

The role of parental depression during early childhood obesity treatment—Secondary findings from a randomized controlled trial

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Summary

Background: Parental depression is a risk factor for childhood obesity.

Objectives: To examine the influence of parental depression on child weight status, eating behaviours, and parental feeding practices during childhood obesity treatment.

Methods: Hundred and twenty eight children with obesity aged 4 to 6 years and their parents were randomized to a parent support program or to standard treatment. At baseline and after 12 months, children's heights and weights were measured. Parents reported levels of depression (Beck's Depression Inventory-II), feeding practices (Child Feeding Questionnaire), and children's eating behaviors (Child Eating Behavior Questionnaire). Independent and dependent paired sample t-tests and linear regressions were used to analyze data.

Results: After obesity treatment, mothers reported lower levels of depression, whereas fathers did not. No associations were found between parental level of depression and child weight status, or between baseline level of parental depression and feeding practices. Associations were found between baseline parental depression and children's food responsiveness ($\beta = .03$; $P = .01$; 95% CI [0.01, 0.05]), emotional overeating ($\beta = .02$; $P = .02$; 95% CI [0.004, 0.04]), and desire to drink ($\beta = .02$; $P = .03$; 95% CI [0.002, 0.04]) (adjusted for background variables).

Conclusions: Parental depression did not influence child weight status or parental feeding practices but was associated with obesity-related child eating behaviors.

KEYWORDS

child eating behaviors, fathers, mothers, parenting feeding practices, preschoolers

1 | INTRODUCTION

Understanding how parental depression affects child feeding and eating behaviors is essential for the development of effective child

obesity treatments. Indeed, parental depression is one of the emerging risk factors consistently associated with child obesity.¹⁻³ Maternal depressive symptoms including distress, depressed mood, and loss of interest and enjoyment have been linked to reduced levels of effective parenting practices, such as involvement in food choice guidance, as well as the adoption of less-responsive feeding styles.⁴⁻⁶ Therefore,

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maternal depressive symptoms and subsequent parenting practices may lead to feeding behaviors associated with higher risk for child obesity.^{1,7,8} A cross sectional study showed that mothers with elevated depressive symptoms reported more pressure to eat, more overall demandingness, and lower authority while feeding their child.⁹ Moreover, these mothers were less likely to eat with their children.

Few studies have examined the direct and indirect influence of depression—for instance, through child eating behaviors and parental feeding practices—on obesity treatment early in life. This is important as depression is common among mothers of young children.⁵ In Sweden, approximately 7% of children in the early preschool age have a parent suffering from a mental health problem.¹⁰ The few studies that have examined this found that parental depression may influence child eating behaviors in early childhood. A pilot study in Switzerland on psychosocial pathways to childhood obesity in preschoolers found that mothers who had more depressive symptoms showed higher rates of less effective parenting practices, such as being more authoritarian or permissive.⁴ These parenting practices predicted higher child impulsivity ratings, which were linked to eating behaviors associated with higher body mass index (BMI) such as enjoyment of food, food responsiveness, emotional overeating, and desire to drink.¹¹ Similarly, a population-based study in the Netherlands found that internalizing problems among both mothers and fathers—including symptoms of anxiety and depression—were prospectively associated with fussy eating in preschool aged children.¹² Another cohort study in Australia found that poor maternal health as well as maternal depression and anxiety independently contributed to irregular eating in children age 2 to 4 years.¹³ Nevertheless, it is not entirely clear how depressed parents' feeding practices influence children's weight and risk for obesity.¹

This study aimed to understand the relationship between parental depression and early childhood obesity treatment outcomes. To address the gap in research concerning the influence of fathers' depression on child obesity,¹⁴ this study analysed separately the roles of mothers' and fathers' depression in relation to child weight status, parental feeding practices, and child eating behaviours. The analysis focused on parental depression during early childhood obesity treatment, using data from the randomized controlled trial, the More and Less (ML) study.^{15,16} The specific research questions were:

- Is there a difference in the level of parental depression in the total sample or between treatment groups after 12 months?
- Is parental depression associated with child weight status?
- Are there any associations between level of parental depression and child eating behaviours measured by the Child Eating Behaviour Questionnaire (CEBQ) at baseline?
- Are there any associations between level of parental depression and parental feeding practices measured by the Child Feeding Questionnaire (CFQ) at baseline?

We hypothesized that the level of parental depression would improve after 12 months of treatment, for both the intervention and the control group, with greater improvement in the intervention

group.¹⁶ We also expected children whose parents reported higher levels of depression to have a higher weight status at baseline and show a smaller improvement in weight status after 12 months. We assumed that greater reductions in parental depression would predict greater improvements in child weight status from baseline to 12 months post-obesity treatment. Finally, we hypothesized that higher baseline levels of parental depression would be associated with obesity-related child eating and parental feeding behaviors. In previous analyses of the ML study, no significant changes in feeding practices or child eating behaviors were found after treatment.^{17,18} Thus, in this study, only baseline reports of feeding and eating behaviors were used to analyze the associations with parental depression.

2 | METHODS

2.1 | Study design and participants

This study presents an analysis of secondary data from the ML study that took place between 2011 and 2017 at the Karolinska Institutet, Stockholm, Sweden.¹⁵ The primary outcomes of the study have been reported elsewhere.¹⁶ The study was approved by the ethics committee in Stockholm, Sweden (dnr: 2011/1329-31/4) on November 16th, 2011. The protocol for the study was registered with the Clinical Trials Registry, clinicaltrials.gov on February 14, 2013, (ID: NCT01792531). The main objective of the ML study was to examine the effectiveness of two early treatment approaches for preschoolers with obesity over 12 months: a newly developed parent support program (with and without additional booster sessions) and standard treatment (primary outcome: change in child weight status). The booster sessions consisted of 30-minute phone calls every 4 to 6 weeks. Families in the group without booster sessions had no further contact with the study team, except for the 6-month and 12-month post baseline weight and height measurements that were offered to all participants. The 10-week program focused on positive parenting practices—such as encouragement and limit setting strategies—to enhance parent-child communication and thus facilitate a healthy lifestyle. The weekly program sessions (1.5 hours/week) were delivered by specially trained dietitians and attended by parents only. The program was compared to standard treatment (on average 5.5 visits in one year) provided in an outpatient pediatric clinic and delivered mainly by pediatric nurses and pediatricians. The standard treatment focused on healthy food choices and active lifestyle habits. Both the parent and the child attended standard treatment. In both the parent support program and standard treatment, no specific guidance or instructions that may have influenced the parent's mental health or depression levels were given. However, the parent support program included stress management techniques and strategies to reduce everyday conflicts between parents and children. The participating families were mainly referred from primary childcare centres between March 2012 and March 2016. The inclusion criteria were:

- The child was between 4 to 6 years old at the start of the study.
- The child was diagnosed with obesity according to international cut-offs for BMI in children.^{19,20}
- The child had no other chronic diseases or developmental problems affecting her/his weight.
- The parent could communicate in Swedish.

2.2 | Measurements

2.2.1 | Weight status and socioeconomic background

All children were measured by trained health care personnel at baseline and after 12 months. Height was rounded to the nearest 0.1 cm and weight was rounded to the nearest 0.1 kg. Children were measured wearing light clothing. All measurements were repeated three times, and mean values were derived to calculate the child's BMI z-score using age- and sex-specific reference data.¹⁹

Sociodemographic data were collected at baseline. Data included the child's sex and age and the parent's sex, age, weight and height (BMI), education level, occupational status, income level, number of years living in Sweden, and foreign origin.

2.2.2 | Parental depression

The *Beck's Depression Inventory-II (BDI-II)* was filled out by both parents at baseline and 12 months post-baseline. The BDI is one of the most extensively used self-report measures of depression in research and clinical practice. The English version of the BDI-II has been translated into 17 languages and has been validated in countries around Europe, the Middle East, Asia, and Latin America.^{21,22} The BDI-II has high internal consistency and validity.²³ In the Scandinavian context, the BDI-II has proven to be an acceptable screening instrument for major depressive episodes in the general population²⁴ as well as in patient and student populations.²¹ The BDI-II assesses psychological and somatic manifestations of 2-week major depressive episodes, as operationalized in the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV).²⁵ The different response options within each symptom category in the BDI-II are arranged according to a 4° severity scale ranging from 0 to 3. The symptom categories are: (1) mood, (2) pessimism, (3) feeling of failure, (4) lack of satisfaction, (5) guilt, (6) punishment, (7) self-loathing (8) self-reproach (9) suicidal thoughts, (10) crying, (11) irritability, (12) social withdrawal, (13) indecisiveness, (14) altered body perception, (15) difficulty to work, (16) insomnia, (17) fatigue, (18) loss of appetite, (19) weight loss, (20) concern for health, and (21) loss of sexual interest. The total score of the BDI-II is calculated by summing the estimates on the 21 items—the minimum score is 0 and the maximum 63—with higher scores indicating higher levels of depression. This study used the recommended standardized cut-off points: (0-13) minimal, (14-19) mild, (20-28) moderate, and (29-63) severe.

2.2.3 | Parental feeding practices and child eating behavior

The *Child Feeding Questionnaire (CFQ)* is a well-recognized psychometric instrument that has been globally employed to assess parental concerns, feeding attitudes, beliefs, and practices associated with child obesity development.²⁶ The CFQ was used to assess parents' feeding practices and includes the following subscales:

- Restriction (8 items), which evaluates parents' restriction of their child's access to foods.
- Pressure to eat (4 items), which evaluates parents' tendency to pressure their children to eat more food.
- Monitoring (3 items), which assesses the extent to which parents supervise their child's eating.

At baseline, both parents responded to each item on a 1 to 5 Likert scale (1 = never, 2 = rarely, 3 = sometimes, 4 = often, 5 = always). Two items concerning the use of food as a reward were excluded from the Swedish version of the CFQ, after validation of the instrument in a population-based study involving parents of preschoolers.²⁷ The mean scores for each item and subscale of the CFQ were then calculated and used in the analyses.

The *Child Eating Behavior Questionnaire (CEBQ)* is the most common instrument to evaluate child eating behaviors associated with the development of obesity.²⁸ The CEBQ includes a list of 35 statements that describe children's appetite, grouping the answers in two dimensions: food approach and food avoidance.²⁹ The food approach dimension is composed by the factors:

- Food responsiveness (5 items), which assesses the child's desire to eat and appetite.
- Enjoyment of food (4 items), which assesses how much the child likes eating.
- Desire to drink (3 items), which assesses how often the child asks for drinks.
- Emotional overeating (4 items), which assesses if the child eats more in response to their feelings.

The food avoidance dimension includes:

- Satiety responsiveness (4 items), which assesses how easily the child stops eating or feels full.
- Food fussiness (6 items), which assesses the child's food avoidance.
- Emotional undereating (4 items), which assesses if the child eats less due to their feelings.
- Slowness in eating (4 items), which assesses how much time the child spends eating a meal.

In this study, the Swedish version validated with families of preschoolers was used.³⁰ This questionnaire was filled out by one of the parents and each behavior was rated on a 1 to 5 Likert scale (1 = never,

2 = rarely, 3 = sometimes, 4 = often, 5 = always). Mean scores were then calculated for each factor (from items).

2.3 | Statistical analysis

To compare parental level of depression at baseline and after 12 months for the total sample, the mean total scores of the BDI-II were calculated for each time point and used in dependent paired sample *t*-tests. A mean change variable in parental depression after 12 months was calculated by subtracting baseline values from 12-month values for both mothers' and fathers' total BDI-II scores (ie, negative values of BDI-II change indicating decreases in BDI-II after 12 months). This variable was used to compare the difference in mean change in parental depression between groups using independent sample *t*-test. Independent samples *t*-tests were also used to compare baseline covariates between ML participants with and without reported baseline BDI-II. Chi-square tests were used for categorical variables.

A variable for mean change in child weight status (BMI *z*-score) after 12 months was also calculated by subtracting baseline values from 12-month values and used in linear regression models to assess associations with mean change in parental depression.

To examine the role of parental depression in child weight status (BMI *z*-score), parental feeding practices, and child eating behaviors, linear regression models analyzed the association between baseline level of parental depression and

- i. baseline BMI *z*-scores,
- ii. change in child BMI *z*-scores after 12 months,
- iii. child eating behaviors and,
- iv. parental feeding practices.

An additional linear regression model analyzed the association between change in level of parental depression and change in child BMI *z*-score after 12 months.

All models were adjusted for the following background characteristics: child's age and sex, parental education level, and parental foreign origin. Education was defined as either having or not having a university degree. Foreign origin was specified as the parent having two parents born abroad, regardless of their own country of birth. Model *iii* was also adjusted for parental sex as the CEBQ was only filled out by one of the parents. IBM SPSS Statistics, Version 25.0 was used to conduct all statistical analysis, and a level of $P < .05$ was set to determine significance.

3 | RESULTS

The total sample characteristics are presented in Table 1. Just over half of the children were girls, and the children's average age was 5.3 years old (SD 0.8) with a BMI *z*-score of 3.0 (SD 0.6). More than half of the parents were of foreign origin (mothers: 56.3%, fathers: 51.4%) and less than half had a university degree (mothers: 45.8%,

fathers: 43.9%). The only significant difference in background characteristics between treatment groups was for child's sex ($P = .03$) with more girls (67.7%) allocated to the standard treatment. Baseline covariates between the families with and without BDI-II reports (due to not returning the questionnaire) differed regarding mother's foreign origin ($P = .04$) and university degree ($P = .01$).

Most parents had a minimal level of depression at baseline (see Table 2). Mothers had higher baseline values than fathers. Compared to fathers, more mothers had moderate or severe depression at baseline.

3.1 | Level of parental depression after treatment

The results showed a significant mean decrease in mothers' BDI-II total score (-1.67 ; $SD = 6.2$; $P = .02$) after 12 months. No significant change was observed among fathers (See Table S1). When comparing the treatment groups, no differences were found in mean change in BDI-II total score after 12 months for mothers ($P = .71$) or fathers ($P = .27$). Additional sensitivity analyses using the BMI percentile 95 (data not shown) did not change the findings, that is, we could not detect an association between parental level of depression and child weight status at baseline or change in weight status during obesity treatment. Mean total scores on the BDI-II, the level of parental depression for the total sample, and the level of parental depression by treatment group are presented in Table 2.

3.2 | Associations between parental depression level and child weight status

No significant associations were found between baseline level of parental depression and child BMI *z*-score at baseline. Similarly, no associations were found between baseline level of parental depression and changes in child BMI *z*-score after 12 months. No associations were found between changes in level of parental depression after 12 months and changes in child BMI *z*-score after 12 months (See Tables S2, S3 and S4).

3.3 | Associations between parental depression and feeding practices

No significant associations were found between baseline levels of parental depression and child feeding practices.

3.4 | Associations between parental depression and child eating behaviors

Parents who reported higher levels of depression were more likely to perceive their children as being responsive to food, as emotional over-eaters, and/or as having higher desire to drink. These positive associations remained significant after adjusting for covariates: food

TABLE 1 Background characteristics of the study sample at baseline

Child	Total sample		Parent treatment		Standard treatment	
	(n = 128)		(n = 66)		(n = 62)	
Boys, % (n)	46.1 (59)		59.1 (39)		32.3 (20)	
Age, years, mean (SD)	5.3 (0.8)		5.2 (0.8)		5.3 (0.7)	
BMI z-score, mean (SD)	3.0 (0.6)		3.0 (0.7)		2.9 (0.6)	
Parent	Mothers (n = 120)	Fathers (n = 108)	Mothers (n = 63)	Fathers (n = 54)	Mothers (n = 57)	Fathers (n = 54)
Age, years, mean (SD)	36.7 (5.6)	40.1 (7.3)	37.1 (5.3)	41.0 (8.0)	36.4 (5.8)	39.2 (6.5)
BMI, mean (SD)	28.0 (5.8)	29.7 (4.4)	28.4 (6.1)	29.5 (4.4)	27.5 (5.5)	29.8 (4.4)
Weight status, % (n)						
Normal weight	33.3 (39)	11.4 (12)	33.3 (20)	13.5 (7)	33.3 (19)	9.4 (5)
Overweight	34.2 (40)	47.6 (50)	33.3 (20)	50.0 (26)	35.1 (20)	45.3 (24)
Obesity	32.5 (38)	41.0 (43)	33.3 (20)	36.5 (19)	31.6 (18)	45.3 (24)
Foreign origin*, % (n)	56.3 (67)	51.4 (55)	58.1 (36)	52.8 (28)	54.4 (31)	50.0 (27)
No. years in Sweden, mean (SD)*	19.7 (10.8)	19.9 (12.2)	19.2 (10.3)	20.2 (13.4)	20.2 (11.5)	17.6 (11.1)
University degree, % (n)	45.8 (54)	43.9 (47)	44.3 (27)	43.4 (23)	47.4 (27)	44.4 (24)
Occupational status, % (n)						
Full time	37.8 (45)	83.0 (88)	43.5 (27)	78.8 (41)	31.6 (18)	87.0 (47)
Part-time	30.3 (36)	12.3 (13)	25.8 (16)	15.4 (8)	35.1 (20)	9.3 (5)
Parental leave	10.9 (13)	0.8 (0.9)	9.7 (6)	0.0 (0)	12.3 (7)	1.9 (1)
Unempl./sick/student	21.0 (25)	3.7 (4)	21.0 (13)	5.7 (3)	21.0 (12)	1.9 (1)
Income level SEK/month, % (n)						
<20 000	60.8 (73)	33.3 (36)	52.4 (33)	33.3 (18)	70.2 (40)	33.3 (18)
20 000 - <30 000	28.3 (34)	46.3 (50)	31.7 (20)	40.7 (22)	24.6 (14)	51.9 (28)
>30 000	10.8 (13)	20.4 (22)	15.9 (10)	25.9 (14)	5.3 (3)	14.8 (8)

Note: Parents weight categories according to the World Health Organization's BMI cut-off criteria (Normal weight BMI = 18.5-24.9; Overweight BMI \geq 25.0; Obesity BMI \geq 30.0). *n* does not always add up due to occasional missing values. Out of the total *n* = 177 families who participated in the ML study, *n* = 3 (1.7%) were excluded post randomization due to a diagnosis that affected the child's physical development; of the remaining *n* = 174 families, *n* = 45 (25.9%) did not complete the BDI-II at baseline and were excluded from the analysis.* Foreign origin was defined as not Swedish born or born in Sweden with both parents born abroad.**number of years in Sweden for parents having migrated to Sweden (mothers: total sample *n* = 47, standard treatment *n* = 22, parent treatment *n* = 25; fathers: total sample *n* = 36, standard treatment *n* = 18, parent treatment *n* = 18).

Abbreviations: BMI, body mass index; SEK, Swedish kronor (mean monthly income level in 2015: 33 600 SEK [men], 26 400 SEK [women]); N: number of parents or children.

responsiveness ($\beta = .03$; $P = .01$; 95% CI [0.01, 0.05]), emotional overeating ($\beta = .02$; $P = .02$; 95% CI [0.004, 0.04]), and desire to drink ($\beta = .02$; $P = .03$; 95% CI [0.002, 0.04]) (see Table 3). When conducting the linear regressions separately for mothers and fathers (unadjusted), significant associations were found only for mothers between levels of depression and child eating behavior (data not shown). However, parental sex could not explain the associations in the adjusted models.

Mean scores and SDs on the CFQ and CEBQ for the total sample, parent treatment group, and standard treatment group are presented in Table S5.

4 | DISCUSSION

This study is one of the first to examine how mothers' and fathers' levels of depression relate to childhood obesity treatment outcomes.

Analysing data collected as part of the RCT, the ML study, we found that levels of depression decreased significantly for mothers, but not for fathers, after obesity treatment. When comparing the treatment groups (parent program vs standard treatment), no difference was found in the levels of depression in mothers or fathers after treatment. No associations were found between parental depression level and child weight status at any point, and between the baseline level of parental depression and baseline parental feeding practices. However, associations were found between parental level of depression and child eating behaviors; parents who reported higher levels of depression were more likely to consider their child as being responsive to food, as an emotional overeater, and/or as consuming beverages more frequently. The results were consistent after adjusting for child's age and sex, parental education level, and parental foreign origin.

The level of depression after treatment decreased among mothers, with no difference between the treatment groups. Similar

TABLE 2 Mean total scores on the Beck's Depression Inventory-II (BDI-II) and level of parental depression, for the total sample and by treatment group, at baseline and after 12 months

	Total sample		Parent treatment group		Standard treatment group	
	Baseline	12 months	Baseline	12 months	Baseline	12 months
Mother	<i>n</i> = 119	<i>n</i> = 85	<i>n</i> = 62	<i>n</i> = 48	<i>n</i> = 57	<i>n</i> = 40
Total Score, mean (SD)	8.6 (9.3)	7.1 (7.0)	8.9 (10.1)	7.6 (7.1)	8.2 (8.5)	6.5 (6.9)
Minimal, % (n)	78.2 (93)	83.5 (71)	41.2 (49)	42.4 (36)	37.0 (44)	41.2 (35)
Mild, % (n)	10.1 (12)	9.4 (8)	4.2 (5)	5.9 (5)	5.9 (7)	3.5 (3)
Moderate, % (n)	5.9 (7)	4.7 (4)	3.4 (4)	3.5 (3)	2.5 (3)	1.2 (1)
Severe, % (n)	5.9 (7)	2.4 (2)	3.4 (4)	1.2 (1)	2.5 (3)	1.2 (1)
Father	<i>n</i> = 108	<i>n</i> = 74	<i>n</i> = 54	<i>n</i> = 38	<i>n</i> = 54	<i>n</i> = 36
Total score, mean (SD)	4.5 (5.3)	5.0 (7.5)	4.1 (4.5)	3.8 (4.1)	4.8 (6.0)	6.3 (9.8)
Minimal, % (n)	91.7 (99)	89.2 (66)	46.3 (50)	48.6 (36)	45.4 (49)	40.5 (30)
Mild, % (n)	6.5 (7)	4.1 (3)	3.7 (4)	2.7 (2)	2.8 (3)	1.4 (1)
Moderate, % (n)	1.9 (2)	2.7 (2)	0.0 (0)	0.0 (0)	1.9 (2)	2.7 (2)
Severe, % (n)	0.0 (0)	4.1 (3)	0.0 (0)	0.0 (0)	0.0 (0)	4.1 (3)

Note: The standardized cut-off points used to categorize the BDI-II total scores of the parents were: (0–13) minimal, (14–19) mild, (20–28) moderate, and (29–63) severe (Beck et al., 2005).

CEBQ at baseline	<i>n</i>	P-value	β	95% CI	
			(unstandardized)	Lower	Upper
Unadjusted					
Food responsiveness	120	.007	0.03	0.01	0.05
Emotional overeating	120	.005	0.02	0.01	0.04
Enjoyment of food	121	.748	0.00	–0.01	0.02
Desire to drink	121	.049	0.02	0.00	0.04
Satiety responsiveness	119	.440	–0.01	–0.02	0.01
Slowness in eating	121	.749	0.00	–0.02	0.02
Emotional undereating	120	.468	0.01	–0.01	0.02
Food fussiness	120	.058	0.02	0.00	0.03
Adjusted					
Food responsiveness	119	.01	0.03	0.01	0.05
Emotional overeating	119	.02	0.02	0.004	0.04
Enjoyment of food	120	.99	0.00	–0.02	0.02
Desire to drink	120	.03	0.02	0.002	0.04
Satiety responsiveness	118	.38	–0.01	–0.02	0.01
Slowness in eating	120	.61	0.00	–0.01	0.02
Emotional undereating	119	.49	0.01	–0.01	0.02
Food fussiness	119	.05	0.02	0.00	0.03

Note: Linear regression analysis was adjusted for child age, child sex, parent sex, parent foreign background, and parent university degree. Significant results are in bold ($p < .05$).

Abbreviations: CI: confidence interval; CEBQ, child eating behavior questionnaire; *n*: number of parents.

TABLE 3 Effects from the linear regression analysis (unadjusted and adjusted) of the association between the baseline level of parental depression measured by the BDI-II and child eating behavior measured by CEBQ at baseline

findings were observed in a study from Switzerland, where two cognitive behavioral therapies for childhood obesity treatment were compared (mother-only vs mother and child groups), and where both treatments led to reduction in maternal depression.³ The lack of a similar reduction in fathers' levels of depression may reflect both the

lower levels of baseline depression reported by fathers, and the possibility that mothers and fathers react differently to aspects of childhood obesity treatment, as we have found in previous analyses.¹⁸ When examining associations between changes in parental feeding practices and changes in child food intake over 12 months of follow-

up, we found differences between mothers' and fathers' use of restriction, pressure to eat and monitoring that were associated with certain food groups.¹⁸

Contrary to what we hypothesized, we did not find any associations between parental depression level and child weight status. These results are aligned with several previous studies that have reported no direct association between maternal depressive symptoms and child BMI z-score.^{1,14,31-33} However, these studies, like ours, also included a small sample with few mothers reporting severe levels of depression. Of note, a systematic review on maternal depression and obesity in children found positive associations only for chronic depression, but not for episodic depression.² Since the updated BDI-II captures episodic depression with a 2-week period of major depressive episodes, it is possible that our study did not capture chronic depression.²² By contrast, an earlier systematic review found positive correlations between maternal depression and child obesity in 15 out of 19 studies.¹ Many of the studies included in this review reported higher prevalence of severe maternal depressive symptomatology. This suggests the studies might have captured a larger number of cases of chronic depression, which likely influenced the results. Notably, all extant studies have not examined the relationship between fathers' levels of depression and child weight outcomes. We found low depression levels in fathers, and these remained stable over the course of the study, with no associations observed between fathers' depression levels and child weight, eating behaviors or feeding practices. We did observe three cases of severe depression in fathers after one year's treatment, compared to none at baseline, all in the standard treatment group; additionally, the level of moderate depression reported by fathers remained the same throughout the study. Due to the small sample size, these results should be interpreted cautiously. However, since mothers' level of depression decreased during the same period, and since mothers attended childhood obesity treatment sessions more frequently than fathers, the results may suggest that we need to find ways to involve fathers in treatment to a greater extent.

As expected, higher levels of parental depression at baseline were associated with parents reporting child eating behaviors that do not support healthy weight development. Specifically, parents who reported higher levels of depression were more likely to consider their child as being more responsive to food, as an emotional overeater, and as having a higher desire to drink. All three eating behaviors are included in the food approach dimension of the CEBQ, which is associated with a higher weight status in children.¹¹ Our findings are in line with previous research regarding associations between parental depression and eating behaviors in children. In one study, mothers with depressive symptoms showed higher rates of less effective parenting practices, which in turn predicted higher child impulsivity ratings associated with higher food approach scores.⁴ Similarly, early maternal depressive symptoms have been linked to child food responsiveness, predicting a heavier child weight.³² A cross-sectional study found that parental stress was associated with children's food responsiveness, although it did not identify similar associations for parental depression.³⁴ Moreover, our results are in agreement with a previous

study that found that maternal negative affect—including depression, anxiety, and stress—was associated with maternal emotional eating, which in turn was related to child emotional eating.³⁵ One possible explanation for these associations, according to the authors of the study, is that emotional eating is a learned behavior that develops over time and may come to replace the instinctive response to hunger and satiety cues.³⁵ Similarly, it has been observed that mothers with symptoms of depression may struggle to model a healthy relationship with food and eating.³⁶ Thus, if a mother who is coping with depression also experiences emotional overeating, her child might learn this behavior over time. This can also be a possible explanation for the positive association between parental depression and reports of children's desire to drink.

4.1 | Strengths and limitations

The study had some limitations. Except for children's weight and height, the data used for the analyses of this study were parent-reported. Additionally, the small sample size reduced the analysis' statistical power. Since the power calculation was based on the ML study's primary outcome—BMI z-score—the treatment groups were large enough to evaluate the primary outcome, but not all secondary outcomes. The statistical power could also have been affected by missing data, as some parents did not complete BDI-II at both time points. Furthermore, as only one parent in each family answered the CEBQ questionnaire, these responses overrepresented mothers (with 105 mothers and 22 fathers responding). Still, a strength of this study was that it also includes reports from fathers, which contributes to the under-researched area of paternal depression and the role of fathers in childhood obesity development. So far, most of the research regarding parental depression has centered on mothers.^{2,5} As fathers may also experience psychological problems or counterproductive coping strategies when raising a child with obesity, they could play a significant role in the management of their child's weight and eating.¹⁴ Another notable strength of this study was the use of high-quality questionnaires validated in the Swedish context.

4.2 | Future research

Our findings convey the importance of including fathers in childhood obesity treatment studies, as well as measuring parental depression at multiple time points and over a longer time. Future research should also include measures that assess both episodic and chronic depression, to understand how both depression types influence parenting practices and child eating behaviors. Lastly, whilst this study did not find associations between parental depression and parental feeding practices, previous studies have found both positive^{9,12} and negative associations.³⁷ Hence, future studies should continue to examine associations between parental depression and feeding practices and how they may influence child weight outcomes.

4.3 | Conclusions

This study is one of the few to examine the role of mothers' and fathers' depression in relation to parental feeding behaviors, child eating behaviors, and childhood obesity treatment outcomes. The study found no significant associations between parental depression levels and child weight status, and between parental depression levels and parental feeding practices. However, associations were identified between the baseline level of parental depression and certain child eating behaviours. Specifically, parents who reported higher levels of depression were more likely to report that their child engaged in obesity-related behaviors: food responsiveness, emotional overeating, and desire to drink. These findings suggest that childhood obesity treatment should attend to parents' mental wellbeing, and thereby provide parents with the support they need to manage their children's weights successfully. Among other measures, it may be helpful to offer parents routine screening for depressive symptoms prior to childhood obesity treatment, and to refer parents to counseling for depression, if needed.

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CONFLICT OF INTEREST

The authors declare no potential conflict of interest.

AUTHORS CONTRIBUTIONS

P.N. conceived the idea of this study in collaboration with A.E. MY.V-B. drafted the paper together with A.E., P.N. and K.E. MY.V-B. conducted the main analyses. P.N. was responsible for the data collection and critically reviewed all analyses together with P.S., M.S., A.E., and MY.V-B. All authors made substantial contributions to conception and design, data collection, and to interpretation of the data. All authors contributed to reviewing and approving the final manuscript.

ETHICS STATEMENT

The study was approved by the ethics committee in Stockholm, Sweden (dnr: 2011/1329-31/4) on November 16th, 2011.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

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