



Original article

Duration of Breastfeeding and Subsequent Adolescent Obesity: Effects of Maternal Behavior and Socioeconomic Status

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Article history: Received April 13, 2017; Accepted October 30, 2017

Keywords: Breastfeeding; Adolescence; Obesity; Socioeconomic status; Parent-child interaction; Observation

ABSTRACT

Purpose: Previous research has shown that longer duration of breastfeeding is associated with less risk of obesity in childhood and adolescence. However, although putative physiological mechanisms have been proposed, less work has focused on psychosocial or environmental factors, including socioeconomic status (SES) and stressful family environments.

Methods: The current study examined the role of observed maternal emotional behavior and SES (parental education) in the association between duration of breastfeeding and adolescent body mass index (BMI). One hundred fifteen mothers and adolescents participated in interaction tasks when adolescents were approximately 12 years of age. We measured adolescent BMI at approximately 15 years of age and, at one point over the course of the study, mothers retrospectively reported on duration of breastfeeding.

Results: Controlling for adolescent gender, age, physical activity, number of perinatal complications, SES, birth weight, and mother's depressive symptoms, longer duration of breastfeeding was associated with lower adolescent BMI ($p = .019$), and this association was moderated by the mother's observed behavior during interactions with her adolescent, such that greater frequency of dysphoric behavior was associated with a stronger association between breastfeeding and adolescent BMI ($p = .002$). Longer duration of breastfeeding mediated the association between higher family SES and lower adolescent BMI.

Conclusions: This study is the first to show that observed parental behavior during adolescence may be an important moderator of the association between breastfeeding and obesity. The findings provide justification for future intervention research examining family environment factors in improving adolescent health.

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IMPLICATIONS AND CONTRIBUTION

Findings demonstrate that maternal emotional behavior and SES are important factors in the relationship between duration of breastfeeding and adolescent body mass index and may be promising targets for prevention of adolescent obesity.

Conflicts of Interest: The authors have no conflicts of interest to disclose.

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Research aiming to elucidate mechanisms underlying obesity in children and adolescents has often focused on infant nutrition because of its role in establishing early growth patterns [1]. Epidemiological studies and meta-analyses have consistently shown that lack of breastfeeding is associated with childhood obesity (e.g., Reference [2]), and that duration of breastfeeding

is particularly important [3]. However, the age at which obesity is measured may be important, and there is not enough research outside of childhood to determine how long the association between breastfeeding and obesity persists. Several studies show an association between shorter duration of breastfeeding and obesity in childhood (e.g., References [4–6]), but only a few in adolescence [7,8]. By contrast, two large epidemiological studies found that lack of or shorter duration of breastfeeding is *not* associated with obesity in adults [9,10], although it should be noted that retrospective data on breastfeeding from mothers may be less reliable as time goes on.

Several mechanisms of the association between breastfeeding and obesity, although yet unclear from empirical evidence, have been hypothesized. The first category includes *physiological* factors. For example, the composition of breast milk, which contains lower levels of protein compared with formula, may be a factor in the slower growth rates in infancy seen in breastfed children [11]. Rapid weight gain in infants is associated with later obesity [12]. Additionally, the physical composition of breast milk could have an effect on regulation of the satiety system of the infant via leptin [13] or effects on the developing infant microbiome [14].

Although these physiological factors are likely mechanisms, a second category of factors related to both breastfeeding and obesity includes *psychosocial or environmental* factors, such as stressful environments and socioeconomic status (SES). Lower SES has consistently been shown to be associated with obesity in children [15]. A recent systematic review [16] suggested that early weaning may mediate this association, but only based on a small number of studies. It is also unclear if these associations persist into adolescence.

A model encompassing environmental factors in the relationship between breastfeeding and physical health should also include measures of stressful family environments, such as those characterized by low-quality interactions between mothers and children. We propose that these may be especially salient because family stressors are associated with adolescent obesity [17]. Observed parental emotional behavior in particular (i.e., coded behavior during interactions between parents and children) is prospectively associated with mental [18] and physical [19] health in adolescents. Parental behavior may either buffer or exacerbate the effect of other risk factors, such as SES or breastfeeding, on obesity outcomes. Parental emotional behavior may be especially salient during adolescence, a phase of development that encompasses significant biological and psychological changes, including in the parent-child relationship itself, as the adolescent establishes autonomy and challenges boundaries [20]. However, observed parental behaviors during adolescence have not yet been tested as a condition in an indirect association between SES and obesity via breastfeeding.

Our aim in the current study was to examine two understudied environmental factors in the breastfeeding and adolescent obesity literature—SES and maternal emotional behavior—in a sample of adolescents, as we also aimed to determine whether these associations are relevant after childhood. We propose an overarching model supported by four hypotheses. In Hypothesis 1, to replicate previous research, we hypothesized that shorter duration of breastfeeding would be associated with higher adolescent body mass index (BMI) scores. In Hypothesis 2, we proposed that parental emotional behavior could influence this association as a moderator, such that mothers who displayed greater frequency of negative behavior and lower frequency of positive behavior would have children with a stronger associa-

tion between shorter duration of breastfeeding and higher BMI. In Hypothesis 3, we hypothesized that shorter duration of breastfeeding would mediate the association between lower family SES and higher adolescent BMI. Finally, in Hypothesis 4, we hypothesized that the mediational path in Hypothesis 3 would be moderated by more negative or less positive maternal behavior.

Finally, given previously identified links with breastfeeding, SES, and/or obesity, the following variables were also included in analyses as potential confounders: adolescent gender [21], age [22], pregnancy/birth complications [23], birth weight [16], maternal depressive symptoms [24], and SES [25] (the latter in Hypotheses 1 and 2 only).

Materials and Methods

The current study included data from the Orygen Adolescent Development Study (ADS)—a large-scale longitudinal research project conducted in Melbourne, Australia. We collected observed family interaction data during the first assessment at T1 when participants were approximately 12 years old. We collected adolescent BMI scores 2–3 years later at T2, and retrospective pre- and postnatal information from parents over the course of the study.

Recruitment and screening of participants

For a diagram of participation, refer to Figure 1. Screening was conducted to identify a community sample of 10- to 12-year-old

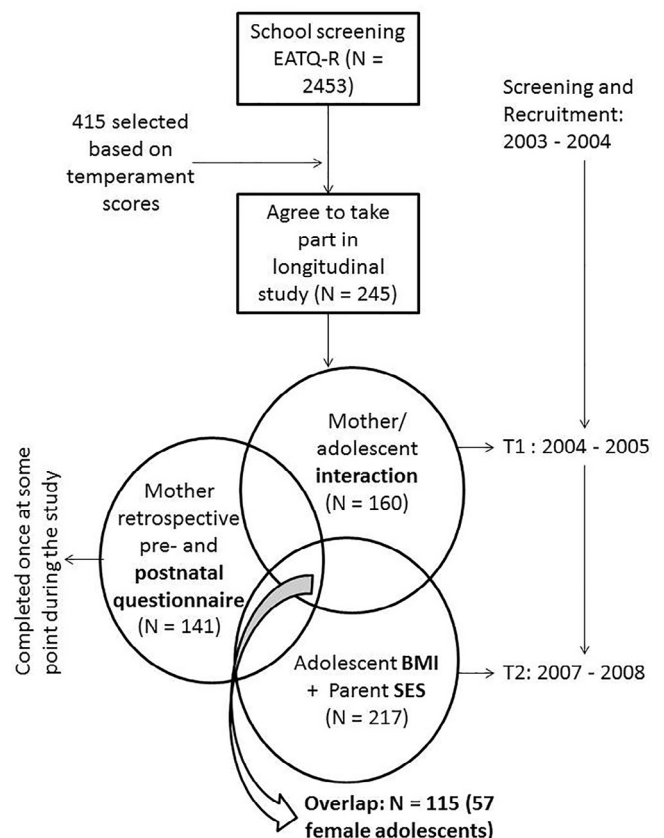


Figure 1. Outline of participation across time.

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