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# Maternal history of eating disorders: Diet quality during pregnancy and infant feeding

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ABSTRACT

We studied associations of maternal history of eating disorders (EDs) with diet quality of pregnant women and their infants, and breastfeeding practices. We included 6196 mother-child pairs from Generation R, a population-based cohort in the Netherlands. Maternal history of lifetime EDs was assessed during pregnancy with a questionnaire. Dietary intake during pregnancy and in infancy was assessed with food-frequency questionnaires and diet quality scores were calculated, reflecting adherence to dietary guidelines. Breastfeeding practices were assessed with questionnaires at 2, 6, and 12 months. We observed that, after adjustment for socioeconomic and lifestyle factors, women with a history of EDs had a higher diet quality than women without a history of EDs (B = 0.24 SD, 95%CI: 0.15; 0.33). Mothers with a history of EDs were less likely to breastfeed (unadjusted OR = 0.68, 95%CI: 0.51; 0.93), although no longer statistically significant after adjustment (OR = 0.75, 95%CI: 0.55; 1.03). These findings suggest that mothers with a history of EDs seem slightly less likely to initiate breastfeeding, however, this warrants further investigation. At the age of 1 year, infants of mothers with a history of EDs had a higher diet quality (B = 0.15 SD, 95%CI: 0.02; 0.27). We conclude that mothers with a history of EDs and their infants have a relative good diet quality, although follow-up studies are needed to assess long-term associations with diet in later childhood and adolescence.



## 1. Introduction

Eating disorders (EDs) are mental disorders characterized by disordered eating and distorted body images (American Psychiatric Association, 1994; American Psychiatric Association, 2013). Anorexia nervosa (AN) is characterized by an extreme restriction of energy intake, a low body weight, an intense fear of gaining weight, and a distorted body image (American Psychiatric Association, 1994; American Psychiatric Association, 2013). Bulimia nervosa (BN) is characterized by recurrent periods of uncontrolled binge-eating, followed by compensatory behaviors to prevent weight gain (American Psychiatric Association, 1994; American Psychiatric Association, 2013). Women with an ED have an increased risk of psychiatric co-morbid disorders and medical complications (Papadopoulos, Karamanis, Brandt, Ekbom, & Ekselius, 2013; Watson et al., 2014), including fertility difficulties (Easter, Treasure, & Micali, 2011; Patel, Wheatcroft, Park, & Stein, 2002), pregnancy complications (Kimmel, Ferguson, Zerwas, Bulik, & Meltzer-Brody, 2015; Micali, Simonoff, & Treasure, 2007; Sollid, Wisborg, Hjort, & Secher, 2004), and their offspring might be at increased risk of health issues (Agras, Hammer, & McNicholas, 1999; Patel et al., 2002). Women who suffered from an ED in the past may be more aware of what they eat during pregnancy (Mazzeo, Zucker, Gerke, Mitchell, & Bulik, 2005) and which foods they provide to their infants (Mazzeo et al., 2005). As nutrition during pregnancy and in early childhood may have long-term

*Abbreviations:* AN, Anorexia nervosa; BMI, Body mass index; BN, Bulimia nervosa; BSI, Brief Symptom Inventory; CI, Confidence interval; ED, Eating disorder; FFQ, Food frequency questionnaire; IQR, Interquartile range; SD, Standard deviation.

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consequences for growth, development, and health (Craigie, Lake, Kelly, Adamson, & Mathers, 2011; Emmett, Jones, & Golding, 2015; Langley-Evans, 2015), it is important to study diet quality during these periods.

Women with a history of EDs may have more nutritional knowledge and therefore provide themselves and their children with healthier diets (Ho, Soh, Walter, & Touyz, 2011; Laessle et al., 1988). Indeed, pregnant women with a history of EDs seem more likely to adhere to a dietary pattern characterized by a high intake of meat substitutes, legumes, nuts and herbal teas (Micali, Northstone, Emmett, Naumann, & Treasure, 2012), and to have lower intakes of high-fat meats (Siega-Riz et al., 2008). Among school-aged children of mothers with a history of EDs, a higher adherence to a data-driven 'health conscious/vegetarian' dietary pattern has also been reported (Easter et al., 2013). Likewise, at ages 1–4 years, these children ate less junk food than children of mothers without a history of EDs (Waugh & Bulik, 1999). Less is known about diet quality in infancy. Moreover, adherence to these data-driven dietary patterns or a low consumption of high-fat foods does not necessarily imply that the overall diet is actually healthier (Kant, 1996; Ocké, 2013). Therefore, further research examining the overall diet quality beyond specific patterns in women with a history of EDs and their infants is needed.

Although mothers with a history of EDs may provide themselves and their infants with healthier diets, they may face difficulties with breastfeeding (Waugh & Bulik, 1999). Enduring shape concerns and body awareness in women with a history of EDs could evoke feelings of embarrassment of breastfeeding (Patel et al., 2002; Waugh & Bulik, 1999). Alternatively, the common belief that breastfeeding promotes weight loss may increase breastfeeding initiation and duration in women with a history of EDs (Patel, Lee, Wheatcroft, Barnes, & Stein, 2005), who may still have the desire to be thin. Contrasting results with regard to breastfeeding have been reported, with a study showing that mothers with a history of EDs were more likely to start breastfeeding and to continue for a longer period (Micali, Simonoff, & Treasure, 2009), whereas other studies found shorter (Larsson & Andersson-Ellström, 2003; Torgersen et al., 2010), or similar durations (Allen, Gibson, McLean, Davis, & Byrne, 2014; Evans & Grange, 1995; Hoffman et al., 2014). Thus, associations between maternal EDs and breastfeeding remain unclear.

Therefore, we aimed to explore the associations between maternal history of EDs and overall diet quality of women during pregnancy, as well as their breastfeeding practices and their infants' diet quality during the first year of life.

## 2. Methods

### 2.1. Study design

This study was embedded in the Generation R Study, a multi-ethnic population-based prospective cohort from fetal life onward, conducted in Rotterdam, the Netherlands (Jaddoe et al., 2012). Pregnant women living in Rotterdam, with an expected delivery date between April 2002 and January 2006 were invited to participate (baseline response rate: 61%). All participating parents gave written informed consent and medical ethical approval was obtained from the medical ethical committee of the Erasmus Medical Center. Further information is available elsewhere (Jaddoe et al., 2012).

### 2.2. Participants

A total of 6608 women were enrolled during pregnancy, provided information on their history of EDs and gave full consent for the prenatal and postnatal phase of the study. Those with missing data on all dietary outcome variables were excluded (n = 412), resulting in a total of 6196 mother-child pairs with eligible data. Because data on diet quality and breastfeeding were not complete for all participants, the population for analysis varied per specific analysis (n between 2933 and 5035).

## 3. Measures

### 3.1. Maternal history of eating disorders

Mothers' history of lifetime EDs was assessed with a self-report questionnaire during pregnancy as described in detail elsewhere (de Barse et al., 2015; Micali, De Stavola et al., 2012). The questionnaire included a vignette to clarify what was meant by AN and BN. This vignette was based on diagnostic criteria (American Psychiatric Association, 1994), but was slightly changed to create a clear and understandable description of both AN and BN. The vignette was followed by questions whether the women had suffered from either AN or BN (ever and in the previous year), such as: "Have you ever tried to lose weight to the extent that you may have suffered from anorexia?", "Have you suffered from anorexia in the past year?", and "Have you ever had bouts of compulsive eating as described for bulimia?". Additionally, the questionnaire included items about treatment, medication, and the inability to work as a result of the disorder. Women who answered 'yes' on at least one of these questions, were categorized as having a history of EDs. Due to a low prevalence of EDs in the year before pregnancy (Micali, De Stavola et al., 2012), women were grouped according to their lifetime history of any ED (i.e., a history of any ED versus no history of EDs).

Given the large sample size, it was not feasible to obtain a clinical diagnosis. However, in a sub-sample (n = 928) of the Generation R Study, our self-reports of EDs were evaluated against clinical diagnoses. Excellent sensitivity (100%) and specificity (96%) were found for self-reported AN, and very good sensitivity (94%) and specificity (81%) were found for self-reported BN (Micali, De Stavola et al., 2012).

### 3.2. Diet quality during pregnancy

Women's dietary intake in early pregnancy was assessed using a semi-quantitative 293-item food frequency questionnaire (FFQ) at enrollment (median 13.6 weeks of gestation, interquartile range (IQR) 12.4–16.2). The FFQ included foods that were frequently consumed in the Dutch population and was modified for use during pregnancy (Klipstein-Grobusch et al., 1998). Energy and nutrient intakes were calculated using the Dutch food composition table from 2006 (Netherlands Nutrition Center, 2006). The FFQ was validated against three 24-h recalls among 71 pregnant women living in Rotterdam. Intra-class correlation coefficients for macronutrient intakes ranged from 0.5 to 0.7 (Tielemans et al., 2015).

National dietary guidelines (Health Council of The Netherlands, 2015) were used to develop a predefined diet quality score for pregnant women. The following 15 components and cut-offs were included in the diet score: vegetables (≥200 g/d), fruit (≥200 g/d), whole grains (≥90 g/d), legumes (≥135 g/wk), nuts (≥15 g/d), dairy (≥300 g/d), fish (≥100 g/wk), tea (≥450 g/d), grain quality (ratio whole grains of total grains), soft fats and oils (ratio of total fat), red meat (≤375 g/wk), sugar-containing beverages (≤150 g/d), alcohol (yes/no), salt (≤6 g/d), and folic acid supplements in early pregnancy (periconceptional/first ten weeks/not). For each component, except for alcohol and folic acid supplements, the ratio of the reported intake and the recommended intake was calculated. For example: a woman with a vegetable intake of 120 g/d received a score of 0.6

(120 g/d divided by 200 g/d) for the vegetable component. The maximum score for each component was 1; if a woman exceeded the recommended intake, her score remained 1. For sugar-containing beverages, red meat, and salt, the scores were reversely coded, meaning that higher scores on these food groups reflect lower intakes. Alcohol intake was dichotomously coded, with no intake scored as 1 and any alcohol intake scored as 0. Intake of folic acid supplements was also categorized, with intake periconceptionally scored as 1; in the first ten weeks of gestation scored as 0.5; and no intake in these periods scored as 0. The scores for the individual components were summed, resulting in an overall score ranging from 0 to 15, with a higher score representing a healthier diet.

### 3.3. Breastfeeding

Information on breastfeeding initiation and duration was obtained from delivery reports and postnatal questionnaires at the child's ages of 2 months, 6 months, and 12 months (Jaddoe et al., 2012). Mothers were asked whether they had ever breastfed their child (yes/no) and if yes, at what age they stopped breastfeeding their children.

### 3.4. Infant's diet quality

Dietary intake of the child was assessed using a semi-quantitative 211-item FFQ, which was filled out by the mothers when the children were at a median age of 12.9 months (IQR: 12.7–14.0) (Kiefte-de Jong et al., 2013; Voortman et al., 2015). This FFQ included foods that are frequently consumed by children aged 9–18 months, according to a Dutch national food consumption survey in 2002 (Breedveld & Hulshof, 2002). Questions covered the frequency of consumption, serving sizes, type of food items, and food preparation over the last month (Kiefte-de Jong et al., 2013). This FFQ was validated against three 24-h recalls in a sample of 32 Dutch children aged 14 months living in Rotterdam. This validation showed reasonable to good intraclass correlation coefficients for nutrient intake of 0.4 to 0.7 (Kiefte-de Jong et al., 2013; Voortman et al., 2015).

The 10 following components were included in the infant diet quality score: vegetables (≥100 g/d), fruit (≥150 g/d), bread and cereals (≥70 g/d), rice, pasta, potatoes and legumes (≥70 g/d), dairy (≥350 g/d), meat, poultry, eggs and meat substitutes (≥35 g/d), fish (≥15 g/d), oils and fats (≥25 g/d), candy and snacks (≤20 g/d), and sugar-sweetened beverages (≤100 g/d) (Voortman et al., 2015). Similar to the maternal diet quality score, ratios of the reported intake and recommended intake were calculated for each component, with reverse coding for the candy and snacks and sugar-sweetened beverage components. Subsequently, these scores were summed, resulting in an overall score ranging from 0 to 10, with higher scores representing a healthier diet. More details on this score are described elsewhere (Voortman et al., 2015).

### 3.5. Covariates

Based on knowledge and previous studies (Easter et al., 2013; Fisk et al., 2011; Torgersen et al., 2015), several covariates that might influence the associations were considered. Potential covariates included maternal age, ethnic background (based on country of birth of the mother and her parents, categorized into Dutch or non-Dutch), educational level (low: ranging from no education up to lower vocational training, or high: higher vocational training and higher academic education), body mass index (BMI), net household income (lower or higher than €2000 per month), and psychiatric symptoms. All variables, except for maternal BMI, were assessed using questionnaires during pregnancy. Maternal psychiatric symptoms were measured with the Brief Symptom Inventory (BSI), a validated 53-item self-report questionnaire. The overall score ranged from 0 to 4, with higher scores representing higher levels of psychiatric symptoms (Derogatis, 1993). Maternal height and weight were measured at enrollment in the study to calculate BMI ($kg/m^2$) (Jaddoe et al., 2012). Child sex was examined as a potential effect modifier, because maternal influence on dietary intake might be different for sons and daughters (Blissett, Meyer, & Haycraft, 2006; Sadeh-Sharvit et al., 2015). Information on child sex was obtained from birth records.

### 3.6. Statistical analyses

Linear and logistic regression analyses were used where appropriate to assess whether maternal history of any ED was associated with the different dietary measures. In all analyses, maternal history of EDs was coded as 'history of any ED' or 'no history of EDs', with the latter category as the reference. The diet quality scores for pregnant women and infants were standardized for energy intake using the residual method (Willett, Howe, & Kushi, 1997). All associations were analyzed in three models: 1) a crude unadjusted model, 2) a model adjusted for maternal age, ethnic background, educational level, BMI, and household income, and 3) a model additionally adjusted for maternal psychiatric symptoms. We adjusted separately for psychiatric symptoms because controlling for these symptoms may represent over-adjusting due to the high co-occurrence of EDs with these symptoms (Hudson, Hiripi, Pope, & Kessler, 2007). Effect modification by child sex was assessed in the analyses with child diet quality, by including an interaction term in all models.

Sensitivity analyses were performed in participants with a Dutch ethnic background only (n between 1975 and 2971) to reduce the risk of residual confounding (Becher, 1992), because the FFQs were developed and validated for a Dutch population (Kiefte-de Jong et al., 2013; Steenweg-de Graaff et al., 2014). Also, analyses with the diet quality score as outcome were repeated, using the original diet quality scores without standardization for energy intake.

To reduce potential bias due to missing values on some of the covariates (ranging from 0% for maternal age to 11.6% for household income), these variables were estimated using multiple imputation techniques (n = 10 imputations) (Rubin & Schenker, 1991). The results presented are the pooled regression coefficients or odds ratios of the 10 imputed datasets. All statistical analyses were carried out using the statistical software program IBM SPSS statistics, version 21.

### 3.7. Non-response analyses

Of the 6608 mothers who provided information on their history of EDs, mothers with missing data on all dietary outcome measures (n = 412) were compared to mothers with at least one dietary outcome measure available (n = 6196). Mothers with missing data on all dietary outcomes were younger ($t(453.5) = -9.7$, $p < 0.001$), more often of non-Dutch origin ($x^2(1) = 132.8$, $p < 0.001$), lower educated ($x^2(1) = 99.7$, $p < 0.001$), and had a higher BMI ($t(450.6) = 2.4$, $p < 0.05$), a lower household income ($x^2(1) = 101.6$, $p < 0.001$), and higher levels of psychiatric symptoms ($t(414.9) = 6.9$, $p < 0.001$).

## 4. Results

### 4.1. Population characteristics

Characteristics of the study population are presented in Table 1. In total, 9.5% (n = 591) of the mothers reported to have experienced

an ED at any point in their life. Mothers with a history of any ED reported more psychiatric symptoms (median BSI score: 0.29 versus 0.15 for women without a history of EDs, $p < 0.001$). Women with and without a history of EDs did not differ significantly on any other characteristics. Most of the women had a Dutch ethnic background (55.8%). Of the non-Dutch group, the largest ethnic groups were women with a Surinamese, Turkish, or Moroccan background. The mean diet quality score of children at age 1 years was 4.3 (standard deviation (SD) = 1.4) on a theoretical range from 0 to 10.

### 4.2. Maternal diet quality score

The associations between maternal history of EDs and maternal diet quality score are presented in Table 2. In all models, including model 3, in which associations were independent of maternal psychiatric symptoms, pregnant women with a history of any ED had a higher diet quality score (B = 0.24 SD, 95% confidence interval (CI): 0.15; 0.33) than pregnant women without such a history.

### 4.3. Breastfeeding

In the unadjusted model (model 1), mothers with a history of EDs were less likely to initiate breastfeeding (OR = 0.68, 95%CI: 0.51; 0.93, Table 2). We observed a similar association after adjustment for covariates, however, the effect estimate slightly attenuated and was no longer statistically significant (model 3: OR = 0.75, 95%CI: 0.55; 1.03). Among mothers who breastfed their infants, we did not find any significant differences in the duration of breastfeeding between mothers with and without a history of EDs (B = 0.15 months, 95%CI: −0.27; 0.57).

### 4.4. Infant diet quality score

Table 2 also shows that infants of mothers with a history of EDs had a higher diet quality score (model 3: B = 0.15 SD, 95%CI: 0.02; 0.27) than infants of mothers without such a history. Results did not significantly differ between boys and girls (p for interaction >0.05).

### 4.5. Sensitivity analyses

Analyses restricted to the subsample of participants with a Dutch ethnic background only (n between 1975 and 2971) showed similar associations between maternal history of EDs and the dietary outcomes (Supplemental Table 1). Only the association between maternal history of EDs and infants diet quality was − although in the same direction − no longer statistically significant (B = 0.12, 95%CI: −0.03; 0.28), probably due to reduced power. Also the analyses with and without standardization for energy intake showed similar results.

## 5. Discussion

In this population-based study, we found that maternal history of EDs was associated with a higher diet quality in both pregnant women and their infants. We did not find a statistically significant association of maternal history of EDs with breastfeeding initiation or duration.

Our findings of a higher diet quality during pregnancy are in line with previous studies, reporting that women with a history of EDs consumed less meat, butter, and full-fat milk and more legumes, margarine, vegetable oils, and skimmed milk compared to women without a history of EDs (Micali, Northstone, et al., 2012). Congruently, Siega-Riz et al. (2008) reported lower intakes of high-fat meats and sweetened beverages among pregnant women with past or current BN. Although these studies focused on individual food groups, the choices in individual food groups that these women made are in line with current dietary guidelines. Thus, these results may imply a desire to make healthy food choices, which is confirmed by our findings of a higher overall diet quality among pregnant women with a history of EDs.

Our findings from unadjusted models suggest that mothers with a history of EDs were slightly less likely to initiate breastfeeding. However, after adjustment for covariates, the effect estimate slightly attenuated and was no longer statistically significant. Several explanations, such as socioeconomic factors, might account for this non-significant finding. However, after adjustment for socioeconomic factors, the attenuation in effect size was only minimal, suggesting that limited power after adjustment rather than confounding may explain why statistically significant differences were no longer detected. In a much larger Norwegian cohort (n = 39355), Torgersen et al. (2010) reported differences in breastfeeding practices between mothers with and without an ED, whereas studies with small sample sizes (ED cases between n = 10 and n = 25) found no differences (Allen et al., 2014; Evans & Grange, 1995; Hoffman et al., 2014). In contrast to our findings,

**Table 1**
General characteristics of the study population.

| | | N | Percentage, mean (SD), median (IQR)[a] | |
|---|---|---|---|---|
| **Maternal characteristics** | | | | |
| Age at enrollment | mean years (SD) | 6,196 | 30.3 | (5.0) |
| Ethnic background[b] | % Dutch | 3,459 | 55.8 | |
| Educational level[c] | % high | 2,914 | 47.0 | |
| Body mass index at enrollment (kg/m$^2$) | median (IQR) | 6,196 | 23.7 | (21.6–26.6) |
| Household income | % ≥2000 €/month | 3,824 | 61.7 | |
| Psychiatric symptoms | median (IQR) | 6,196 | 0.15 | (0.06–0.35) |
| History of lifetime eating disorders | % yes | 591 | 9.5 | |
| Diet quality score in pregnancy (before standardization) | mean (SD) | 4,824 | 7.6 | (1.6) |
| Breastfeeding initiation | % yes | 4,616 | 91.7 | |
| Breastfeeding duration | median months (SD) | 3,673 | 3.5 | (1.5–8.5) |
| **Child characteristics** | | | | |
| Sex | % girls | 3,126 | 50.5 | |
| Diet quality score at age 1 year (before standardization) | mean (SD) | 2,933 | 4.3 | (1.4) |

[a] Values are percentages for categorical variables, means (standard deviation) for continuous normally disturbed variables, and medians (interquartile range) for continuous non-normally distributed variables, derived from the imputed dataset (n = 10 imputations).
[b] Large non-Dutch groups included Surinamese (8.2% of all participants), Turkish (6.9%), and Moroccan (4.9%).
[c] Low: ranging from no education up to lower vocational training; high: higher vocational training and higher academic education.

**Table 2**
Associations of maternal history of eating disorders (EDs) with maternal and infant diet quality and breastfeeding initiation and duration.

| | Maternal diet quality score (SD)[a] (N = 4,824) B (95%CI) | Breastfeeding initiation (yes/no) (N = 5,035)[a] OR (95%CI) | Breastfeeding duration (months)[a] (N = 3,673) B (95%CI) | Infant diet quality score (SD)[a] (N = 2,93s3) B (95%CI) |
|---|---|---|---|---|
| No history of ED | *0 [Reference]* | *1 [Reference]* | *0 [Reference]* | *0 [Reference]* |
| Lifetime history of any ED[b] | | | | |
| Model 1 | 0.22 (0.12; 0.31)** | 0.68 (0.51; 0.93)* | 0.01 (-0.42; 0.43) | 0.13 (0.00; 0.25)* |
| Model 2 | 0.23 (0.14; 0.32)** | 0.74 (0.54; 1.01) | 0.11 (-0.31; 0.52) | 0.13 (0.01; 0.26)* |
| Model 3 | 0.24 (0.15; 0.33)** | 0.75 (0.55; 1.03) | 0.15 (-0.27; 0.57) | 0.15 (0.02; 0.27)* |

*p < 0.05, **P < 0.001.
Model 1: Unadjusted model.
Model 2: Adjusted for maternal: age, ethnic background, educational level, and BMI, and household income.
Model 3: Additionally adjusted for maternal psychiatric symptoms.
[a] Values are regression coefficients or odds ratios with 95% CIs from linear or logistic regression analyses. Values can be interpreted as the difference between any type of ED and the reference group (no ED).
[b] Number of cases with a history of eating disorders; n = 453 for maternal diet quality analyses, n = 478 for breastfeeding initiation analyses, n = 330 for breastfeeding duration analyses, and n = 266 for infant diet quality analyses.

Torgersen et al. (2010) did not observe differences in breastfeeding *initiation*, but reported shorter *durations* of breastfeeding among mothers with EDs. The same underlying mechanism (i.e. embarrassment and body dissatisfaction (Patel et al., 2002; Waugh & Bulik, 1999)) could underlie an association of maternal ED history with breastfeeding initiation and duration. Therefore, contrasting findings could be attributed to ED ascertainment. Torgersen et al. (2010) defined the presence of an ED in the six months prior to pregnancy and during pregnancy, which may imply that these women had more active and severe psychopathology than the women with a *lifetime* history of EDs in our study. Indeed, they found stronger associations for women with AN than in women with ED not otherwise specified (Torgersen et al., 2010), who may have less severe ED psychopathology (Arcelus, Mitchell, Wales, & Nielsen, 2011). Alternatively, since Torgersen et al. did not observe an association between maternal history of BN and breastfeeding, the associations may be ED-specific. In our study, we did not distinguish between AN and BN because the proposed mechanisms, which were body shame, dissatisfaction, embarrassment, and high body awareness, are characteristics of both AN and BN (American Psychiatric Association, 1994; American Psychiatric Association, 2013), and because we did not have enough power to distinguish subtypes of EDs.

Although infants of mothers with a history of EDs seemed to be breastfed somewhat less than infants of mothers without a history of EDs, they had a higher diet quality around the age of 1 year. This seems contrary to previous findings, reporting that children who were breastfed, had a higher diet quality (Voortman et al., 2015). However, this may be different for children of mothers with a history of EDs. These mothers often have a negative self-image (American Psychiatric Association, 1994; American Psychiatric Association, 2013), and may therefore not feel comfortable about breastfeeding (Waugh & Bulik, 1999). Previous studies reported that well-functioning breastfeeding requires confidence and belief in the capacity of one's body (Arora, McJunkin, Wehrer, & Kuhn, 2000; Brown, Rance, & Warren, 2015). Moreover, in the general population, women with higher body image concerns were less likely to initiate breastfeeding and more likely to breastfeed for a shorter period (Brown et al., 2015). However, because of a higher awareness of food (Mazzeo et al., 2005), mothers with a history of EDs may have the desire to provide their children with healthy food and limit unhealthy or high-fat foods, which is reflected by the higher overall diet quality score.

Several explanations might account for our findings of the higher diet qualities in pregnant women with a history of EDs and their infants. Some studies suggested that women with EDs may have more nutritional knowledge, especially with regard to the caloric content of food (Ho et al., 2011; Laessle et al., 1988), or that women who recovered from an ED had a higher preference for foods with health benefits (Dellava, Hamer, Kanodia, Reyes-Rodríguez, & Bulik, 2011). Thus, mothers with a history of EDs may be more keen and knowledgeable on providing themselves and their children a healthy diet. Alternatively, our findings may be attributed to ongoing or recurrent ED symptoms. Previous studies have reported that ED symptoms tend to improve during pregnancy, but worsen postpartum (Blais et al., 2000; Crow, Agras, Crosby, Halmi, & Mitchell, 2008). However, other studies reported that ED symptoms may still be present during pregnancy (Micali, Treasure, & Simonoff, 2007) and that women with an ED tend to worry more about weight gain during pregnancy (Swann et al., 2009). To prevent further weight gain, they may therefore choose healthier food products with low calories, thereby scoring higher on our quality score. Since reoccurrence of ED symptoms may be present in the postpartum period (Crow et al., 2008), concerns about body weight and shape may not only apply to women themselves, but also to their infants. We previously found that children of mothers with a history of EDs or children with a higher diet quality did not have a lower BMI at the age of 6 years (Voortman et al., 2016; de Barse et al., 2015). However, several studies indicated that mothers with a history of EDs tend to worry about their children's diet (Agras et al., 1999; Sadeh-Sharvit et al., 2015), and weight (Wentz, Gillberg, Anckarsäter, Gillberg, & Råstam, 2009), which may explain the higher infant diet quality.

### 5.1. Strengths and limitations

This study is one of the first that has examined the associations between a mother's history of EDs and diet quality during pregnancy as well as offspring's diet quality in early childhood. The strengths of this study are its population-based, longitudinal design, the repeated measurements of breastfeeding practices, and availability of several covariates, including maternal psychiatric symptoms allowing us to distinguish between EDs and psychiatric problems in general. Another strength is the use of a predefined approach to measure overall diet. An advantage of a predefined approach over a data-driven approach is that predefined diet scores are based on dietary guidelines (Kant, 1996; Ocké, 2013), which may therefore better reflect a healthy diet.

Despite these strengths, several limitations should be considered. First, maternal history of EDs was self-reported, which might have resulted in reporter bias. However, substantial overlap between self-reported lifetime ED and clinical diagnosis in a small subsample of the Generation R Study has been shown previously (Micali, De Stavola et al., 2012). Second, a general limitation of FFQs

to measure dietary intake is that they rely on memory and reported intakes are subject to measurement errors (Kipnis et al., 2003). Moreover, both exposure and outcomes were reported by the same informant (i.e. the mother), which could have led to common method variance bias (Siemsen, Roth, & Oliveira, 2010). Given the possible preoccupation with diet (Hoffman et al., 2014), mothers with a history of EDs may have underreported energy-dense, unhealthy food items, because of embarrassment. If so, the association of maternal history of EDs with a higher diet quality may reflect an overestimation. Alternatively, mothers with a history of EDs may have over-reported unhealthy food items, because of a higher awareness of eating high calorie food, resulting in an underestimation of our findings. Even though Whelan and Cooper (2000) provided evidence that women with EDs are capable of reporting reliably on their children's eating behavior, future research should use additional informants of both mothers' and children's food intake. Another limitation is that our FFQs were developed to measure a Dutch diet and that the diet quality scores were partly based on Dutch dietary guidelines, whereas women and children with different ethnic backgrounds, such as Surinamese, Turkish, and Moroccan, were included in our study population. Thus, some caution is needed with regard to the diet quality scores of participants with another ethnic background. However, in our sensitivity analyses restricted to participants with a Dutch ethnic background only, similar results were found, suggesting no large bias due to ethnic background.

## 6. Conclusion

Mothers with a history of EDs and their infants had a higher diet quality, independent of psychiatric symptoms, suggesting that our findings are specific for EDs. Although our finding of a lower tendency to initiate breastfeeding among mothers with a history of EDs needs further evaluation, our results suggest that women with a history of EDs and their infants have a relatively good diet quality. However, further research is needed to examine whether these children remain to eat healthier when they start making their own food choices. Further research in which children are followed as they grow older is needed in order to assess long-term associations, preferably with more objectively measured data on EDs as well as on dietary intake.

## Competing interests/funding sources

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## Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.appet.2016.11.030.

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