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The relationship between maternal feeding styles and weight-to-length ratio in two year old children.

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Abstract

Due to the growing concerns worldwide about the increasing rates of overweight and obesity in adulthood and childhood, it is important to examine mechanisms and risk factors in childhood for developing overweight and obesity. This study investigated the association between weight-to-length ratio in two year old children and maternal feeding styles, such as responsive feeding, restrictive feeding, indulgent feeding, pressuring feeding and laissez-faire feeding. The participants were recruited through a larger study called 'Baby's First Bites', where mothers and their firstborn were followed from the start of the study until the child was 36 months old. In this study 151 mother-child pairs were included. In the current study babies were weighted with an electronic calibrated scale and mothers were asked to fill in the Infant Feeding style Questionnaire (IFSQ) to measure the feeding styles. To examine the research hypotheses a multiple regression analysis was used. BMI of the mother, research condition, educational achievement and gender and age of the child were included as covariates. There were no significant associations between weight-to-length ratio and any of the feeding styles. However, the study showed a trend to statistical significance between weight-to-length ratio and restrictive feeding. Future studies should include questionnaires to detect social desirability bias or use observational methods to measure feeding. On top of that, there is a need for a new validated self-report instrument to measure feeding styles, especially for young children.

Key words: feeding style, weight-to-length ratio

Introduction

There are growing concerns worldwide about the increasing rates of overweight and obesity. Kelly, Yang, Chen, Reynolds and He (2008) estimated that in 2030 48% of the adult population worldwide will be overweight. On top of that, another 20% would be obese by then. Overweight and obesity are associated with multiple mental health problems such as ADHD, depression and anxiety and physical health problems such as mortality, coronary heart disease and type 2 diabetes (Halfon, Larson & Slusser, 2013; Sturm, 2002). Moreover, it is also associated with increased costs for healthcare (Sturm, 2002). The increasing rates of overweight and obesity already start during childhood. In 2015 there were 41 million children worldwide under the age of five who were suffering from being overweight or obese (WHO, 2015 in Shloim, Shafiq, Blundell-Birtill & Hetherington, 2018). It is of high importance to reduce or even prevent overweight by examining risk factors already in early childhood. Infancy and toddlerhood are believed to be important periods for developing overweight and obesity, because childhood obesity is a strong predictor for obesity later in life (DiSantis, Hodges, Johnson & Fisher, 2011; Ogden, Carroll, & Flegal, 2008; Stettler et al., 2003b). Therefore examining the mechanisms and risk factors in childhood for developing a higher weight could help to reduce the world wide problem of overweight and obesity.

One of the factors found to be related to the risk of developing overweight in childhood is the role of the parents, especially in the context of feeding. This role is not only important in context of what they are feeding their children, but also in the way the feed their children, which can also be referred to as the feeding style of parents. Feeding styles are based on the extent of warmth and nurturance versus control, but specifically in the feeding context (Hughes, Power, Orlet Fisher, Mueller & Nicklas, 2005). This thesis will focus on five feeding styles. The first feeding style is responsive feeding. Responsive feeding can be described as responding adequately to signals of hunger and satiety of the child (DiSantis et al., 2011, p. 480). This is based on the concept of responsive parenting which is defined as 'responding to the infant promptly, contingently, in ways that are developmentally appropriate' (Ainsworth, Bell & Stayton ,1991 in Richards, 1974). Caregivers are considered responsive if they respond to the cues of their infant in just a few seconds, can satisfy the needs of their child, can make immediate changes in their previous behavior and these changes in behavior are according to the needs of their child (Black & Aboud, 2011). Parents who tend to have a responsive feeding style tend to let their child decide how much it eats and

they act according to the child signals of hunger and satiety. In this way children will learn what signals their bodies gives them when they are full or when they are hungry. They learn how to trust on the signals of their body and how to respond to this signals. This promotes self-regulation of the child, which in turn reduces the risk of obesity in children (Savage et al., 2018).

The second feeding style is restrictive feeding, which is characterized by restricting specific foods and controlling the eating behavior of the child, regardless of the child's needs (Hubbs-Tait, Kennedy, Page, Topham & Harrist, 2008). This is in line with the restrictive/authoritarian parenting style, which is characterized by low warmth and high demand and control (Langer et al., 2017). Within the feeding context parents with a restrictive feeding style limit the child to only eat healthy food and the quantity is excessively monitored (Thompson et al., 2009). This gives the child little opportunity to manage their feelings of hunger and satiety and therefore limits the development of self-regulation skills (Fisher & Birch, 2000). Birch, Fisher and Davidson (2003) stated that restrictive feeding practices may teach children to ignore their own hunger and eat despite of not being hungry. In addition, restricting specific foods would possibly make the food even more appetizing to children (Fisher & Birch, 1999), which in turn could increase the risk of overeating and overweight even more (Kanikami, Barnett, Séguin & Paradis, 2015; Birch et al., 2003). However, there are mixed findings with respect to the association between restrictive feeding and weight in children. Faith, Scanlon, Birch, Francis and Sherry (2004) found in their literature review that in 19 of the 22 examined studies an association was found between restrictive feeding styles and a higher weight in children of different age groups. In the other three studies no association was found between food restriction of the parents and weight in children, but Faith et al. (2004) hypothesized this was due to using measures of global parenting styles, which might be not sensitive enough to show any associations on feeding styles. A more recent study of Campbell et al. (2010) showed that restrictive feeding was associated with a higher BMI in 5- and 6-year old children, but not for children between the age of 10 and 12. The authors suggested that feeding practices have an effect on younger children, but may not have an effect on older children (Campbell et al., 2010). Johannsen, Johannsen and Specker (2006) found no direct relation between restrictive feeding and the weight of 3 to 5 year old children. However, they stated that due to their relative small sample

size (n = 63), it was impossible to show a clear relationship between feeding practices and weight in children (Johannsen et al., 2006).

The third feeding style is pressuring feeding, which is characterized by using different techniques to pressure the child to eat more, such as using rewards and encouragement, regardless of the child's signals (Gross et al., 2010). This is based on the pressuring parenting style, in which parents tend to force their child to behave, feel and think in the way the parents desire (Dieleman et al., 2018). Because children are pressured to eat more, regardless of their satiety, children do not learn to recognize their hunger and satiety cues. Therefore, the development of their self-regulation is hindered (Gross, Mendelsohn, Fierman, Hauser & Messito, 2014). The risk of overeating is therefore heightened and this eventually leads to weight gain and overweight (Johnson & Birch, 1994). Several studies also stated that when parents use the pressuring feeding style with regards to healthy food, the intake and preference for that specific food is decreased, while the intake and preference for non-healthy food is increased (Galloway, Florito, Francis & Birch, 2006; Lee, Mitchell, Smiciklas-Wright & Birch, 2001). However, in more recent studies is pressuring feeding mostly found to be associated with a lower BMI in children (Carnell & Wardle, 2007; Keller et al., 2006; Spruijt-Metz, 2002). Webber, Hill, Cooke, Carnell and Wardle (2010) hypothesized that parents use this feeding style more when their child is underweight or has a small appetite. In this way parents try to promote the eating behavior of their child. Furthermore, some studies also reported that pressuring with regards to healthy food sometimes leads to a increase preference in children for healthy food (e.g. Bourcier, Bowen, Meischke & Moinpour, 2003). In this way children eat more healthy food, which does not lead to a higher BMI.

The fourth feeding style is indulgent feeding, which is characterized by parents who show responsiveness to the child's signals, but who provide little structure in the feeding moments. (Thompson et al., 2009). Thus, indulgent parents respond to their child's hunger and satiety signals, but they set no limits to the quantity or the quality the child consumes This is in line with the indulgent parenting style which is characterized with high responsiveness and low demandingness (Kremers, Brug, de Vries & Engels, 2003; Thompson et al., 2009).
If parents do not set adequate boundaries for their child in the feeding context, there is a heightened risk of the child to ignore their satiety cues and consume larger portions than children of parents with other feeding styles (Fisher, Birch, Grusak & Hughes, 2008, as cited in Hughes et al., 2011; Hughes et al. 2011). In addition, children of parents with an indulgent

feeding style tend to prefer energy-dense food over nutrient-rich foods, such as fruits and vegetables, which eventually leads to a higher weight in children (Hoerr et al., 2009). Several studies showed that the indulgent feeding style is indeed associated with a higher weight in preschool children, from 2 to 5 year old (Blisset & Haycraft, 2008; Hughes, Shewchuk, Baskin & Nicklas, 2008; Hughes et al., 2005; Frankel et al., 2014; Fairley et al., 2015).

The last feeding style is laissez-faire feeding, which is characterized by not being responsive to hunger and satiety cues, together with not setting any limits to the quantity or quality of food the child consumes (Sacco, Bentley, Carby-Shields, Borja, & Goldman, 2007). Therefore, the parent is unable to monitor the amount or the quality of the food intake of the child. The caregiver has little interaction with the child in the context of feeding and expects that the child itself can regulate its food intake at an early age (Engle, 2002). This feeding style is based on the laissez-faire parenting style which is characterized by parents who have little interaction and are uninvolved with their child (Cyril, Halliday, Green & Renzaho, 2016). There are mixed findings on the association between laissez-faire feeding and weight in children. In a study of Lumeng, Kaciroti, Retzloff, Rosenblum and Miller (2017) and a study of Thompson, Adair and Bentley (2013) no association was found between laissez-faire feeding and weight in respectively 33 month and 18 month old children. In contrast, a study of Berlin, Kamody, Banks, Silverman and Davies (2015) showed an association between laissez-faire feeding and a lower BMI in children from 2 to 6 years old. Unfortunately, none of the authors described above gave an explanation for their findings. However, the study of Berlin et al. (2015) had a relative small sample size in their laissez-faire feeding group, with only 14 participants.

Although a lot of research has already been done on the association between the parental feeding style and overweight in children, little is known about this association in early infancy. However, it is believed that being overweight in infancy increases the likelihood of being overweight in adulthood (Stettler, Kumanyika, Katz, Zemel & Stallings, 2003a; Stettler, Kumanyika, Katz, Zemel & Stallings, 2003b; Stettler et al., 2003; Ekelund et al., 2006; Baird et al., 2005). Therefore it is important to know more about the role of the parents in developing overweight in infancy, so parents could receive advice about how to reduce the risk of overweight and it might be prevented.

This study will explore the association between the five different parental feeding styles described above and the weight of two year old children. As a measure of weight,

weight-to-length ratio will be used. The thesis will focus solely on the role of the mother, since they spend more time with the offspring compared to fathers, and therefore have a big role in their upbringing (Yogman & Garfield, 2016). The research question studied is this: 'To what extent is weight-to-length ratio in two year children related to maternal feeding styles?'. First, it is expected that a more responsive maternal feeding style is associated with lower weight-to-length ratio in two year old children. Secondly it is expected that a more restrictive feeding style is associated with a higher weight-to-length-ratio in two year old children. Third it is expected that a more pressuring feeding style is associated with a lower weight-to-length ratio in two year old children. Fourth it is expected that a more indulgent feeding style is associated with a higher weight-to-length ratio in two year old children. Lastly, with respect to the laissez-faire feeding style, no expectation is formulated, due to the inconclusive findings about an association between laissez-faire feeding and weight-to-length ratio in two year old children.

Finally, some covariates will be taken into consideration. According to Svensson et al.(2011) and Schaefer-Graf et al. (2005) weight of the child, and in particular overweight in children, is associated with the weight of the mother. In addition, maternal education is found to be associated with both child nutrition and feeding styles (Boyle et al., 2006; Sacton, Carnnell, van Jaarsveld & Wardle, 2009). For example, Sacton et al. (2009) found that mothers who had a higher education had significantly more control over feeding and lower scores on emotional feeding. Finally, research condition, as described in the method, will be included as covariates as well.

Method

Participants

The participants of the current study are part of a larger longitudinal study about weaning (i.e. the transition to solid food in the first year of life), called 'Babies First Bites'. This study is a collaboration between Leiden University and Wageningen University & Research. The study is performed in the Netherlands in the provinces Zuid-Holland and Gelderland. Mothers and their babies were followed for 36 months. Participants were recruited through a list of email addresses from the organization 'WIJ Nederland'. This organization provides free boxes filled with presents for expecting mothers, named 'Blije Doos pakketjes'. Participants were also recruited through a list of email addresses from

'Nutricia voor jou', in which parents can voluntarily be informed about nutrition. Participants were approached with an email about the project. If one was interested in participating, they could sign up at the website of the project, send an email or call.

Participants were eligible for the study if: 1) their child was a firstborn or they were pregnant of their first child, 2) the child had not eaten any solid foods yet, 3) the child was born between 37 and 42 weeks of pregnancy, 4) the mother was proficient in the Dutch language, 5) the mother did not suffer from any psychopathology and 6) the baby did not suffer from any serious gastrointestinal disorder or disorder that could hinder the ability to swallow. Finally, parents needed to be willing to give their child jarred pureed fruits and/or vegetables of the brand 'Olvarit' for the first 19 days and needed to consent to being video-taped in their own homes.

This study population consisted of 151 mother-child pairs. This was part of a larger study population, but because the study was still ongoing, some house visits had yet to be completed and not all data was collected at the start of this thesis. There were 66 boys and 85 girls included in the study. The average age of the children was 2.02 years (SD = 0.044, range = 1.9 - 2.2 years). The average age of the mothers was 32.49 years (SD = 4.762, range = 20.4-45.8 years). There were 103 mothers with a low educational achievement, 95 with an average educational achievement and 48 with a high educational achievement. The educational achievement of 9 mothers was unknown.

Procedure

Mothers and their baby were followed from the start of the study until the child was 36 months old. At the start of the study participants were asked to give informed consent. Participants were randomly assigned to one of the four research conditions, as can be seen in Table 1.

Mothers were given a feeding schedule for the first 19 days of feeding. All the feeding schedules consisted of cauliflower and green beans before and after the testing days. The vegetable feeding schedule consisted of spinach, broccoli, green beans or cauliflower for the other 17 days. The fruit feeding schedule consisted of carrot, pear, banana or apple for the other 17 days.

Table 1

Overview of the research conditions

	VIPP-FI	Control condition
Vegetable feeding schedule	Condition C	Condition A
Fruits feeding schedule	Condition B	Condition D

Mothers in condition B and C received the Video-Feedback Intervention to promote Positive Parenting-Feeding Infants (VIPP-FI), which promotes responsive feeding and sensitivity during the feeding moments. This intervention is based on the Video-Feedback Intervention to promote Positive Parenting-Sensitive Discipline (VIPP-SD), which is developed at Leiden University (Juffer, Bakermans-Kranenburg & Van IJzendoorn, 2008). The feeding moments between mother and child were recorded and mothers received positive feedback on the feeding moments using the tapes. The feedback was given by making use of five video phone-calls, twice when the child was between four and six months old and once when the child was 8 moths, 13 months and 16 months old. The control condition also received five telephone calls from the researcher about feeding and child development in general, at the same time as the calls in the VIPP-FI. In the control condition no specific feedback was given.

Participants were visited at home before and after the 19 day feeding schedule (age 4-6 months), and subsequently at 12, 18, 24 and 36 months. One week prior to each visit, mothers were asked to fill out questionnaires about various topics, using the online program Qualtrics. During the home visits, mother and child were weighed and measured. In addition, the feeding interaction between mother and child was video-taped. Other tasks were performed as well, such as a free play session between mother and child and a short interview about the way mothers experienced mealtimes with their child. In the present study, these other tasks will not be covered and only questionnaire data and length and weight of mother and child will be used. The study was approved by the Ethics Review Committees of both Leiden and Wageningen University.

Measures

Weight-to-length ratio. To assess the weight of the children, they were weighed during the home visits. Mothers were also weighed during the home visits. All children and mothers were measured with an electronic calibrated scale from the brand KERN. For the children a weight for height z-score is computed with WHO Anthro version 3.2.2 2011. According to the World Health Organization (2011) this program allows researchers to assess different domains of anthropometry in infants or young children.

Parental feeding style. To measure the maternal feeding style the Infant Feeding Style Questionnaire (IFSQ) was conducted. The IFSQ is divided in five feeding styles: laissez-faire, pressuring, restrictive, responsive and indulgent. The laissez-faire feeding style was assessed through attentiveness to the child and attentiveness with respect to diet quality, such as 'I am watching television during the feeding moments.'. This domain consisted of 7 items. Pressuring feeding was assessed through items about pressuring to finish, pressuring to finish with regards to eating cereal and soothing, such as 'I try to let my child eat, even though he/she is not hungry.'. This domain consisted of 8 items. The restrictive feeding domain consisted of items about restrictiveness with respect to quantity of the food intake and with respect to quality of the food intake. An example of an item is: 'I am monitoring that my child does not eat too much.'. This domain consisted of 4 items. The responsive feeding domain consisted of items about responsiveness to satiety and being responsive to attention and interaction, such as 'I let my child decide how much he/she eats.'. This domain consisted of 9 items. Indulgent feeding was assessed through items about being permissive, coaxing, soothing and pampering, such as 'I will allow that my child eats sweets, such as candy or cookies.'. This domain consisted of 16 items. The items on all the domains were answered on a 5-point scale, ranging from 'never' (1) to 'always' (5).

According to Thompson et al. (2009) the IFSQ has an acceptable to excellent internal reliability for the sub-constructs, ranging from .75 to .95. In the present study, the internal consistency of the sub-constructs was questionable to good ($\alpha_{responsive}$ = .65, $\alpha_{restrictive}$ = .61, $\alpha_{indulgent}$ = .85, $\alpha_{laissez\text{-}faire}$ = .60, $\alpha_{pressuring}$ = .67). With respect to validity, no information is present.

Covariates. To control for covariates, the variables BMI of the mother, research condition, educational achievement, child gender and child age will be included in the analyses. For the research condition four scores are possible (1 = A, 2 = B, 3 = C, 4 = D, as

shown in Table 1). For educational achievement three scores were possible (1 = low, in Ducht called 'basis-, voortgezet- of Middelbaar Beroepsonderwijs', 2 = average, in Dutch called 'Hoger Beroepsonderwijs', 3 = high, in Dutch called 'Wetenschappelijk onderwijs of hoger'). For gender of the child 2 scores were possible (1 = boy, 2 = girl).

Data analysis. To examine the association between different maternal feeding styles and overweight in children a hierarchical multiple regression analysis will be performed. With this analysis, a few assumptions will be checked. First, the presence of a linear relationship between the outcome variable (weight-to-length z-score of the child) and the independent variable (maternal feeding style) will be assessed with a scatterplot. Secondly, homoscedasticity of the residuals will be checked, when the multiple regression is performed. Thirdly, multicollinearity will be checked, by verifying if Tolerance values are > .1 and Variation Inflation Factors (VIF) values are <10 for the predictor variables. Finally, the normal distribution of the residuals will be checked using normal probability plots, when the multiple regression is performed. Even though it is no assumption for a multiple regression analysis, univariate outliers will also be checked using a boxplot.

In this analysis BMI of the mother, research condition, educational achievement of the mother, and gender and age of the child will be included as covariates.

The first step of the hierarchical multiple regression analysis will be to include the covariates on the outcome variable weight to height z-score. Second, next to the covariates, all parental feeding styles will be included simultaneously in the analysis. For the analysis IBM SPSS Statistics 25 will be used. A significance level of alpha < .05 will be used. Power is calculated with G*Power 3.1.9.4 (Faul, Erdfelder & Buchner, 2007; Faul, Erdfelder, Buchner & Lang, 2009).

Results

The assumptions of the multiple regression analysis, as described above, were checked. There were no violations of the assumptions. Notable is that there were 6 missing values on the BMI of the mother. There were also 16 mothers who did not fill in the questionnaire about feeding styles, which led to 16 missing values on all the feeding styles. Due to the amount of missing values a missing value analysis was performed. There were no systematic differences on other variables between the cases with missing values on the feeding styles and cases with non-missing values on the feeding styles. There was one

univariate outlier in the dataset, on the dependent variable, namely weight-to-length z-score. The Cook's distance of that outlier was 0.065, so based on the traditional cutoff of >1 for Cook's distance, the outlier should not be removed from the dataset (de Vocht, 2015). On top of that, according to Smit (2017) outliers should not be removed if there is no assignable cause for the outlier. The outlier was not removed from the data analysis.
According to the casewise diagnostics of the regression analysis there were six outliers in the analysis. For these cases the Cook's distance was also <1 and the leverage values were less than the critical leverage value for the analysis. Data analysis showed that the outliers were no violation to the assumption of normal distribution of the residuals.

As depicted in table 1 the weight-to-length z-score, responsive feeding, restrictive feeding, laissez-faire feeding and the pressuring feeding were normally distributed. However the indulgent feeding was not symmetrical, since the standardized skewness was >3, which means that there were more mothers who reported a lower indulgent feeding and only a few mothers who reported a higher indulgent feeding style. However, since there is no assumption about a normal distribution of the independent variables and no problems emerged within the residual model, no action was taken.

The power of the analysis was .59, which was lower than the .8 which is suggested in earlier research (Cohen, 1988; Field, 2005).

Table 1 shows the descriptive statistics of the focus variables. As shown in table 1, the average reported responsive feeding of the mothers was the highest reported feeding style with $m = 3.86$. The lowest reported feeding style of the mothers was indulgent feeding with $m = 1.70$. The average weight-to-length z-score was .730, which indicates a healthy weight-to-length according to the WHO (2011). The child growth standards can be seen in Appendix 1.

As shown in table 2, weight-to-length z-score had a positive relationship with restrictive feeding ($r = .187$, $p = .017$), indicating that mothers who reported a higher restrictive feeding style had babies with a higher weight-to-length z-score. The BMI of the mother had a negative relationship with responsive feeding ($r = -.172$, $p = .026$), so mothers with a higher BMI reported a lower responsive feeding style. Responsive feeding was also significantly correlated with educational achievement of the mother ($r = -.229$, $p = .005$) and with the age of the child ($r = .175$, $p = .024$), so more responsive feeding was associated with a lower educational achievement and a higher age of the child.

Table 1

Descriptive statistics of the focus variables

	Minimum	Maximum	Mean	Std. Deviation	Standardised skewness
Weight-to-length z-score	-1.58	3.62	.730	.973	1.096
Responsive feeding	2.25	5.00	3.86	.439	-1.836
Restrictive feeding	1.00	4.75	3.41	.623	-1.995
Laissez-faire feeding	1.17	4.17	2.62	.613	1.478
Pressuring feeding	1.00	4.17	2.44	.610	.856
Indulgent feeding	1.00	3.33	1.70	.442	5.711

In the first model of the regression analysis, as shown in table 3, the covariates BMI of the mother, educational achievement of the mother, the age of the child and the research condition were included. This model was not significant (F (7, 128) = .466, p = .857). The covariates did not have a significant contribution to the explained variation of the weight-to-length z-score of the child (R^2 = .026, p = .857). In the second model the feeding styles, namely responsive feeding, restricting feeding, laissez-faire feeding, pressuring feeding and indulgent feeding, were included. This did not result in a significant change in the explained variation (F_{change} (5, 116) = 1.61, p = .163). This model as a whole was not a significant prediction for weight-to-length ratio in two year old children (F (12, 128) = .949, p = .502, R^2 = .09). As depicted in table 3, none of the feeding styles or the covariates were significantly related to the weight-to-length z-score. However, on top of the covariates, restrictive feeding showed a trend to statistical significance in predicting weight-to-length z-score (beta = .206, t = 1.95, p = .054), indicating that more restrictive feeding was related to a higher weight-to-length z-score, but this was not significant in the whole model.

Table 2

Correlation matrix of weight-to-length, BMI of the mother, educational achievement, age of the child, gender of the child, research conditions and feeding styles.

	Weight-to-length	BMI Mother	Educational achievement	Age child	Gender child	Responsive feeding	Restrictive feeding	Laissez-faire feeding	Pressuring feeding	Indulgent feeding
Weight-to-length										
BMI Mother	.140									
Educational achievement	-.102	-.010								
Age child	.004	-.015	.020							
Gender child	-.162*	.022	.149*	-.034						
Responsive feeding	-.160*	-.260**	-.244**	.177*	.004					
Restrictive feeding	.321**	.045	.061	.032	-.070	-.072				
Laissez-faire feeding	-.150*	.126	-.006	-.049	.091	-.003	-.526**			
Pressuring feeding	-.147	-.017	.054	.097	-.080	.310**	-.013	.058		
Indulgent feeding	-.102	.079	.022	.096	-.049	.131	-.175*	.314**	.344**	

*. Correlation is significant at the .05 level (2-tailed).

**. Correlation is significant at the .01 level (2-tailed).

Table 3

Regression table of weight-to-length ratio of the child predicted by BMI of the mother, educational achievement, age of the child, research condition and feeding styles

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	R^2
		B	Std. Error	Beta			
1	(Constant)	2.116	4.387		.482	.630	
	BMI Mother	.007	.016	.040	.444	.658	.026
	Educational achievement	-.253	.357	-.064	-.708	.480	
	Age child	-.114	2.046	-.005	-.056	.955	
	Gender child	-.211	.185	-.104	-1.139	.257	
	Condition A	-.196	.262	-.082	-.750	.455	
	Condition B	-.007	.250	-.003	-.028	.978	
	Condition C	.000	.253	.000	.002	.999	
2	(Constant)	1.067	4.430		.241	.810	
	BMI Mother	.001	.016	.004	.039	.969	.089
	Educational achievement	-.381	.366	-.097	-1.040	.300	
	Age child	.658	2.071	.029	.318	.751	
	Gender child	-.211	.184	-.104	-1.146	.254	
	Condition A	-.125	.263	-.052	-.474	.636	
	Condition B	-.018	.254	-.008	-.070	.944	
	Condition C	.057	.255	.025	.223	.824	
	Responsive feeding	-.273	.229	-.122	-1.192	.236	
	Restrictive feeding	.328	.169	.206	1.946	.054	
	Laissez-faire feeding	.107	.187	.064	.570	.570	
	Pressuring feeding	-.134	.168	-.081	-.799	.426	
	Indulgent Feeding	-.072	.224	-.032	-.324	.747	

a. Dependent Variable: WeightToLength

Discussion

This study investigated the association between weight-to-length ratio in two year old children and maternal feeding styles. The research question was: 'To what extent is weight-to-length ratio in two year children related to maternal feeding styles?'. The study did not find any association between weight-to-length ratio and the maternal feeding style. A few hypotheses were examined in the study. First, it was expected that a more responsive maternal feeding style was associated with lower weight-to-length ratio in two year old children. Secondly it was expected that a more restrictive feeding style was associated with a higher weight-to-length ratio in two year old children. Third it was expected that a more pressuring feeding style was associated with a lower weight-to-length ratio in two year old children. Fourth it was expected that a more indulgent feeding style was associated with a higher weight-to-length ratio in two year old children. Lastly, with respect to the laissez-faire feeding style, no expectation was formulated, due to the inconclusive findings in earlier research about an association between laissez-faire feeding and weight-to-length ratio in two year old children. In this study no association between any of the particular feeding styles and weight-to-length ratio was found. However, there was a slight trend to statistical significance visible between restrictive feeding and weight-to-length ratio, whereas more restrictive feeding was associated with a higher weight-to-length ratio in children. There are a few explanations that might explain why the trend has failed to reach significance in this study sample, as described below.

An explanation for the findings in general is that for some maternal feeding practices it might be too early to have an influence on the weight of two year old children. Farrow and Blissett (2008) discussed that some maternal feeding styles mostly have an influence on the weight on children later in life. Farrow & Blissett (2008) stated that two year old children are highly dependent of the caregiver in the feeding context and mostly eat food that is offered only by the caregiver. The influence of this on the self-regulation and the preference for specific foods in children might be something that can only be detected in older children, when they are more self-employed in the feeding context and can make their own choices regarding food and satiety. Besides that, the power of the analysis was quite low, namely .59. Cohen (1988) and Fields (2005) suggested that a power of .8 should be aimed for. According to Fields (2005) power is important to detect an effect in your analysis. To give a power of .8 more participants should be included in the study. To aim for a power .8 the suggested sample size should be >192. This is particularly interesting with regards to the trend to statistical

significance which was found between restrictive feeding and weight-to-length ratio. If more participants were included in the study, the chances are that this trend could reach significance (Lieber, 1990), in which higher restrictive feeding would be associated with a higher weight-to-length ratio

There are a few explanations which might explain the findings for a few specific hypotheses. With regards to responsive feeding inspection of the items of the IFSQ can give some insight on the findings of the study. Responsive feeding, as described earlier, can be defined as responding adequately to signals of hunger and satiety of the child. However not all items within the IFSQ seem to cover this definition. For example the item 'My child let's me knows whenever he/she is hungry' does not seem to cover the part where the parent is responding to the signals of the child. The question only asks about the signals of the child. This is also the case for the item 'I am carefully watching when my child seems to let me know he/she is hungry'. Therefore the concept 'responsive feeding' might not be measured accurately enough. With respect to restrictive feeding it is noteworthy that, besides the questionable internal consistency for this subconstruct which is described later on, it was measured with only 4 items on the IFSQ. This might be not enough items to measure the restrictive feeding style of the mother, which might explain the findings of the study. With regards to indulgent feeding the distribution of the scores might give some insight on the findings of the study. As described earlier there were only a few mothers who reported higher indulgent feeding and a lot of mothers who reported lower indulgent feeding. It is possible that there was not enough distribution of the scores to explain the variance in the model. It might be possible that the children were still too young to measure indulgence feeding and that this feeding style is expressed at a later age. With regards to pressuring feeding it is noteworthy that earlier research had mixed findings on the association between pressuring and weight-to-length ratio. On the one hand research found that children with pressuring parents do not learn to recognize their hunger and satiety cues which lead to a hindered development of their self-regulation (Gross et al., 2014). This leads to a heightened risk of overeating and eventually leads to weight gain and overweight (Johnson & Birch, 1994). However as described earlier it also believed that pressuring is associated with a lower weight-to-length ratio, because parents only uses this feeding style with children who are underweight to try to increase their energy intake (Galloway, Florito, Francis & Birch, 2006; Lee, Mitchell, Smiciklas-Wright & Birch, 2001; Webber, Hill, Cooke, Carnell and Wardle, 2010). It is

possible that both the arguments of the effect of pressuring feeding on weight-to-length ratio might be true. If this is the case, both the effects may have cancelled each other out.

There are a few limitations to this study. Firstly, the internal consistency of the IFSQ was questionable for the most sub-constructs, such as responsive feeding, restrictive feeding, laissez-faire feeding and pressuring feeding. This can indicate that the individual items on the sub-constructs are not necessarily measuring the exact same construct. On top of that, there was no information present with respect to the validity of the IFSQ. Due to the questionable internal consistency and the unknown validity the results should be interpreted with caution. Secondly, the feeding styles are measured with a self-report questionnaire. Although Faith et al. (2004) stated that self-report gives insight in the ongoing, steady feeding dynamics, it is questionable if this gives accurate results while self-report is always susceptible for acquiescence bias and social-desirability bias (SDB, Daniels et al., 2014). According to Kröller & Waschburger (2008) there is a great chance of SDB with regards to feeding styles, as this is a delicate subject for most mothers. This could result in underreporting on some 'socially undesirable' feeding styles. Another method to obtain information about the maternal feeding styles is by using observational methods. As stated by Faith et al. (2004) this is, however, usually a snapshot of the feeding style used in that particular moment. Therefore, it is advisable to use a few meals to observe the feeding styles, to diminish both the possible acquiescence bias and the risk of having a snapshot of the feeding styles used in a particular moment. Another way to diminish SDB is to include a measure of this type of bias, which was not used in this study. Third, it should be noted that on top of the unknown validity and questionable internal consistency, the sub-constructs of the IFSQ were measured with only a few items. For example, restrictive feeding is measured with 4 questions. Future research should consider adding items to the IFSQ to measure the sub-constructs. Fourth, there is an issue that needs to be addressed with respect to restrictive feeding. According to Ogden, restriction is when the child is limited to eat unhealthy food in a way the child is able to perceive. For example, particular food is eaten by the parent in front of the child, but the child is not allowed to eat it themselves. Covert restriction is when the child is not able to perceive the restriction. Ogden et al. (2006) stated that measures for food restriction often only use measures that have items on overt control and therefore only measure a few ways in which parents try to control the food intake of their children. The IFSQ makes no distinction in overt and covert restrictive feeding, however the difference in ways to control the food intake may have different effects on eating behavior of children and later on also on weight. Loth, Friend,

Horning, Neumark-Sztainer and Fulkerson (2016) stated that covert restriction was related to less unhealthy snacking in children, while overt restriction was associated with greater healthy snacking. In addition, restrictive feeding could also be distinguished in directive and non-directive control (Murashima, Hoerr, Hughes & Kaplowitz, 2012). Non-directive control includes promoting healthy eating and not bringing unhealthy food in the home, while directive control includes restriction of the quantity of food. Murashima et al. (2012) found that non-directive restriction was associated with more consumption of nutrient-dense foods and negatively related to energy-dense foods. They did not find any association with directive restriction. Again, the IFSQ makes no distinction in restriction whatsoever. Fifth, there is lack of evidence for causality in this study. Causality could be implied with the theoretical background, however the questionnaires and the weight-to-length ratio of the children are administered at the same time. Therefore causality could only be suggested. As described earlier, it is already hypothesized that pressuring feeding is only used for children who are underweight, to promote eating behavior (Webber et al., 2010). This could also be the case for the other feeding styles, for example restrictive feeding, which was found to be positively associated with a higher weight-to-length ratio in this study. Parents with overweight children might try to restrict the food intake of their children, to reduce their energy intake. Lastly, the study was ongoing when the data analysis was executed. Therefore, some house visits had yet to be completed and not all data was collected. This could be related to the issue with the power of the analysis, as described earlier. The analysis should be executed on all the data when all the house visits are completed. This should increase the power of the analysis (Lieber, 1990).

There are a few recommendations for future research. First, as mentioned earlier, due to the low power of the current study it is advisable to include more participants in future research. Especially with regards to the findings on restrictive feeding, it is possible that including more participants will give a significant association between restrictive feeding and weight-to-length ratio. Secondly, as mentioned earlier, there is a great chance on social desirability bias in self-report questionnaires on feeding styles. Therefore some mothers may have reported lower scores on some feeding styles. Even though measures for detecting SDB do exist, none of them were included in this study. When these measures were included mothers who gave lower scores on 'socially undesirable' answers may have been detected, and their (expected) lower scores on some feeding styles could have been examined. Future research should include such measures to examine the effect of social desirability on the

results. Another way to eliminate social desirability is to assess the feeding style of mothers with observations of the feeding moments. When observations are used to assess the maternal feeding styles, a few moments should be assessed to eliminate having a snapshot of the feeding moments. Third, it is advisable to have a critical look at the instrument to measure the feeding styles. The sub-construct of the IFSQ have a low validity and as described earlier the responsive feeding scale does not seem to cover the definition of responsive feeding. On top of that, the indulgent feeding scale is only measured with 4 items, which may not be sufficient enough to give accurate results. There is a need for a new validated instrument which has more items to measure the sub-constructs, specifically for measuring feeding styles used with young children. The items to measure the sub-constructs should cover the definition of the feeding styles more precisely.

Conclusion

This study did not show an association between maternal feeding styles in general and weight-to-length ratio in two year old children. There was no significant association between weight-to-length ratio and the feeding styles in particular, namely responsive feeding, pressuring feeding, indulgent feeding and laissez-faire feeding. There was a trend to statistical significance between weight-to-length ratio and restrictive feeding, whereas more restrictive feeding was associated with a higher weight-to-length ratio in children.

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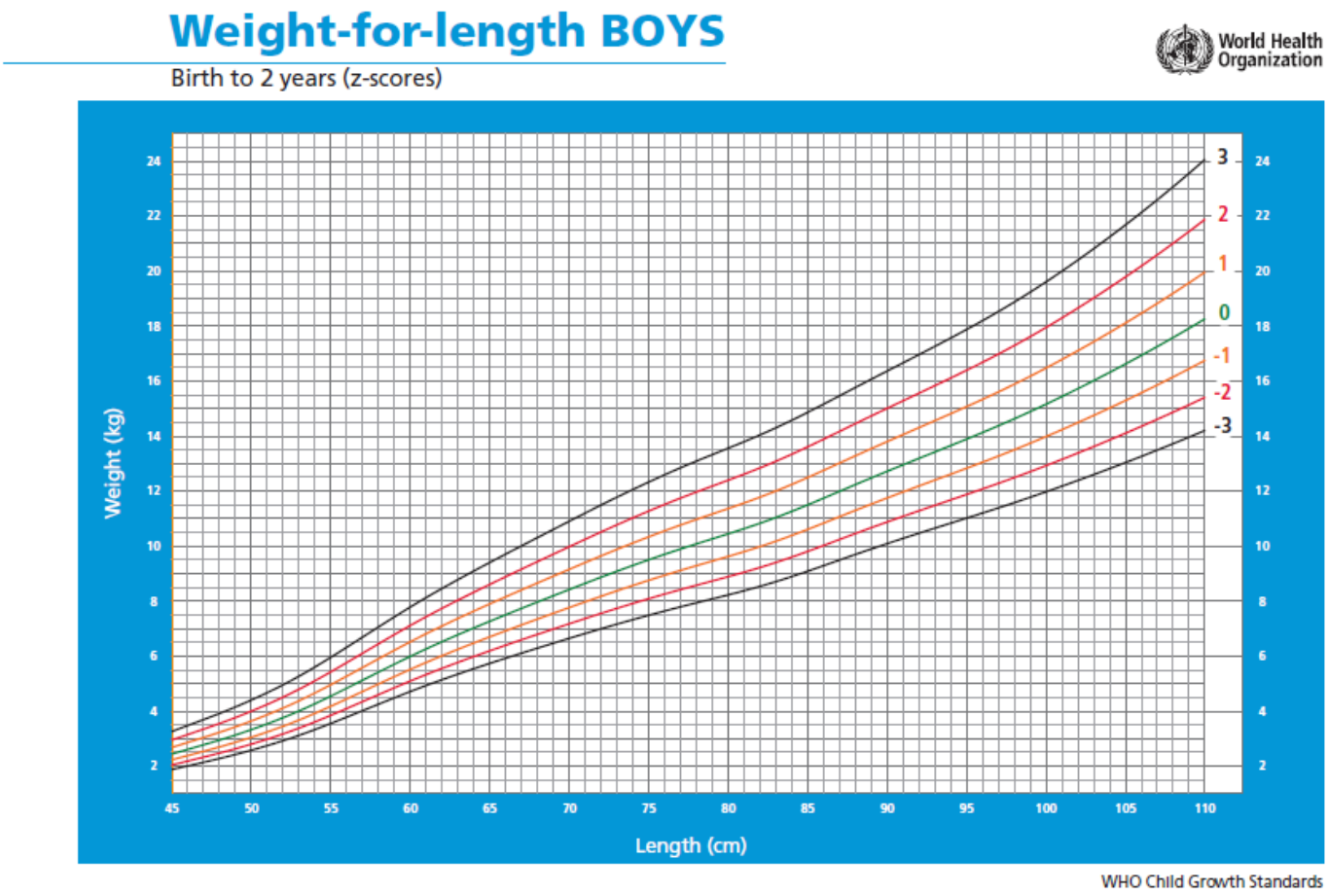
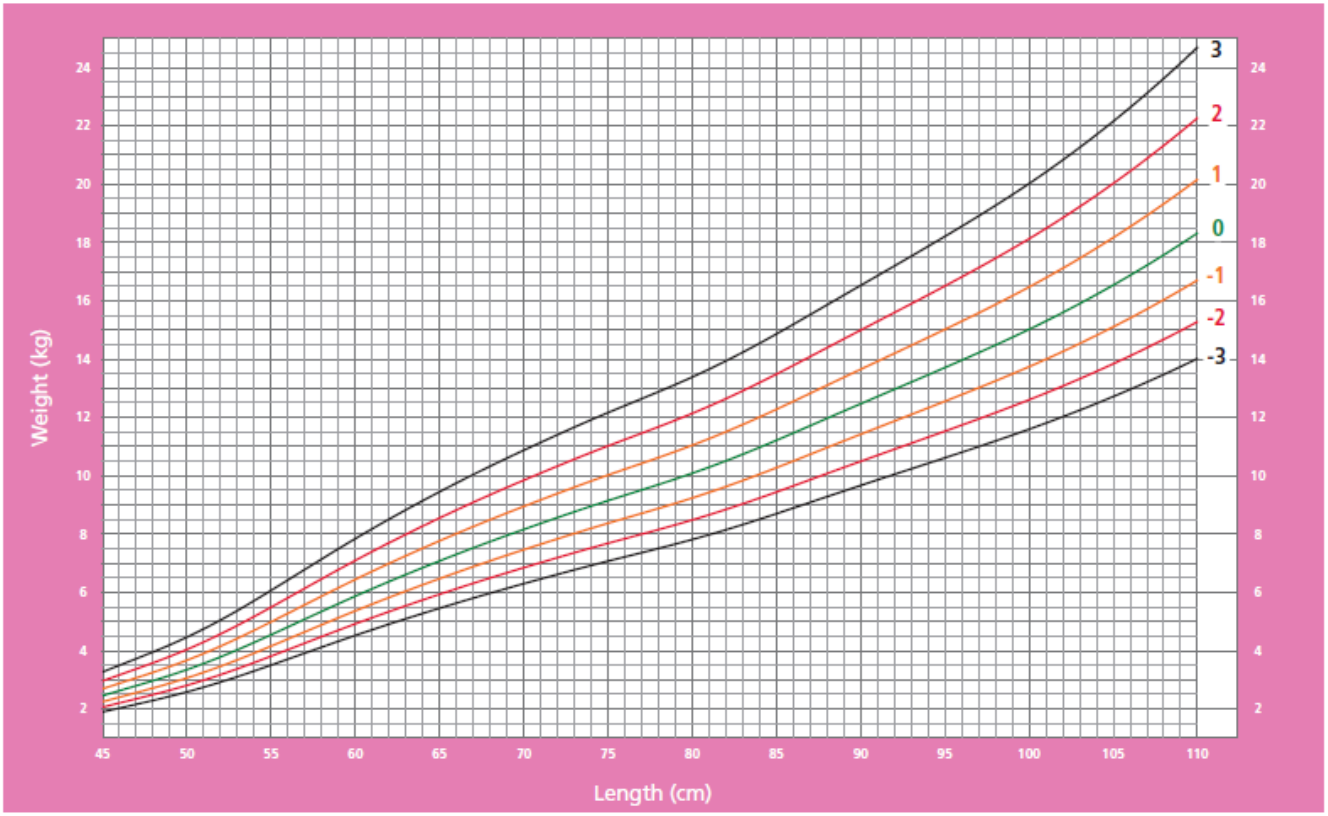
Appendix A
Child growth standards



Weight-for-length GIRLS

Birth to 2 years (z-scores)

World Health Organization



WHO Child Growth Standards