



Eating behavior traits associated with demographic variables and implications for obesity outcomes in early childhood



Nikki Boswell ^{a,*}, Rebecca Byrne ^b, Peter S.W. Davies ^a

^a The University of Queensland, Brisbane, QLD, Australia

^b Queensland University of Technology, Brisbane, QLD, Australia

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ABSTRACT

Despite ongoing investigation of children's eating behaviors to better understand the etiology of childhood obesity, few studies have aimed to determine differences in eating behavior based on psycho-social variables reflective of 'stressful' life circumstance.

Cross-sectional data collected from parents of 977 Australian children (2.0–5.0 years) in an online survey was used to determine associations between parent-reported Children's Eating Behavior Questionnaire [CEBQ] sub-scales, child BMI z-scores and psycho-social variables.

When examined individually, all CEBQ sub-scales, except Slowness in Eating, were associated with BMI z-score (Food Responsiveness $B = 0.226$, $p = 0.003$, Enjoyment of Food $B = 0.169$, $p = 0.035$, Food Fussiness $B = -0.139$, $p = 0.024$, Satiety Responsiveness $B = -0.318$, $p = 0.001$). On examining CEBQ sub-scales along with psycho-social demographic variables, only Food Responsiveness and Satiety Responsiveness were retained, along with being a boy, child age, and parent BMI.

Food Responsiveness was positively associated with parental stress and child age and negatively with parent BMI, while Enjoyment of Food was positively associated with child sleep duration, single parent status, and negatively with breastfeeding less than 6 months and parental depression. Satiety Responsiveness was positively associated with parent BMI and child age, and negatively with child sleep duration, while Food Fussiness was positively associated with child age and breastfeeding less than 6 months, and negatively with sleep duration, parental depression and single parent status.

Attention to eating behaviors and associated psycho-social variables may provide opportunity for targeted obesity prevention initiatives.

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1. Background

Despite the attention that childhood overweight and obesity has been given over the past few decades, it remains an issue of major public health concern, with rates reaching around 20% among Australian children aged 2–3 years (2007) and around 27% among children aged 5–17 years (2014–2015) (CSIRO, 2008, Australian Bureau of Statistics 2013; Australian Bureau of Statistics, 2015). The emergence of overweight and obesity at such early stages of life is particularly concerning given that being overweight and obese during childhood significantly increase the risk of being overweight

and obese as an adult, as is associated with an increased risk non-communicable disease in both the long and short term (Australian Institute of Health and Welfare, 2015).

According to the Behavioral Susceptibility Theory, obesity emerges when genetic susceptibility interacts with environmental circumstances and 'obesogenic' behaviors ensue (Llewellyn & Fildes, 2017). In accordance with this, eating behaviors provide a potential intermediary pathway from which obesity development can be better understood and prevention initiatives targeted. In particular, the early childhood period offers a unique and critical window for such intervention, as it is during this period that eating behaviors emerge and are reinforced to provide a foundation for obesogenic behavior throughout the lifespan (Campbell et al., 2008). This intermediary role of eating behaviors in childhood obesity can be seen across the literature which shows food approach eating behaviors such as Food Responsiveness and Enjoyment of Food to be positively associated with overweight and

* Corresponding author. Child Health Research Centre Level 6, Centre for Children's Health Research (CCHR), 62 Graham Street, South Brisbane, QLD 4101 Australia.

E-mail addresses: nikki.boswell@uqconnect.edu.au (N. Boswell), ra.byrne@qut.edu.au (R. Byrne), ps.davies@uq.edu.au (P.S.W. Davies).

obesity, while food avoidance eating behaviors such as Satiety Responsiveness, Slowness in Eating and Food Fussiness, are associated with reduced overweight and obesity outcomes (Sleddens, Kremers, & Thijs, 2008; Webber, Hill, Saxton, Van Jaarsveld, & Wardle, 2009; Spence, Carson, Casey, & Boule, 2011).

In attempting to understand this role of eating behaviors in early childhood obesity, attention has largely been given to proximal, micro-environmental factors, such as parents feeding strategies, which are considered to have a pivotal influence on child behavior (Birch & Davison, 2001; Mitchell, Farrow, Haycraft, & Meyer, 2013). Far less attention, however, has been given to exploring psycho-social variables which may underpin eating behaviors, such as parent's stress and depression, low income status, single-parent status, and/or short sleep duration, which have been seen to internally alter appetite regulatory systems (Taheri, Lin, Austin, Young, & Mignot, 2004; Cohen, Doyle, & Baum, 2006; Birch, Savage, & Ventura, 2007; Torres & Nowson, 2007; Anzman, Rollins, & Birch, 2010; Lupu, Tint, & Niculescu, 2012; Mayo, 2012; Scott & Johnstone, 2012; Obermann-Borst et al., 2013; McCurdy, Kisler, & Metallinos-Katsaras, 2014; Sominsky & Spencer, 2014; McDonald, Wardle, Llewellyn, & Fisher, 2015). For the purposes of this paper, a distinction will be made between micro-environmental determinants of eating behaviors and psycho-social determinants of eating behaviors, by using the term *eating behavior traits* to refer to the latter.

Current understanding of the eating behavior traits that underpin childhood overweight and obesity postulates that alteration in the homeostatic regulation of food intake, as coordinated by neuroendocrine feedback loops, involving nutrient and hormonal signals, results in a down regulation of food avoidance eating behavior traits and/or an up regulation of food approach eating behavior traits (Chodkowski, Cowan, & Niswender, 2016; Cornier et al., 2013; Webber et al., 2009). These alterations may be a consequence of internal susceptibility to inappropriate responses to homeostatic regulatory systems or a vulnerability of these systems to be overridden by external influences. Additionally, vulnerability to hedonic eating (eating for pleasure in the absence of energy deficits), neurologically, can contribute to overweight and obesity through excess energy intake (Chaput et al., 2014).

These systems, particularly during early childhood, are vulnerable to epigenetic changes and/or changes in neurological structure in response to certain environmental circumstances. (Anzman et al., 2010; Birch & Doub, 2014; Harshaw, 2008; Llewellyn, Trzaskowski, van Jaarsveld, Plomin, & Wardle, 2014; Scaglioni, Arrizza, Vecchi, & Tedeschi, 2011). That is, while eating behavior traits are estimated to have approximately 50% heritability, it is possible that they are manipulated and shaped through shared environment which is similarly estimated to account for approximately 45% of variance in eating behavior traits (Scaglioni et al., 2011). For instance, alterations in the appetite regulating hormones leptin, ghrelin and cortisol, under control of the hypothalamic-pituitary-adrenal [HPA] axis, have been noted as a result of chronic stress, reduced breastfeeding, reduced sleep duration, and general 'disadvantaged' life circumstances (Anzman et al., 2010; Birch et al., 2007; Cohen et al., 2006; Lupu et al., 2012; Mayo, 2012; McCurdy et al., 2014; McDonald et al., 2015; Obermann-Borst et al., 2013; Scott & Johnstone, 2012; Sominsky & Spencer, 2014; Taheri et al., 2004; Torres & Nowson, 2007). Furthermore, it is understood that children from low socio-economic backgrounds often experience greater neurological impulsivity and reward seeking behavior, as has been associated with increased food approach behaviors and obesity development (Chodkowski et al., 2016; Kolb & Gibb, 2015; Noble et al., 2015). This underpinning of chronic stress and adversity on appetite and eating behaviors highlights a potential pathway from which higher

rates of obesity in disadvantaged sub-population groups could be explained, however are yet to be extensively explored (Australian Bureau of Statistics, 2010; Australian Institute of Health and Welfare, 2014; Australian Bureau of Statistics, 2015).

Given this, this study aims to determine psycho-social demographic variables associated with eating behaviors traits and the relationship these traits have with obesity development in Australian children during early childhood. It is hypothesized that low income status, single-parent status, short sleep duration, parent's depression, stress and anxiety, and breastfeeding duration, will be associated with obesogenic eating behavior traits in children. Gaining understanding of such interaction of these psycho-social variables provides a new perspective in approaching childhood obesity and support alternative/novel preventative focus.

2. Material and methods

2.1. Recruitment

Between July and November, 2016, Australian parents of children aged 2.0–5.0 years self-enrolled to complete an online, cross sectional survey. Participants were invited to enroll in the survey through advertising on the social media website Facebook[®]. The advertisement provided brief information about the survey and provided a link to a website which contained further details about the research project as well as the plain language statement, participant consent form, and access to the online survey, hosted by Checkbox[®]. Children were excluded from this study if parents reported the child had a medical condition likely to affect the child's growth, development or metabolism. In the instance that a parent had more than one child within the target age, parents were asked to refer to the child whose birthday occurred next.

2.2. Measures

Self-selected parents responded to questions regarding their child's age, gender, parent/respondent gender, single parent status, income, state and region of residency, sleep duration, breastfeeding history, parent depression, anxiety and stress, and children's eating behaviors. These variables were selected for inclusion in analysis as identified to be psycho-social variables associated with eating behaviors and/or obesity development across the literature.

Participants were prompted to use household measures (e.g. bathroom scales/household tape measure) to report child weight and height which were subsequently used to calculate weight, height and BMI z-scores according to the 2000 CDC growth charts (Kuczmarski et al., 2001). Use of CDC growth charts for children from 2 years of age is consistent with the recommendations of the National Health and Medical Research Council (NHMRC) (National Health and Medical Research Council, 2013). Child BMI categories were additionally determined according to Cole, 2000 and 2007 (Cole, Flegal, Nicholls, & Jackson, 2007; Cole, Bellizzi, Flegal, & Dietz, 2000).

Parents were also prompted to use household measures to report their weight and height which were used to calculate BMI scores and BMI categories in accordance with the World Health Organization's classifications (Underweight <18.50 kg/m²; Normal weight 18.50–24.99 kg/m²; Overweight ≥25.00 kg/m²; Obese ≥30.00 kg/m²) (World Health Organisation, 2000).

2.3. Data screening and sample size

As child height and weight were by parental report it was deemed necessary to screen the data for biologically implausible values (BIVs). Although there is no standard approach to assessing

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