & Landau, 1993).

2.2. Measures

2.2.1. Predictor measure

Duration of breastfeeding was recorded in months and included any breastfeeding, regardless of the introduction of solid food or other milk sources. Breastfeeding data were collected retrospectively during the follow up phases at 1, 2, and 3 years, with each follow up interview within a year of the child's birth date. A binary variable of <6 months or $\geqslant$6 months was created to compare groups. In addition a categorical variable for breastfeeding, including <3 months, 3–5 months, 6–11 months and $\geqslant$12 months was created to investigate the effect of breastfeeding over time.

2.2.2. Outcome measure

Motor Development was measured at 10 (M = 10.54, SD = 2.27), 14 (M = *14.02, SD = 2.33*) and 17 (M = *16.99, SD = 2.97*) years of age using the McCarron Assessment of Neuromuscular Development (MAND) (McCarron, 1997). Participation in motor development testing at 10 (n = 1622), 14 (n = 1584) and 17 years (n = 1221) showed participation rates of 79%, 85% and 69% of the active cohort for each year (Table 1). Nine hundred and eighty-nine children completed all three data collection phases, while 533 participated in two of the three phases and 395 completed motor development testing once.

The MAND is a ten item battery of tests including fine and gross motor items including a) hand strength b) finger-nose-finger placement c) jumping d) heel-toe walk e) standing on one foot f) beads in a box g) beads on a rod h) finger tapping i) nut and bolt j) rod slide. The Neuromuscular Developmental Index (NDI) was calculated by converting each items' raw score to a scaled score (M = 10, SD = 3) which was summed and normalized according to age and sex appropriate norms. The NDI

Table 1
Available Data from each follow up of the Raine Study.

Year	Active	MAND	Deferred	Lost	Withdrawn	Deceased	Total
Birth	2868		–	–	–	–	2868
10	2047	1622	281	162	348	30	2868
14	1860	1584	357	207	412	32	2868
17	1754	1221	414	184	480	36	2868

MAND = McCarron Assessment of Neurological Development.