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Title

Poor dietary patterns at 1-5 years of age are related to food neophobia and breastfeeding duration but not age of introduction to solids in a relatively advantaged sample

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Abstract: Previous studies have investigated associations between individual foods or food group intake, and breastfeeding duration, age of solid introduction and food neophobia. This study aimed to investigate associations between whole dietary patterns in young children, and breastfeeding duration, age of solid introduction and food neophobia. Parents of children (N=234) aged 1-5 years completed an online questionnaire. Dietary risk scores were calculated using the Toddler (1-3 years) or Preschool (>3-<5 years) Dietary Questionnaires which evaluates the previous week's food-group intake (scored 0-100; higher score=higher risk of poor dietary quality). Neophobia was measured using the Child Food Neophobia scale (1.0–4.0; higher score=more neophobic). Associations were investigated using multivariable linear regression, adjusting for covariates. Children (54% female, 3.0±1.4 years) were from advantaged families and were breastfed until 11.8 (5.0–16.0) months, started solids at 5.6±1.4 months of age, moderately neophobic (2.1±0.7) and at moderate dietary risk (29.2±9.2). Shorter breastfeeding duration (ß=-0.21; p=0.001) and poorer child food neophobia scores (ß=0.36; p<0.001) were associated with higher dietary risk scores. Age of introduction to solids showed no association with dietary risk (p=0.744). These findings suggest that in addition to breastfeeding promotion, supporting parents to manage neophobic behaviour may be important in promoting healthy eating patterns in early childhood.

Keywords: dietary patterns; neophobia; breastfeeding; solid introduction; child; infant feeding practices

1. Introduction

Early feeding experiences (breastfeeding and age and process of solid introduction) can shape the development of later dietary intake patterns. The Australian infant feeding guidelines recommend exclusive breastfeeding to around six months of age, solid introduction at around six months, and continued breastfeeding with complementary foods until 12 months [1]. Studies have shown that breastfeeding duration is positively associated with later food variety and healthy eating habits in children under five years [2]. In contrast, earlier introduction of solids and breastfeeding cessation have been shown to be associated with children liking a greater proportion of non-core foods (otherwise known as 'discretionary' [3] food groups i.e. high-fat, sugar and/or salt foods that are recommended to be limited) at age two years [4] and 'unhealthier' dietary patterns at one to two years [5] and six years of age [6]. Thus, feeding experiences in early life may influence later diet quality in young children.

Young children are further placed at risk of poor diet due to the emergence of food neophobia, the innate reluctance to try new foods [7]. Although neophobia is considered a normal developmental stage, peaking between two and six years of age [8], it can have adverse effects on the development of food preferences, acceptance and intake [4]. For example, studies have shown that more neophobic children consume a lower variety of nutrient-dense foods such as fruit and vegetables [9, 10] and more nutrient-poor foods [10].. Reducing neophobia in children may thereafter result in improvements in children's diets. Studies investigating the relationship of early feeding experiences and neophobia with young children's diet are limited in two ways. First, studies have not investigated the inter-relationship between early feeding experiences (breastfeeding duration and solid introduction), neophobia *and* diet, but rather only breastfeeding experiences and diet [4-6] or neophobia and diet ([9, 10]); and second, diet has commonly been expressed as individual foods or food groups [4, 10, 11], not as whole diet. As individuals do not consume single nutrients, foods or food groups, but rather combinations of these [12],dietary patterns, combinations of foods and frequency of consumption [12, 13] which are more reflective of the way people eat, are more useful for understanding the influence of diet, a complex exposure, on health [12, 13]. Dietary patterns are also easier for the public to interpret [12, 13].

The recent development of two short questionnaires that assess toddlers' or preschoolers' dietary patterns [14], provides an opportunity to examine the relationship between early feeding experiences, food neophobia and children's overall diet patterns. These questionnaires characterise dietary patterns according to 'dietary risk', a term used to describe any inappropriate 'dietary pattern' that may 'impair or endanger health' [15]. A previous study of 12-36 month olds (n=117) from relatively advantaged families showed that lower and higher toddler dietary risk scores reflected better and poorer nutrient intakes, respectively, although risk scores were not shown to

influence weight status [16]. This study aims to investigate the relationship between dietary risk among children aged one to five years and breastfeeding duration, age of introduction to solids, and child food neophobia. We hypothesise that shorter breastfeeding duration, earlier introduction to solids and higher child food neophobia will be associated with higher dietary risk scores (i.e. poorer diet quality).

2. Materials and Methods

2.1. Study design and sample

This cross-sectional study is a secondary analysis of data collected through the [Blinded for review] [17]. Participants were biological, step or adoptive parents of children aged one to ten years recruited via advertisements from March - June 2014 in [Blinded for review] emails, [Blinded for review] newsletters, and social media sites (Facebook, Yammer, LinkedIn, Reddit.com forum, parenting/feeding forums). Parents were aged 18 years or over with facility in English and access to the internet, necessary for completion of an online survey. Children diagnosed with a congenital abnormality or chronic condition likely to influence normal development including feeding behaviour, were excluded. Informed consent was obtained by clicking 'next' after reading the Participant Information Sheet on the first page of the survey. The study was approved by the [Blinded for review].

2.2. Data collection

Data were collected from participants via one online survey. For this study, only parents of children aged one to five years were included, as parents of children older than five years did not complete the Toddler or Preschooler Dietary Questionnaire necessary to investigate associations with dietary risk scores.

2.2.1. Demographics

Parental (age, marital status, education status, relationship to child, country of resiidence, employment status, number of children living in household) and child (age, gender) demographic characteristics were ascertained by online questionnaire. Marital status was reported according to four categories (married, living with partner but not married, no partner, partner but living separately) and collapsed into two (partnered, not partnered) (Table 1). Parental education was reported as the highest completed level of six categories (year 10 or equivalent, year 12 or equivalent, TAFE/trade or equivalent, diploma or equivalent, University bachelor degree, Postgraduate university degree) and collapsed into two (University, not University) (Table 1). Respondent relationship to the child was reported as six categories (biological, adoptive, or step

mother/father, grandmother/father, relative (e.g. aunty/uncle), other) and collapsed into two (Biological mother/father, step mother/father) (Table 1). Country of residence was categorised into two groups (Australasia [Islands of the Southern Pacific Ocean including Australia, New Zealand and New Guinea]; Other) and the number of hours of paid work categorised into two (Less than full time work (<35hours/week); Full time work (≥35hours/week)) (Table 1).

2.2.2. Early feeding experiences

Breastfeeding duration (in months) was calculated from respondents reporting whether their child had never been breastfed, the age their child stopped breastfeeding (in weeks or months) or whether their child was still being breastfed. For the latter, children's current age was used to represent breastfeeding duration. Duration of exclusive and partial breastfeeding was not able to be ascertained from the data. Age of introduction to solids was defined as age in months that the child was first given solid or semi-solid food regularly (i.e. more than twice a week for more than two weeks in a row).

2.2.3. Child food neophobia scale

The Child Food Neophobia (CFN) scale is a 10 item validated tool (α=0.88, original Food Neophobia Scale) assessing parental report of child neophobia. Six items (four excluded as considered age-inappropriate, as per previous studies utilising this tool[4, 10],e.g. my child likes to eat in ethnic restaurants) were assessed; 1) My child does not trust new foods, 2) If my child doesn't know what a new food is (s)he won't try it, 3) My child is afraid to eat things (s)he has never tried before, 4) My child will eat almost anything (reversed score), 5) My child is very particular about the things (s)he eats, 6) My child is constantly trying new and different foods (reversed score). Item response options were a four-point scale ranging from 'strongly disagree' (1) to 'strongly agree' (4). An average CFN score was computed, with higher scores indicating parent report of a stronger behavioural display of neophobia [18, 19]. As an indicator of internal reliability, the Cronbach's alpha for the 6-item neophobia scale was calculated for the present study (α=0.93).

2.2.4. Child diet risk

Parents' of children aged ≥one to ≤three years (12-36 months) and >three - <five years (37-60 months) completed the Toddler Dietary Questionnaire (TDQ) [14] and Preschooler Dietary Questionnaire (PDQ), respectively. The 19-item TDQ and PDQ assess the previous week's intake of 'core' [3] food groups (i.e. foods recommended to be consumed every day) and 'non-core' or 'discretionary' [3] food groups (i.e. foods that are recommended to be limited). As described previously [14], food groups were identified for inclusion according to dietary patterns derived

from principal component analysis [13], and the Australian Dietary Guidelines [3]. Food groups were categorized into three sections: 1) 'core' intake (e.g. fruit, vegetables, dairy products), 2) 'non-core' intake (e.g. hot potato products, sweet biscuits or cakes, ice-cream) and 3) 'usual intake' of bread, milk beverages and non-milk beverages, as described in Table 2. Frequency (nil, once, 2–4 times and ≥5 times in the previous seven days) and portion size ('small' (e.g. <50g), 'medium' (e.g. <50-100g) and 'large' (e.g. >100g) categories) of each food group in section 1 and 2 is assessed and intake evaluated using a scoring system to determine dietary risk (0 - 100; higher score = higher risk) (Table 2). Portion size categories were informed by age-appropriate recommended serving sizes (section 1 items) and tertiles of consumption of [Blinded for review] children from the control arm of [Blinded for review] [19] and the [Blinded for review] study, a longitudinal study of infants' and toddlers' dietary intake (section 2 items) [14]. Details regarding the scoring of the TDQ and PDQ have been described in detail previously[14]. In brief, for sections 1 and 2, intake was determined based on the available response options (multiplying the frequency response by the median quantity response) and compared against Australian recommendations [20]. For section 1 ('core' intake), lower and higher intakes are scored according to deviation from the recommendations, whereas for section 2 ('non-core' intake), scores increase proportionally from 0 with increasing consumption frequency and quantity. Section 3 scoring (range 0 – 12) varies by question. Dietary risk scores for each section are tallied (score out of 336) and converted to a total dietary risk score (range 0-100; higher score = higher risk). Total; dietary risk scores are stratified into four risk categories (low (0–24), moderate (25–49), high (50–74) and very high (75–100) risk). Examination of the psychometric properties of the TDQ showed that it is reliable and valid for assessing dietary risk of toddlers from relatively advantaged populations [14, 21]. The PDQ is a modified version of the TDQ, differing only in the amounts represented by the portion size categories. Psychometric testing revealed that despite significant differences in risk scores derived from the PDQ for reliability and validity, the differences were small (1.5 and -1.6 respectively, out of 100 points) and there was no systematic bias between the two tools indicating good group-level agreement [16].

2.3. Data Analysis

Calculation of a dietary risk score is not possible without completion of each question (both frequency and portion size responses) in the TDQ and PDQ. In order to retain as much data as possible, incomplete questionnaires and missing data were treated as follows: 1) participants who did not attempt all three sections of the questionnaire were excluded (n=4); 2) if the frequency (n=7) or portion size (n=18) response was missing, a value representing the most common response was imputed; 3) as the questionnaire requires a response for both frequency and portion size, a value

representing 'nil' was imputed if either responses were missing and the other response was 'nil' (n=50). Continuous data were assessed for normality by histogram and skewness within -1 to 1. Breastfeeding duration (age stopped breastfeeding) was not normally distributed and therefore log transformed. All data were analysed using SPSS for Windows, version 22.0 (SPSS Inc., Chicago, IL). Multiple linear regression analysis was employed to test the association between early feeding experiences (breastfeeding duration, age of introduction to solids; independent variables), child neophobia (independent variable) and dietary risk scores (dependent variable) (Table 3). The final multivariable model included all three independent variables and potential covariates (parent age, education level, relationship with child, marital status, work status, country of residence, number of children living in the household, child age, and child gender). The level of significance was set at $p<0.05$.

3. Results

3.1. Participant Characteristics

A total of 206 participants (n=108 TDQ, n=98 PDQ) provided sufficient data for this study. Their characteristics are presented in Table 1. Participants (99.5% biological parent; 90% biological mother) were on average 33.6±4.7 years, predominately university educated (74%), married (80%), living in Australasia (68%) and not working full time (70%). Children (54% female) were on average 3.0±1.4 years, breastfed until 11.8 (5.0 – 16.0) months of age and first given solids at 5.6±1.4 months of age. Approximately 9% (n=19) of children were never breastfed. The mean neophobia score was 2.1±0.7 (range 1.0 – 4.0) and the average dietary risk score of toddlers and preschoolers combined was 29.2±9.2 out of 100. The majority of children were classified at 'moderate risk' (63.1%), one-third at 'low risk' (34.5%), few at 'high risk' (2.4%) and none at 'very high' risk.

3.2. Factors associated with child dietary risk scores

The multivariable model was statistically significant ($p<0.001$) and explained 31.3% of total variability. After adjustment for covariates, shorter breastfeeding duration (ß=-0.21; 95% CI –7.08 to –1.79; p=0.001) and higher child food neophobia score (ß=0.36; 95% CI 2.89 to 6.06; $p<0.001$) were significantly associated with higher dietary risk scores. Age of introduction to solids was not associated with dietary risk scores (ß=-0.02; 95% CI -0.98 to 0.70; p=0.744). The covariates of parent education level (ß=0.15; 95%CI -5.81 to -0.54; p=0.018), country of residence (ß=0.13; 95%CI 0.12 to 5.04 p=0.040) and child age (ß=0.23; 95%CI 0.04 to 0.20 p=0.004) were significantly associated with

higher dietary risk scores. Given some children were still being breastfed (n=28), and children <2.0 years (n=65) tend to display less neophobia behaviour than those ≥2.0 years (n=141), we repeated the analyses excluding these participants, however findings did not change.

Table 1. Parent, child and family characteristics of participants (n=206)

		n (%) or mean (SD)
Parental and family characteristics		
Age (years)[1]		33.6 (4.7)
Highest education level[2]		
	University	153 (74.3)
	Not university	53 (25.7)
Child relationship		
	Biological mother/father	205 (99.5)
	Step mother/father	1 (0.5)
Marital status[3]		
	Partnered	201 (97.6)
	Not partnered	5 (2.4)
Work status[4]		
	Less than full time work (<35hours/week)	144 (69.8)
	Full time work (≥35hours/week)	62 (30.1)
Country of residence		
	Australasia	141 (68.4)
	Other	65 (31.6)
Number of children living in household[5]		
	1	108 (52.4)
	2	92 (44.7)
	3	6 (2.9)
Child characteristics		
Age (years)		3.0 (1.4)
Gender		
	Male	95 (46.1)
	Female	111 (53.9)
Ever breastfed		187 (90.8)
Breastfeeding duration (months)[6]		11.8 (5.0 – 16.0)
Age first given solids (months)[4]		5.6 (1.4)
Mean neophobia score[7]		2.1 (0.7)
Mean dietary risk score[8]		29.2 (9.2)
Dietary risk score range		11.31 – 58.63

Abbreviations: TAFE, Technical and Further Education

[1] missing, n=2 (0.9%)

[2] categorised as: 1) university (university degree), 2) not university (school/trade/TAFE)

[3] categorised as: 1) partnered (married, living with partner but not married, partner but living separately); 2) not partnered (no partner); missing, n=3 (1.3%)

[4] missing, n=3 (1.3%)

[5] missing, n=18 (7.7%)

[6] not normally distributed, therefore median (IQR) reported.

[7] possible range, 1.0-4.0

[8] possible range, 0.0 -100.0

Table 2. *Toddler Dietary Questionnaire (TDQ)* [1] */ Preschooler Dietary Quetionnaire (PDQ)* [1] *items and scoring system*

Section	TDQ/PDQ items	Response			Score	Maximum score per question	Possible section score range
1: 'core' intake	Items 1-8	Frequency[2]	and	Quantity[2]		18	0 - 144
	Fruit	Nil		Nil	18		
	Green vegetables	Once		Small	14		
	Orange vegetables	Once		Medium	11		
	Other vegetables	Once		Large	8		
	Yoghurt or custard	2-4 times		Small	6		
	Grains	2-4 times		Medium	0		
	Red meat	2-4 times		Large	4		
	Fish	≥5 times		Small	2		
		≥5 times		Medium	6		
		≥5 times		Large	12		
2: 'non-core' intake	Items 9-16	Frequency[2]	and	Quantity[2]		18	0 - 144
	Spreadable fats	Nil		Nil	0		
	Vegemite-type spreads	Once		Small	2		
	Snack products	Once		Medium	4		
	Hot potato products	2-4 times		Large	6		
	Meat products	2-4 times		Small	8		
	Sweet biscuits	2-4 times		Medium	10		
		≥5 times		Large	12		
		≥5 times		Small	14		
		≥5 times		Medium	16		
		≥5 times		Large	18		

	or cakes						
	Chocolate						
	Ice-cream or frozen yoghurt						
3: 'usual intake'	Items 17-19						0 - 48
	Bread type	None white: All non-white			0	12	
		Some white: Mostly non-white			3		
		Mostly white: Some non-white			9		
		All white: None non-white			12		
	Milk drinks	Breast milk or plain milk (dairy or non-dairy)			0	12	
		Formula			4		
		Flavoured milk (dairy or non-dairy)			8		
		None of the above i.e. no milk drinks			12		
	Non-milk drinks	Water			0	24	
		Diluted juice (fruit and/or vegetable)			4		
		Un-diluted juice (fruit and/or vegetable)			8		
		Cordial or soft drink			12		
						TOTAL	0 - 336 (converted to out of 100)

[1]The TDQ [14] and PDQ are 19-item questionnaires that assess toddler and preschooler's intake of 'core' [3] and 'non-core' or 'discretionary' [3] food group intake over the previous week, respectively.

[2]Frequency and quantity response for each question item of section 1 and 2

Table 3. Multivariable associations of breastfeeding duration, age of introduction to solids and neophobia with dietary risk scores at 1-5 years of age, adjusted for covariates[1] (n=206)

	Dietary risk score		
	standardised beta	**95% CI**	**p-value**
Parental and family characteristics			
Age (years)	0.07	-0.23, 0.26	0.914
Highest education level	-0.15	-5.81, -0.54	0.018
Child relationship	0.01	-0.75, 0.83	0.925
Marital status	-0.07	-11.18, 3.03	0.259
Work status	0.01	-2.70, 2.20	0.841
Country of residence	0.13	0.12, 5.04	0.040
Number of children living in household	-0.04	-2.99, 1.71	0.592
Child characteristics			
Age (months)	0.23	0.04, 0.20	0.004
Gender	-0.06	-3.27, 1.02	0.303
Breastfeeding duration[2]	-0.21	-7.08, -1.79	0.001
Age of introduction to solids	-0.02	-0.98, 0.70	0.744
Child neophobia score	0.36	2.89, 6.06	<0.001

[1] Covariates = Parent age, education level, relationship with child, marital status, work status, country of residence, number of children living in the household, child age, child gender.

[2] Not normally distributed, therefore log transformed

4. Discussion

This cross-sectional study aimed to examine the effect of early feeding experiences (breastfeeding and solids introduction) and child neophobia on child dietary risk. Children were breastfed for nearly 12 months, were introduced to solids in a timely manner (at approximately six months of age), were moderately neophobic and were mostly at 'low' or 'moderate' dietary risk. These findings likely reflect the socio-economically advantaged sample. Nonetheless, after adjustment for covariates, findings showed that shorter breastfeeding duration and greater child food neophobia were significantly associated with greater dietary risk in early childhood. No association was found between age of solid introduction and dietary risk.

Our finding that longer breastfeeding duration is associated with lower dietary risk supports previous Australian findings on the relationship between breastfeeding duration and subsequent diet quality [22, 23]. Scott et al [23] found that breastfeeding duration was an independent predictor of dietary variety, that is, both core food variety and fruit and vegetable variety, at two years of age. Grieger et al [24] reported a positive association between breastfeeding and the 'healthy' dietary pattern, but not with the 'non-core' food pattern or 'combination' pattern in children aged two to eight years. Of note, however, is that breastfeeding rates observed in this study (earliest age and average age of breastfeeding cessation, five and 12 months respectively) are inconsistent with national data (half of children still receiving breastmilk beyond 4 months and less than one-fifth (13%) of breastfed beyond 12 months), likely due to the relatively advantaged sample. Nonetheless, the association between breastfeeding duration and dietary risk supports previous evidence regarding one mechanistic pathway; that exposure to flavours occurs via maternal milk during breastfeeding and may influence children's food preferences [25]. It suggests that longer exposure to flavours in mother's milk, even prior to exposure via solids, may enhance children's taste preferences for 'core' foods and reduces their dietary risk. Further research is needed to explore the extent to which mother's diet during lactation can influence children's food and flavour preferences to fully understand this mechanism [26]. Nonetheless, t despite high initiation rates of breastfeeding in Australia (90%) [27], mothers report facing several challenges when it comes to breastfeeding (e.g. lactation difficulties, concerns regarding infant weight and health)[28] which result in a dramatic decline after initiation to approximately half of children still being breastfed at six months of age [27, 29]. Thus, our findings suggest that providing effective support for mothers to improve breastfeeding duration may improve subsequent dietary intake through enhancing flavour acceptance.

The average food neophobia score for children in this study (2.2±0.5, n=206) is consistent with those observed in a previous study of Australian children aged 2 years (2.2±0.6, n=245) [4]. After adjusting for covariates, child food neophobia remained a significant independent predictor of

dietary risk, with more neophobic children more likely to be at greater dietary risk in early childhood. This is consistent with findings in children under five years that showed more neophobic children consume less 'core' foods such as fruits and vegetables [9], lower fruit and vegetable variety [10, 19] and greater proportion of energy from discretionary foods [10]. Nonetheless, these studies have assessed dietary outcomes at the individual food and/or food group level rather than whole diet. Our findings demonstrate an association between child neophobia and poorer overall dietary patterns in early childhood. The present results, together with past findings [4, 9, 10, 19]) suggest that early intervention, before the age of two when neophobia begins to peak [8], for those children with high levels of neophobia may improve dietary patterns in these children. Research suggests that although child neophobia is highly heritable [30], it can be influenced by maternal factors, such as concern for child's underweight, lower awareness of infant hunger and satiety cues, and maternal responses such as pressure to eat [31, 32]. It also shows that a positive family food environment, neutral exposure and role-modelling appropriate behaviours can promote children's acceptance and consumption of novel food [31-33]. Thus, early-life interventions that equip parents with skills and strategies that foster children to try, and eventually accept, unfamiliar foods may attenuate dietary risk in early childhood.

Although the timing of solid introduction has been shown to affect acceptance of foods in infancy and later life [25], the age at which children were introduced to solids was not associated with later dietary risk in this study. This is consistent with large international studies [34, 35], however is in contrast to previous studies in a similar population that showed timing of solid introduction to be associated with dietary patterns in Australian children aged 14- and 24-months [5] and two to eight years [24]. The differences in findings may be due to the lack of variance in age of solid introduction in our sample, with half introduced to solids at or beyond six months of age (5% <4 months, 47% 4 - 6 months, 48% ≥6 months). This is similar to recent national Australian data which found that just over half of children (54%) had been introduced to solids between the ages of five and six months of age [36]. Of note is that these studies did not adjust for neophobia [5, 24, 34, 35] which has previously been found to be associated with children's dietary quality [10]. The types and textures of foods introduced early may play a greater role in the formation of children's dietary patterns than the timing of solid introduction. Studies have found that delayed introduction to lumpy solids is associated with reduced food variety both cross-sectionally [37] and longitudinally [38], suggesting that early exposure to textures, not just variety of tastes, is important in the development of children's food preferences and thus diet quality. Importantly though, investigation of the relationship between timing of solid introduction and dietary risk in a larger, more generalisable sample is warranted.

The findings of this study should be considered within a few major limitations. First, this is a cross-sectional analysis and thus a causal relationship cannot be determined. Second, our sample was

relatively homogenous and advantaged, with approximately three-quarters of participants' university educated and married and thus generalisability of the results beyond this sample is limited. The relatively advantaged sample may explain the lack of variance in dietary risk (most classified at 'low' or 'moderate' dietary risk and few classified as 'high' or 'very high' risk). In addition, one-third of participants were from countries outside Australasia and thus the findings are not representative of the general population in any particular country. Further, participants were recruited via advertisements which may have resulted in selection bias and all data were self-reported and thus reporting bias is also possible.

It should also be noted that early feeding experiences were retrospectively reported, and this reporting period was clearly larger for children aged 5 years compared to 1 year of age. While maternal recall of breastfeeding duration has been shown to be reliable and valid for short (≤three years) and long-term (up to 6 [39] and 20 [40] years after childbirth) recall periods, [41] the validity and reliability for maternal recall of age of introduction to solids is less satisfactory [41, 42]. This may account in part for why no association was seen between dietary risk and age of introduction to solids, particularly as the recall period was large. Further, other factors not assessed and adjusted for in this study that may affect children's diets, such as parental health beliefs and parental feeding practices [31, 43, 44], may have influenced the associations between breastfeeding duration, introduction to solids, neophobia and child dietary risk. In addition, breastfeeding data were limited in that some children were still being breastfed at the time of data collection (current age used as a proxy for duration), and as no distinction was made between exclusive and partial breastfeeding, the influence of breastfeeding itself on later dietary risk may be influenced by other foods and fluids consumed. Although the validity of the shortened six-item Neophobia scale used in this study (and previously [4, 10]) has not been tested, the internal reliability in our sample was high. There is potential however that for some children (in particular those aged less than two years) their level of neophobia increased after the data collection period. Lastly, the treatment of missing data for the TDQ and PDQ may have impacted our findings as we cannot guarantee that the responses imputed were the true responses of the participants, whilst artificial inflation of the observed correlations in this study due to common-method variance, (i.e. variance attributable to the measurement method rather than to the constructs the measures represent) [45] is possible due to the nature of the data being self-reported by the same parent. However, this is a possibility and not a certainty [46]. Nonetheless, the study is the first to investigate predictors of dietary risk assessed using a combination of novel tools, the TDQ and PDQ.

5. Conclusions

The findings of this study are consistent with previous evidence, showing that children breastfed for a shorter duration and those who are more neophobic are at greater dietary risk. However, contrary to some previous studies, there was no link between age of solid introduction and later child dietary risk. Investigating these relationships in a larger, more representative sample is required to confirm these findings. Nonetheless, our preliminary findings suggest that interventions and public health initiatives that focus on providing guidance to parents to assist them to expect, understand and effectively manage food neophobia in young children may ameliorate adverse impact on dietary quality. Further, the inverse relationship between breastfeeding duration and dietary risk strengthens the evidence on the importance of breastfeeding in early life on children's health outcomes and reinforces the need to support parents in their breastfeeding journey.

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HIGHLIGHTS

- Children breastfed for a shorter duration are at greater risk of poor diet quality
- More neophobic children are at greater risk of poor early-life dietary patterns
- Age of solid introduction was not associated with dietary risk in this sample