




## Feeding practices and concerns as mediators between maternal mental health and eating behaviours in early childhood

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### ABSTRACT

**Background:** The impact of maternal mental health on child eating beyond infancy is understudied. This study explores whether maternal feeding practices and concerns mediate the association between maternal depression and anxiety symptoms and eating behaviours at age three years.

**Methods:** Data from 409 mother-child dyads in the Growing Up in Singapore Towards healthy Outcomes cohort were analysed. Maternal mental health was assessed using the Beck Depression Inventory-II and State-Trait Anxiety Inventory, feeding practices and concerns with the Preschooler Feeding Questionnaire, and child eating behaviours with the Children's Eating Behaviour Questionnaire. Structural equation modelling was used to test pathways.

**Results:** Depression symptoms in mothers showed direct and indirect links to child eating behaviours. For example, maternal depression symptoms were directly associated with enjoyment of food ( $B = 0.011, p = 0.015$ ) and indirectly with food responsiveness ( $B = 0.004, p = 0.034$ ) via use of food to calm the child. Anxiety symptoms, however, had only indirect associations with child eating behaviours through maternal feeding concerns, not practices. For example, maternal anxiety symptoms were indirectly linked with food responsiveness through perceived difficulty in feeding ( $B = -0.001, p = 0.011$ ).

**Conclusions:** Depression and anxiety symptoms influence children's eating behaviours differently. Anxiety symptoms were linked with child eating behaviours only through maternal feeding concerns, whereas depression symptoms were linked with child eating behaviours both directly and indirectly via feeding to calm the child. As maternal anxiety symptoms are linked with more child eating concerns, the validity of mother-reported child eating behaviours requires consideration.

### 1. Introduction

Approximately 13 % of mothers who have recently given birth live

with a mental health disorder, most commonly depressive and anxiety disorders (WHO, 2025). The prevalence of reported postpartum depression and anxiety varies across countries, influenced by

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sociocultural and economic factors (Halbreich & Karkun, 2006; Hong & Buntup, 2023). Poor mental health may start before conception or in early pregnancy and last up to two years after childbirth, highlighting the chronicity of maternal mental health over time (El-Heis et al., 2024; Kee et al., 2023).

Maternal mental health is a significant public health concern due to its established downstream effects on child health, growth, and development (Meaney, 2018; Mudiyansele et al., 2024). Depression and anxiety in mothers have been associated with perinatal health and health-related behaviours (Dias & Figueiredo, 2015; Farias et al., 2021; Goodwin et al., 2017; Jang et al., 2025; Qiu et al., 2009; Shuffrey et al., 2022) and with adverse outcomes for offspring, including heightened infant anger, passivity and withdrawal (Bernard-Bonnin et al., 2004; Slomian et al., 2019), poorer self-regulation abilities (Wang et al., 2024), reduced cognitive functioning (Power et al., 2021), higher problem internalization (Kurbatfinski et al., 2025), less creative play (Rao et al., 2021), lower IQ scores (Stein et al., 2014), lower academic performance (Mensah & Kiernan, 2010; Pearson et al., 2016), as well as increased risk of life course cardiovascular disease (Doom et al., 2024; Lampard et al., 2014).

Given the established links between maternal mental health and various socioemotional, behavioural, and health outcomes in children, it is plausible that maternal mental health may also influence children's eating behaviours, the observable patterns by which children regulate their food intake based on internal hunger and satiety signals, as well as external cues (Birch & Fisher, 1998; Carnell & Wardle, 2008). Some evidence suggests that mothers experiencing psychological distress may perceive their children to be fussier, hungrier, and more demanding during feeding (Hellin & Waller, 1992). Maternal anxiety during the child's preschool years has also been previously associated with reports of higher food fussiness (de Barse et al., 2016) and with emotional overeating (Hardman et al., 2016). Mothers with anxiety and depressive symptoms may struggle to establish consistent and structured meal-times, leading to irregular eating patterns and less healthy diets in childhood (Helle et al., 2024; Keresztes et al., 2022; McCurdy et al., 2019). Such environments foster the development of suboptimal eating behaviours, including overeating, emotional eating, and a preference for high-calorie, nutrient-poor foods (Keresztes et al., 2022; McCurdy et al., 2019).

One potential mechanism through which maternal mental health may shape children's eating behaviours is through specific feeding practices, the specific strategies used by mothers to encourage or limit food intake (Costa & Oliveira, 2023; Ventura & Birch, 2008), and/or through *feeding concerns*, which are the perceptions and worries about the child's eating and growth. Feeding practices exert a strong influence on children's eating from infancy through adolescence (Birch et al., 2007; Wood et al., 2018). In particular, controlling feeding practices such as pressure, persuasion, or restriction are designed to override children's internal hunger and satiety cues (Birch et al., 2007; Ventura & Birch, 2008), potentially leading to overeating, higher food responsiveness, higher enjoyment of food, tendency to eat in the absence of hunger, as well as food fussiness, low food responsiveness, and reduced enjoyment of food (Costa & Oliveira, 2023; Say et al., 2023). These feeding practices are likely shaped by caregiver mental health (Miller et al., 2018) and, like other parenting behaviours, can mirror the caregiver's emotional state. Mothers experiencing mental health difficulties may show greater hostility or coerciveness toward children or be less engaged during everyday activities (Lovejoy et al., 2000), potentially including feeding (Hurley et al., 2008; Lindsay et al., 2017).

Mothers who struggle with depression or anxiety symptoms are more likely to pressure children to eat (Francis et al., 2001), use incentives to encourage food intake (Goulding et al., 2014; Haycraft et al., 2013; Mitchell et al., 2009), or adopt indulgent styles that allow child autonomy over eating, which can be detrimental (Hurley et al., 2008). Parental pressure has been shown to predict food fussiness (Jansen et al., 2017), while using food as a reward has been linked with emotional

overeating and food fussiness (Jansen et al., 2020). Indulgent styles have been associated with lower fruit intake and higher risk of overweight (Chen et al., 2021; Olvera & Power, 2010; Vollmer & Mobley, 2013).

Mothers facing mental health challenges may also show increased worry about their child's eating habits and become excessively focused or anxious about typical fluctuations in appetite (Brown et al., 2016). Heightened concern over their child's eating can create stressful meal-time dynamics, and is associated with more controlling feeding practices such as pressure to eat (Haycraft, 2020) and reward for eating (Harris et al., 2018). These controlling feeding practices, along with others such as food as a reward and food to soothe, have been previously shown to mediate the relationship between maternal mental health and emotional eating in 2- and 4-year-old children (Rodgers et al., 2014; Sampige et al., 2023).

Few studies have comprehensively explored maternal mental health in relation to a broad range of feeding practices, feeding concerns, and child eating behaviours. The objective of this study was to evaluate the associations between maternal depression and anxiety symptoms, maternal feeding practices and concerns, and eating behaviours in three-year-olds from the Growing Up in Singapore Towards healthy Outcomes (GUSTO) cohort. More specifically, we wanted to examine whether the associations between maternal mental health symptoms and child eating behaviours were mediated by maternal feeding practices and concerns.

## 2. Materials and methods

### 2.1. Participants

Participants of this study were mother-child dyads from the GUSTO parent-offspring cohort study, which recruited pregnant women of Chinese, Indian and Malay ethnicity between 2009 and 2010, described in detail elsewhere (Soh et al., 2014). The study was granted ethics approval from the ethics committees of two study centres, the SingHealth Centralized Institutional Review Board (CIRB 2018/2767 and CIRB 2018/3138) and the National Healthcare Group Domain Specific Review Board (D/2009/021, B/2014/00406 and D/2010/210) in Singapore. Written informed consent was obtained from all participants. This study was also registered and is available online at ClinicalTrials.gov: NCT01174875.

### 2.2. Measures and procedures

#### 2.2.1. Sociodemographic information

Self-reported sociodemographic variables relevant to our research question were obtained from the GUSTO study at recruitment or at the three-year time point. Variables selected a priori as potential confounders included child sex, maternal age, maternal ethnicity, maternal education level, and parity. Prior evidence from the GUSTO cohort shows links between child eating behaviours, child sex, and ethnicity (Fogel et al., 2017a, 2017b). In GUSTO perinatal mental health models, maternal age, ethnicity, education, and parity are routinely considered as covariates, supporting their inclusion as confounders when estimating associations between maternal mental health and child eating behaviours (Teo et al., 2018).

#### 2.2.2. Maternal mental health

Maternal depression and anxiety symptoms at the three-year-old timepoint were measured using the self-reported Beck's Depression Inventory- Second version (BDI-II) and the State-Trait Anxiety Inventory (STAI), respectively.

The BDI-II is a 21-item self-administered survey that consists of two subscales – affective symptoms and somatic symptoms – to measure the presence and intensity of depressive symptoms (Beck et al., 2009; Hubley, 2014). Items are scored on a four-point Likert-type scale from 0 to 3, in increasing order of severity, with the cut-off scores of 0–13 to indicate no/minimal depression, 14–19 to indicate mild depression,

20–28 to indicate moderate depression and 29–63 to indicate severe depression (Kneipp et al., 2010). The BDI-II is extensively used in both adolescent and adult populations and has demonstrated acceptable internal consistency (Cronbach's  $\alpha = 0.73 - 0.95$ ) (Dworkin et al., 2008). In our sample, reliability for the BDI-II was good (Cronbach's  $\alpha = 0.85$ ).

The STAI is a 40-item self-administered survey that consists of two subscales, the 20-item State Anxiety Scale (S-Anxiety) and the 20-item Trait Anxiety Scale (T-Anxiety). Both subscales are scored on a four-point Likert scale from 0 to 3. The S-Anxiety Scale measures the current state of anxiety, while the T-Anxiety Scale measures anxiety proneness, such as general calmness (Julian, 2011). The sum of the 40-item STAI was used in our analyses, with higher scores indicating higher levels of anxiety. Using the total STAI score allows for a general anxiety measure that is easy to interpret and reduces the number of statistical tests compared to analysing state and trait scores separately, thereby reducing the risk of Type I error in our analysis. This instrument has demonstrated construct validity in both clinical and non-clinical populations (Meades & Ayers, 2011). It was also found to be reliable (Chong et al., 2016; Qiu et al., 2013) within the GUSTO cohort. In our sample, STAI-State and STAI-Trait were highly correlated ( $r = 0.81, p < 0.001$ ), consistent with prior psychometric evidence of substantial overlap and higher-order common variance across the two subscales (Bee Seok et al., 2018). This supports the plausibility of a global anxiety factor and aligns with prior studies that have used the total STAI score as a continuous measure of anxiety (Tanaka & Haruno, 2025; Sang et al., 2024). Internal consistency for the 40-item total STAI was excellent (Cronbach's  $\alpha = 0.96$ ). Subscales were likewise high (STAI-State Cronbach's  $\alpha = 0.93$ ; STAI-Trait Cronbach's  $\alpha = 0.92$ ), converging with evidence of robust reliability of the total score within the GUSTO cohort (Chong et al., 2016; Qiu et al., 2013).

### 2.2.3. Maternal feeding practices and feeding concerns

Maternal feeding practices and feeding concerns were assessed using the Preschooler Feeding Questionnaire (PFQ), a 32-item questionnaire (Baughcum et al., 2001). The first 26 questions of the PFQ measure how often mothers engaged in feeding behaviours with their children, scored on a five-point Likert scale from 1 (Never) to 5 (Always). The last 6 questions on the PFQ focused on feeding concerns. These were scored on a four-point Likert scale from 1 (Disagree a lot) to 4 (Agree a lot). The PFQ was completed by mothers when children were three years old. Items on the PFQ were grouped into eight factors. Five of these factors - 3) Pushing the child to eat more; 4) Using food to calm the child; 6) The child's control of feeding interactions; 7) Structure during feeding interactions and 8) Age-inappropriate feeding - focus on specific feeding practices while the other three factors - 1) Difficulty in child feeding; 2) Concern about the child overeating or being overweight and 5) Concern about the child being underweight - are feeding concerns. Higher scores for each factor indicate a higher engagement in the given feeding practice or feeding concern. The PFQ has been validated previously among preschoolers (Baughcum et al., 2001), and in Singapore, it has been used within the GUSTO sample from which our participants were identified. Results show a moderate model fit (RMSEA 0.063; SRMR 0.105; CFI 0.694; TLI 0.649) (Quah et al., 2019). Cronbach's  $\alpha$  was computed for subscales with three or more items, and the inter-item Pearson correlation ( $r$ ) was reported for two-item subscales, as per the original instrument's scoring recommendations (Baughcum et al., 2001). In the present sample, reliability estimates were Difficulty in feeding ( $\alpha = 0.82$ ), Concern about the child overeating or being overweight ( $\alpha = 0.81$ ), Pushing the child to eat more ( $\alpha = 0.61$ ), Using food to calm the child ( $\alpha = 0.68$ ), The child's control of feeding interactions ( $\alpha = 0.45$ ), and structure during feeding interactions ( $\alpha = 0.24$ ); for the two-item subscales, Concern about the child being underweight ( $r = 0.74$ ) and age-inappropriate feeding ( $r = 0.08$ ).

### 2.2.4. Child eating behaviours

Child eating behaviours were measured using the Children's Eating

Behaviours Questionnaire (CEBQ) (Wardle et al., 2001). The CEBQ was completed by parents and consists of 35 items that measures eight dimensions of children's appetitive traits: food responsiveness (FR), enjoyment of food (EF), emotional overeating (EOE), desire to drink (DD), satiety responsiveness (SR), slowness in eating (SE), emotional undereating (EUE), and food fussiness (FF). These eating behaviours are often classified as markers of *food approach* (FR, EF, EOE, DD) and *food avoidance* (SR, SE, EUE, FF) behaviours (Wardle et al., 2001). In this paper, we refer to suboptimal eating behaviours to describe behaviours that may contribute to either insufficient or excessive energy intakes (Birch & Fisher, 1998; Carnell & Wardle, 2008). Each CEBQ subscale is scored on a 5-point Likert scale, with higher scores indicating higher levels of individual eating behaviours (Wardle et al., 2001). The CEBQ was attempted to be validated in Singapore via CFA, but this proved to be a poor fit at ages 3 years and 5–6 years (Quah et al., 2017; Quah et al., 2019). Thus, in the absence of a single, time-invariant local model, the revised structures would limit external comparability. Instead, the original 35-item CEBQ was retained with the canonical 8-subscale scoring to ensure comparability with the international literature. Parents completed the CEBQ at the three-year-old timepoint. Internal consistency in our sample ranged from acceptable to excellent, Cronbach's  $\alpha = 0.76$  (FR); 0.71 (EOE), 0.88 (EF), 0.81 (DD),  $\alpha = 0.71$  (SR),  $\alpha = 0.80$  (SE),  $\alpha = 0.76$  (EUE), and  $\alpha = 0.85$  (FF).

### 2.3. Statistical analysis

GUSTO study recruited 1468 mother-child pairs. This study focused on a sub-population of participants who completed assessments when the children were three years of age. Selection criteria for the analytical sample are described in the participant flowchart (Supplementary Figure 1). We included participants who completed mental health, feeding practices and eating behaviours assessments at the three-year time-point ( $n = 414$ ) and who had full covariate data ( $n = 409$ ). Next, we examined the extent of missing data among the remaining participants and variables (questionnaires with multiple sub-scales) to ensure the proportion of missing data was below 20 % for each participant and each variable. Among the 409 mother-child dyads, 369 had no missing entries, 30 pairs had one missing entry, and 10 pairs had missingness not exceeding 12.5 % for the 79 variables considered. The proportion of missing data for each variable was consistently below 2.8 %. Overall, the percentage of missing data was 0.23 % (75 out of 32,311 observations). Moreover, covariates were all available for the 409 children with no missing values. Thus, no additional subjects or variables were excluded at this stage. Multiple imputation using chained equations (van Buuren & Groothuis-Oudshoorn, 2011) was used to impute various missing values for 30 participants (75 missing values out of 32,311 total data points). We generated 5 imputed datasets under the assumption of Missing At Random (MAR). Convergence of the imputation models was assessed through standard MICE diagnostics, including trace plots and inspection of between- and within-imputation variance, which indicated stable convergence. Given the extremely low proportion of missing data ( $\sim 0.2\%$ ), these imputations are unlikely to have influenced the results, while preserving variability and minimizing potential bias.

BDI-II and STAI scores were standardized to z-scores (mean = 0, SD = 1) to place the two scales on a common metric and permit direct comparison of effect sizes across measures with different ranges. Regression coefficients can therefore be interpreted as the change in the outcome per one standard deviation increase in depressive or anxiety symptoms. These standardized scores were used in subsequent mediation analyses to examine the direct and indirect pathways from maternal anxiety and depression symptoms to each of the eight eating behaviours captured in the subscales of the CEBQ, with maternal feeding practices and feeding concerns as the target mediators. All analyses were adjusted for child sex, maternal age, ethnicity, parity, and mother's highest attained education.

Mediation analyses were conducted using linear structural equation

modelling (SEM) with the R package *sem* (Fox et al., 2024, p. 16). We used the package's default two-stage least squares (2SLS) estimator because it does not require the distributional assumptions of maximum likelihood. 2SLS provides consistent parameter estimates under weaker normality assumptions and is well-suited to moderate sample sizes. Model identification was confirmed by positive degrees of freedom in the *sem* output and by full column rank of the exogenous variable covariance matrix. As preliminary correlation analysis revealed a high correlation between STAI and BDI-II scores ( $r = 0.65, p < 0.001$ ), raising multicollinearity concerns, a single SEM framework was not feasible. Therefore, two separate mediation models were examined: (1) maternal depression (BDI-II) → feeding practices and concerns → child eating behaviours; and (2) maternal anxiety (STAI) → feeding practices and concerns → child eating behaviours. This approach minimized statistical interference from overlapping predictors. Fig. 1 details our conceptual framework.

Given the extensive number of mediator and outcome variables captured across the measures, we undertook a two-step systematic approach to identify suitable candidate mediators and then all candidate parallel mediators were tested in a mediation model. To select candidate mediators, first, direct associations between maternal depression and anxiety symptoms and feeding practices and concerns were explored (pathway a), applying a liberal threshold of  $p < 0.10$ . Following this, the associations between feeding practices and concerns and children's eating behaviours were assessed (pathway b) via backward elimination with threshold of  $p < 0.10$  in regression models predicting child eating behaviours.

Mediators were retained if they fulfilled two criteria: (1) demonstrated a significant association ( $p < 0.10$ ) with maternal mental health variables (pathway a), and (2) survived backward elimination ( $p < 0.10$ ) in regression models predicting child eating behaviours (pathway b). The threshold  $p < 0.10$  was intentionally chosen in the selection of potential mediators to avoid prematurely excluding potentially relevant mediators, in line with methodological recommendations from prior studies (Hesketh et al., 2007; Williams et al., 2008). Feeding practices and concerns failing to meet either criterion were excluded from further consideration, as no valid mediation pathway could be reasonably established.

Finally, direct (pathway c) associations between anxiety/depressive symptoms and child eating behaviours, and indirect (pathway c') associations via candidate mediators retained in the preliminary analyses described above were explored. The indirect effect for each pathway was estimated as the product of the a and b path coefficients, and its standard error and  $p$ -value were computed via the delta method (MacKinnon et al., 2002; Sobel, 1982). In the presence of significant mediation (indirect effect with  $p < 0.05$ ), mediation was defined as complete when the direct associations between maternal mental health symptoms and child eating behaviours were no longer significant upon including the mediator; it was considered partial if both direct and indirect

associations remained significant. The usage of this terminology follows well-established definitions in the mediation literature (Baron & Kenny, 1986; MacKinnon et al., 2002).

Corrections for multiple comparisons were not applied in the analyses since the coefficients within an SEM are estimated simultaneously and share variance-covariance structures, making standard multiplicity corrections (e.g., Bonferroni) overly conservative and potentially prone to Type II errors (Smith & Cribbie, 2013; Stevens et al., 2017). In addition, our SEM was specified a priori based on theoretical and empirical foundations, thereby reducing the likelihood of spurious findings (Perneger, 1998). All analyses were completed in R (version 4.3.2) using the *sem* package (version 3.1–15). This study adhered to the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines for reporting observational studies (von Elm et al., 2008) (Supplementary Table 6).

### 3. Results

#### 3.1. Descriptive characteristics

The final analytical sample comprised 409 mother-child dyads. Mothers had a mean age of 30.7 years ( $SD = 5.2$ ), ranging from 19.0 to 46.4 years. Most mothers were of Chinese ethnicity (55.8 %), followed by Malay (29.8 %) and Indian (14.4 %). 189 (46.2 %) mothers were nulliparous, and 220 (53.8 %) multiparous (range: 1–4). Educational attainment varied across the sample, with 29.1 % of mothers having secondary education or lower, 36.4 % having post-secondary education, and 34.5 % holding a university degree or higher. Slightly more than half of the children were male (53.3 %). Mothers' mental health symptoms were assessed using the BDI-II and the STAI. The mean BDI-II score was 14.4 ( $SD = 6.3$ ), which corresponds to mild depression on average. Based on the BDI-II classification system, 54.5 % of mothers exhibited no/minimal depressive symptoms, 25.9 % reported mild depression, 15.7 % reported moderate depression, and 3.9 % were categorised as having severe depression. The mean STAI score was 70.1 ( $SD = 19.2$ ), ranging from 40 to 140. Supplementary Table 1 details the maternal and child characteristics in this study.

We found that maternal ethnicity and education were significantly associated with certain maternal feeding practices and concerns, as well as child eating behaviours. Specifically, mothers of Indian ( $B = -0.252, p = 0.017$ ) and Malay ( $B = -0.223, p = 0.013$ ) ethnicity were significantly less likely to use food to calm their child compared to mothers of other ethnic groups (Supplementary Table 2). Additionally, having a university education or higher was associated with increased child food responsiveness ( $B = 0.306, p = 0.001$ ) and emotional undereating ( $B = 0.488, p < 0.001$ ; Supplementary Table 4).

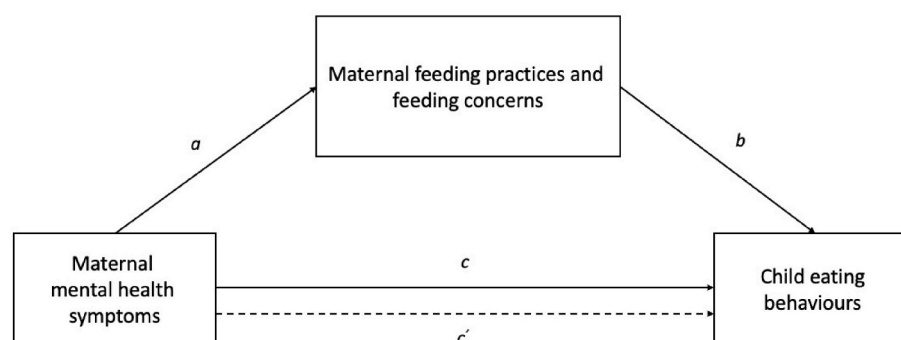


Fig. 1. Conceptual diagrams representing the proposed relationships.

Note. Maternal feeding practices and feeding concerns were jointly tested as parallel mediators within each exposure-specific model.



### 3.2. Associations between maternal mental health symptoms and maternal feeding practices and concerns (Pathway a)

Significant direct associations adjusted for the covariates have been summarised in Table 1. Full results with covariate effects have been summarised in Supplementary Tables 2 and 3.

Maternal depression symptoms were positively associated with one feeding practice, the use of food to calm the child ( $B = 0.013, p = 0.026$ ), and positively associated with one feeding concern, the concern about the child being underweight ( $B = 0.015, p = 0.079$ ).

Maternal anxiety symptoms were positively associated with three feeding concerns: 1) concern about the child being underweight ( $B = 0.008, p = 0.005$ ), 2) concern about child overeating or being overweight ( $B = 0.004, p = 0.016$ ), and difficulty in feeding ( $B = 0.006, p = 0.003$ ). Maternal anxiety was also positively associated with one feeding practice, the use of food to calm the child ( $B = 0.004, p = 0.056$ ).

### 3.3. Associations between maternal feeding practices and concerns and child eating behaviours (Pathway b)

Direct associations between feeding practices and concerns, and child eating behaviours have been summarised in Table 2. Full results with covariate effects have been summarised in Supplementary Table 4.

#### 3.3.1. Food responsiveness

Food responsiveness was negatively associated with difficulty in feeding ( $B = -0.193, p < 0.001$ ), concern about the child being underweight ( $B = -0.063, p = 0.048$ ), and child control of feeding ( $B = -0.118, p = 0.002$ ). It was positively associated with concern about child overeating or being overweight ( $B = 0.380, p < 0.001$ ) and using food to calm the child ( $B = 0.266, p < 0.001$ ).

#### 3.3.2. Enjoyment of Food

Enjoyment of Food was positively associated with concern about the child overeating or being overweight ( $B = 0.155, p = 0.001$ ) and pushing the child to eat more ( $B = 0.111, p = 0.013$ ). It was negatively associated with difficulty in feeding ( $B = -0.564, p < 0.001$ ) and concern about the child being underweight ( $B = -0.127, p < 0.001$ ).

#### 3.3.3. Emotional overeating

Emotional overeating was positively associated with both concern about child overeating or being overweight ( $B = 0.176, p < 0.001$ ) and using food to calm the child ( $B = 0.254, p < 0.001$ ). It was negatively associated with structure in feeding ( $B = -0.099, p = 0.013$ ).

#### 3.3.4. Desire to drink

Desire to drink was positively associated with using food to calm the child ( $B = 0.193, p = 0.006$ ) and age-inappropriate feeding practices ( $B$

$= 0.199, p = 0.003$ ).

#### 3.3.5. Satiety responsiveness

Satiety responsiveness was positively associated with difficulty in feeding ( $B = 0.330, p < 0.001$ ), using food to calm the child, concern about the child being underweight ( $B = 0.078, p = 0.003$ ), and child control of feeding interaction ( $B = 0.090, p = 0.003$ ). It was negatively associated with concern about the child overeating or being overweight ( $B = -0.149, p < 0.001$ ).

#### 3.3.6. Slowness in eating

Slowness in eating was positively associated with difficulty in feeding ( $B = 0.271, p < 0.001$ ), pushing the child to eat more ( $B = 0.109, p = 0.033$ ), and concerns about the child being underweight ( $B = 0.128, p < 0.001$ ). It was negatively associated with concern about child overeating or being overweight ( $B = -0.165, p = 0.001$ ).

#### 3.3.7. Emotional undereating

Emotional undereating was positively associated with difficulty in feeding ( $B = 0.125, p = 0.031$ ), using food to calm the child ( $B = 0.169, p = 0.003$ ), and pushing the child to eat more ( $B = 0.102, p = 0.073$ ). It was negatively associated with concern about the child overeating or being overweight ( $B = -0.137, p = 0.015$ ).

#### 3.3.8. Food fussiness

Food fussiness was positively associated with difficulty in feeding ( $B = 0.651, p < 0.001$ ) and negatively associated with pushing the child to eat more ( $B = -0.122, p = 0.002$ ).

### 3.4. Mediation analysis

Candidate mediators that satisfied both the criteria were (1) using food to calm the child and (2) concern about underweight for models examining maternal depression symptoms; and (1) difficulty in feeding, (2) concern about the child overeating or being overweight, (3) concern about the child being underweight and (4) using food to calm the child for models examining maternal anxiety symptoms (Supplementary Table 5). Mediation results are summarised in Table 3.

#### 3.4.1. Maternal depression symptoms and child eating behaviours

There were significant direct associations between maternal depression symptoms and child enjoyment of food ( $B = 0.011, p = 0.015$ ) and slowness in eating ( $B = 0.012, p = 0.024$ ), which were not mediated by maternal feeding practices or feeding concerns. Mothers with higher depression scores reported that their children enjoyed food more and ate food more slowly.

The relationships between maternal depression symptoms and child food responsiveness ( $B = 0.004, p = 0.034$ ) and emotional overeating ( $B = 0.003, p = 0.034$ ) were fully mediated by the use of food to calm the child. No direct relationships were observed for these variables. Mothers with higher symptoms of depression reported more use of food to calm the child, which was associated with higher food responsiveness and emotional overeating.

Concern about the child being underweight did not mediate any of the relationships.

#### 3.4.2. Maternal anxiety symptoms and child eating behaviours

Maternal anxiety symptoms did not have any direct associations with child eating behaviours. However, several indirect associations were observed, indicating full mediation through maternal feeding concerns. For food responsiveness specifically, two significant and directionally opposite pathways were found. Greater difficulty in child feeding was associated with lower food responsiveness ( $B = -0.001, p = 0.011$ ), while more concern about the child overeating or being overweight was associated with higher food responsiveness ( $B = 0.002, p = 0.020$ ). Mothers with higher anxiety reported higher levels of both concerns,

**Table 1**

Significant direct associations between maternal depression and anxiety symptoms and maternal feeding practices and concerns with estimate coefficients and covariate effects.

	B	SE	z	p	$\beta_1$	$\beta_2$
Using food to calm the child						
Depression	0.013*	0.006	2.220	0.026	0.013	0.108
Anxiety	0.004†	0.002	1.912	0.056	0.004	0.095
Concern about child being underweight						
Depression	0.015†	0.008	1.759	0.079	0.015	0.086
Anxiety	0.008**	0.003	2.835	0.005	0.008	0.140
Concern about the child overeating or being overweight						
Anxiety	0.004*	0.002	2.410	0.016	0.004	0.118
Difficulty in child feeding						
Anxiety	0.006**	0.002	2.924	0.003	0.006	0.143

Note.  $B$  = unstandardized coefficient;  $SE$  = standard error;  $\beta_1$  = standardized coefficient (latent variables only);  $\beta_2$  = standardized coefficient (all variables). † $p < .10$ . \* $p < .05$ . \*\* $p < .01$ .

Table 2

Significant direct associations between maternal feeding practices and concerns and child eating behaviours with estimate coefficients and covariate effects.

	B	SE	t	p	95 % CI	
					LL	UL
Food Responsiveness (FR)						
Difficulty in feeding	−0.193***	0.046	−4.195	<0.001	−0.284	−0.103
Concern about child overeating or being overweight	0.380***	0.044	8.544	<0.001	0.292	0.467
Using food to calm the child	0.266***	0.045	5.932	<0.001	0.178	0.354
Concern about child being underweight	−0.063**	0.032	−1.983	0.048	−0.125	−0.001
The child's control of feeding interactions	−0.118**	0.037	−3.174	0.002	−0.191	−0.045
Enjoyment of Food (EF)						
Difficulty in feeding	−0.564***	0.046	−12.378	<0.001	−0.653	−0.474
Concern about child overeating or being overweight	0.155**	0.044	3.527	0.001	0.069	0.241
Pushing the child to eat more	0.111*	0.044	2.500	0.013	0.024	0.199
Concern about child being underweight	−0.127***	0.031	−4.035	<0.001	−0.188	−0.065
Emotional Overeating (EOE)						
Concern about child overeating or being overweight	0.176***	0.040	4.374	<0.001	0.097	0.256
Using food to calm the child	0.254***	0.041	6.236	<0.001	0.174	0.333
Structure during feeding interactions	−0.099*	0.040	−2.496	0.013	−0.177	−0.021
Desire to Drink (DD)						
Using food to calm the child	0.193**	0.069	2.781	0.006	0.057	0.329
Age-inappropriate feeding	0.199**	0.066	3.003	0.003	0.069	0.329
Satiety Responsiveness (SR)						
Difficulty in feeding	0.330***	0.038	8.725	<0.001	0.256	0.404
Concern about child overeating or being overweight	−0.149***	0.037	−4.075	<0.001	−0.220	−0.077
Using food to calm the child	0.072†	0.037	1.947	0.052	−0.001	0.144
Concern about child being underweight	0.078**	0.026	2.983	0.003	0.027	0.129
The child's control of feeding interactions	0.090**	0.031	2.948	0.003	0.030	0.150
Slowness in Eating (SE)						
Difficulty in feeding	0.271***	0.052	5.184	<0.001	0.168	0.373
Concern about child overeating or being overweight	−0.165**	0.050	−3.274	0.001	−0.264	−0.066
Pushing the child to eat more	0.109*	0.051	2.145	0.033	0.009	0.210
Concern about child being underweight	0.128***	0.036	3.556	<0.001	0.057	0.199
Emotional Undereating (EUE)						
Difficulty in feeding	0.125*	0.058	2.161	0.031	0.011	0.239
Concern about child overeating or being overweight	−0.137*	0.056	−2.441	0.015	−0.246	−0.027
Pushing the child to eat more	0.102†	0.057	1.796	0.073	−0.010	0.213
Using food to calm the child	0.169**	0.056	2.993	0.003	0.058	0.280
Food Fussiness (FF)						
Difficulty in feeding	0.651***	0.040	16.305	<0.001	0.573	0.730
Pushing the child to eat more	−0.122**	0.039	−3.125	0.002	−0.199	−0.045

Note. B = unstandardized coefficient; SE = standard error; LL = lower limit of 95 % confidence interval; UL = upper limit of 95 % confidence interval. † $p < .10$ . \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

consistent with these pathways.

Maternal anxiety symptoms were also indirectly linked to child enjoyment of food, satiety responsiveness, and slowness in eating via the same maternal feeding concerns. Through reported difficulty in feeding, maternal anxiety symptoms showed indirect associations with higher satiety responsiveness ( $B = 0.002$ ,  $p = 0.005$ ), higher slowness in eating ( $B = 0.002$ ,  $p = 0.007$ ), lower enjoyment of food ( $B = -0.003$ ,  $p = 0.004$ ), higher food fussiness ( $B = 0.004$ ,  $p = 0.004$ ), and higher emotional undereating ( $B = 0.001$ ,  $p = 0.033$ ). Through concern about child overeating or being overweight, maternal anxiety symptoms showed indirect associations with lower satiety responsiveness ( $B = -0.001$ ,  $p = 0.035$ ), faster eating ( $B = -0.001$ ,  $p = 0.045$ ), higher enjoyment of food ( $B = 0.001$ ,  $p = 0.042$ ), and higher emotional overeating ( $B = 0.001$ ,  $p = 0.033$ ). Through concern about child being underweight, maternal anxiety symptoms showed indirect associations with lower enjoyment of food ( $B = -0.001$ ,  $p = 0.016$ ), higher satiety responsiveness ( $B = 0.001$ ,  $p = 0.032$ ), and more slowness in eating ( $B = 0.001$ ,  $p = 0.017$ ).

#### 4. Discussion

This study investigated whether maternal depression and anxiety symptoms were associated with child eating behaviours. We also explored the potential mediating pathway through maternal feeding practices and concerns. We found that higher maternal symptoms of depression were directly associated with greater child enjoyment of food and slower eating. Maternal depressive symptoms were also linked

indirectly to higher food responsiveness and emotional overeating in children, which was explained by mothers' use of food to calm the child. Maternal anxiety symptoms had no direct influence on child eating behaviours; instead, anxiety symptoms was linked to various child eating behaviours *indirectly* via maternal feeding concerns (e.g., perceived feeding difficulties, or concern about the child being overweight or underweight). Through these concerns, mothers' anxiety was associated with the child's food responsiveness, satiety responsiveness, eating speed, and enjoyment of food. Notably, the patterns differed between anxiety and depression symptoms; maternal anxiety symptoms were associated with child eating exclusively through maternal feeding concerns rather than actual feeding practices, whereas maternal depression showed some direct links to child eating behaviours in addition to indirect paths via feeding practices.

Importantly, maternal depression and anxiety symptoms were correlated in our sample, suggesting shared underlying factors. We acknowledge this, and our analyses show distinct pathways through which depression and anxiety symptoms were associated with child eating behaviours.

##### 4.1. Maternal depression symptoms and child eating behaviours

Our findings indicate that maternal depression symptoms were directly linked to greater enjoyment of food and slower eating in children. Higher levels of maternal depressive symptoms predicted greater child food enjoyment. One potential explanation is that mothers with depression symptoms may have reduced energy for active engagement

**Table 3**

Mediation results with direct (pathway c) and indirect (pathway c') associations between maternal mental health symptoms and child eating behaviours.

			FR	EOE	EF	DD	SR	SE	EUE	FF
Depression	Direct	<b>B p</b>	0.008 (0.069)	0.000 (0.918)	0.011* (0.015)	0.002 (0.732)	0.004 (0.271)	0.012* (0.024)	−0.003 (0.618)	0.002 (0.469)
		<b>95 % CI</b>	[−0.001, 0.018]	[−0.008, 0.009]	[0.002, 0.020]	[−0.012, 0.016]	[−0.003, 0.012]	[0.002, 0.022]	[−0.014, 0.009]	[−0.005, 0.011]
		<b>B p</b>	0.004* (0.034)	0.003* (0.034)	None	0.003 (0.060)	0.001 (0.108)	None	0.002 (0.059)	None
	Indirect via using food to calm the child	<b>95 % CI</b>	[0.001, 0.007]	[0.001, 0.006]	None	[0.000, 0.006]	[0.000, 0.002]	None	[0.000, 0.005]	None
		<b>B p</b>	−0.001 (0.150)	None	−0.002 (0.098)	None	0.001 (0.120)	0.002 (0.104)	None	None
		<b>95 % CI</b>	[−0.002, 0.000]	None	[−0.004, 0.000]	None	[0.000, 0.002]	[0.000, 0.004]	None	None
	Indirect via concern about the child being underweight	<b>B p</b>	−0.001 (0.150)	None	−0.002 (0.098)	None	0.001 (0.120)	0.002 (0.104)	None	None
		<b>95 % CI</b>	[−0.002, 0.000]	None	[−0.004, 0.000]	None	[0.000, 0.002]	[0.000, 0.004]	None	None
		<b>B p</b>	0.001 (0.381)	0.001 (0.366)	0.000 (0.959)	0.001 (0.691)	0.001 (0.272)	0.001 (0.674)	−0.003 (0.151)	0.000 (0.993)
Anxiety	Direct	<b>95 % CI</b>	[−0.002, 0.004]	[−0.001, 0.004]	[−0.003, 0.003]	[−0.004, 0.006]	[−0.001, 0.004]	[−0.003, 0.004]	[−0.007, 0.001]	[−0.003, 0.003]
		<b>B p</b>	−0.001* (0.011)	None	−0.003** (0.004)	None	0.002** (0.005)	0.002** (0.007)	0.001* (0.033)	0.004** (0.004)
		<b>95 % CI</b>	[−0.002, −0.001]	None	[−0.006, −0.001]	None	[0.001, 0.003]	[0.001, 0.003]	[0.001, 0.002]	[0.001, 0.007]
	Indirect via difficulty in child feeding	<b>B p</b>	0.002* (0.020)	0.001* (0.033)	0.001* (0.042)	None	−0.001* (0.035)	−0.001* (0.045)	−0.001 (0.101)	None
		<b>95 % CI</b>	[0.001, 0.003]	[0.001, 0.001]	[0.001, 0.001]	None	[−0.001, −0.001]	[−0.001, −0.001]	[−0.001, 0.000]	None
		<b>B p</b>	0.001 (0.064)	0.001 (0.064)	None	0.001 (0.093)	0.000 (0.135)	None	0.001 (0.084)	None
	Indirect via concern about the child overeating or being overweight	<b>95 % CI</b>	[0.000, 0.002]	[0.000, 0.002]	None	[0.000, 0.002]	[0.000, 0.001]	None	[0.000, 0.002]	None
		<b>B p</b>	−0.001 (0.064)	None	−0.001* (0.016)	None	0.001* (0.032)	0.001* (0.017)	None	None
		<b>95 % CI</b>	[−0.001, 0.000]	None	[−0.002, −0.001]	None	[0.001, 0.001]	[0.001, 0.002]	None	None
	Indirect via using food to calm the child	<b>B p</b>	0.001 (0.064)	0.001 (0.064)	None	0.001 (0.093)	0.000 (0.135)	None	0.001 (0.084)	None
		<b>95 % CI</b>	[0.000, 0.002]	[0.000, 0.002]	None	[0.000, 0.002]	[0.000, 0.001]	None	[0.000, 0.002]	None
		<b>B p</b>	−0.001 (0.064)	None	−0.001* (0.016)	None	0.001* (0.032)	0.001* (0.017)	None	None
	Indirect via concern about the child being underweight	<b>95 % CI</b>	[−0.001, 0.000]	None	[−0.002, −0.001]	None	[0.001, 0.001]	[0.001, 0.002]	None	None

Note. B = unstandardized coefficient; 95 % CI = bootstrap 95 % confidence interval; FR = food responsiveness; EOE = emotional overeating; EF = enjoyment of food; DD = desire to drink; SR = satiety responsiveness; SE = slowness in eating; EUE = emotional undereating; FF = food fussiness. \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

in other domains of parenting (e.g., playing, reading), and may compensate by increasing positive attention through food-related interactions (Lovejoy et al., 2000). This could lead to children perceiving mealtimes as especially nurturing or positive experiences, potentially enhancing their enjoyment of food. Alternatively, mothers with higher levels of depression symptoms may be promoting greater food enjoyment through engaging with greater use of palatable but non-nutritive foods and snacks. It has been previously reported that mothers who self-reported greater levels of stress offer more non-nutritive palatable snacks and discretionary foods, which may be associated with greater food enjoyment among children (Berge et al., 2017; Gross et al., 2013; Jansen et al., 2021). Further, the direct relationship between maternal depression and slower eating in children may be explained through parental modelling. Mothers experiencing depressive symptoms might exhibit slower, less engaged, or more withdrawn behaviours during mealtimes. Children observe and model these maternal behaviours (El-Behadli et al., 2015), adopting similar eating patterns, potentially characterized by a slower eating pace.

We also found some indirect associations between maternal depression and child food responsiveness and emotional overeating, suggesting that maternal depression can also impact child eating behaviours through its expression in maternal behaviours. We observed that mothers with higher depressive symptoms were more likely to use food to calm their child, which in turn was associated with the child's heightened food responsiveness and tendency toward emotional overeating. Past research similarly indicates that mothers experiencing elevated depressive symptoms use food to soothe their children more often than mothers with fewer depressive symptoms (Savage & Birch, 2017). Several mechanisms might explain these associations. For instance, mothers with depression symptoms often experience impaired emotion regulation; they tend to be less emotionally responsive or attentive to their child's needs, which can lead them to use food as an

external regulator to provide immediate relief for both mother and child (Hamburg et al., 2014). In addition, maternal depressive symptoms are linked to non-responsive feeding practices, characterized by greater parental control over feeding rather than responding to the child's hunger and satiety cues (Sampige et al., 2023). These results align with prior research reporting similar patterns (Berge et al., 2020; Ek et al., 2021) and support the hypothesis that mothers with depressive symptoms may be more inclined to offer highly enjoyable, discretionary foods as a strategy to calm their child.

#### 4.2. Maternal anxiety symptoms and child eating behaviours

Maternal anxiety symptoms showed no direct associations with child eating behaviours. However, maternal anxiety was indirectly related to child eating behaviours via maternal feeding concerns (i.e., difficulty in feeding, concern about the child overeating or being overweight and concern about the child being underweight). Specifically, maternal anxiety symptoms were linked to more food-avoidant behaviours (reduced food responsiveness, reduced enjoyment of food and increased satiety responsiveness, slower eating, more emotional undereating and more food fussiness) when mothers also reported feeding difficulties. Meanwhile, maternal anxiety symptoms were indirectly linked to more food approach behaviours (higher food responsiveness, more emotional overeating, more enjoyment of food, higher eating speed, and less emotional undereating) when mothers also expressed concern about the child overeating or being overweight. Concern about the child being underweight explained the link between maternal anxiety symptoms and food-avoidant behaviours (lower enjoyment of food, higher satiety responsiveness, and slower eating). Several potential mechanisms can explain these relationships. Maternal anxiety is characterized by excessive worry and hyper-vigilance, which may cause mothers to closely scrutinize their child's eating and become easily worried by

anything perceived as abnormal (Challacombe et al., 2007; Mathews, 1990). This heightened vigilance can inadvertently transmit anxiety to the child, creating an emotionally tense environment around eating (Farrow & Blissett, 2005; Hurley et al., 2008). Children may also internalize these negative emotions, potentially causing them to develop aversive associations with food or mealtimes, leading to suboptimal eating behaviours.

An interesting aspect of these findings is the role of maternal feeding concerns in linking maternal anxiety symptoms to child eating behaviours. This raises the question of whether anxious mothers might be misinterpreting their child's eating behaviours, or worrying about aspects of eating more as a general trait. High anxiety symptoms could make a mother more likely to perceive a problem where none exists or to exaggerate a mild issue. Anxious mothers may consider a mildly picky eating phase as "feeding difficulty" or perceive a child's healthy weight to be "too low" or "too high". Research on parental perceptions of feeding has documented that parental anxiety is associated with reporting more child-feeding problems regardless of the child's actual intake or growth (Hatcher & Richtsmeier, 1990; Hellin and Waller, 1992). This suggests that mothers with anxiety symptoms may indeed have a biased perception in that their worries can lead them to believe the child isn't eating well, even when the child is objectively eating adequately. Such misperceptions could explain why *feeding concerns* were the link between maternal anxiety and child eating behaviours. This raises an important question on the reliability of mother-reported measures among high-anxiety mothers. These associations should be further examined when comparing maternal reports to laboratory measures, to shed light on (a) the reliability of these reports and (b) the associations between maternal anxiety symptoms and child eating behaviours.

#### 4.3. Differential pathways: anxiety vs. depression symptoms

Our study highlights a meaningful difference in the relationships between maternal depression and anxiety symptoms, and child eating behaviours. Depression symptoms in mothers showed *both* direct links to the child's eating and indirect links via a specific feeding practice (using food to calm), whereas anxiety symptoms had *only* indirect links, operating or being expressed through maternal concerns about feeding rather than through overt feeding practices. These divergent pathways likely reflect distinct profiles of maternal behaviours associated with depression and anxiety, respectively. Mothers with depression often struggle with low energy, sadness, and disengagement, which can lead to less responsive feeding interaction (El-Behadli et al., 2015; Hurley et al., 2008; Lovejoy et al., 2000). This is supported by our findings and that of previous research demonstrating that mothers with depression use less responsive feeding practices such as food to calm the child, resulting in suboptimal eating behaviours in young children (Savage & Birch, 2017). In contrast, mothers with anxiety symptoms often experience excessive worry. Our results suggest that when maternal anxiety is present, it's not the anxiety *per se* but the mother's resultant concerns that have observable effects on child's eating behaviours. Taken together, anxiety and depression represent two different pathways to influence a child's eating. Anxiety works through maternal feeding concerns, whereas depression works through maternal feeding practices. This distinction has important implications – it suggests that interventions may need to be tailored to the specific mechanisms at play for mothers experiencing anxiety versus depression symptoms.

#### 4.4. Strengths and limitations

A strength of this study is the novel examination of how maternal depression and anxiety are associated with child eating behaviours via *distinct* pathways through feeding practices and feeding concerns. The inclusion of multiple mediators allowed for the detailed exploration of both feeding practices and feeding concerns in the pathways between

maternal mental health symptoms and child eating behaviours. Furthermore, the focus on toddlers at three years of age is developmentally important, as this is the period during which they engage in largely independent self-feeding behaviours, learn to eat and develop eating behaviours that become the foundation of their future eating behaviours. Our analysis was guided by a prespecified, theory-driven parallel mediation framework and estimated with exposure-specific SEMs to reduce multicollinearity and clarify direct and indirect pathways. Paths were adjusted for a priori covariates. Conceptually, delineating feeding practices from feeding concerns as separate mediators advances theorising about *how* maternal symptoms may translate into children's eating behaviours.

Nonetheless, the results of our study should be considered in light of some limitations.

First, the observational, cross-sectional study design (all measures at three years of age) precludes causal inference and temporal ordering. Second, all data were reported by mothers, which raises the possibility of reporting bias and shared-method variance. We have discussed how mothers with anxiety might misinterpret or over-report feeding concerns; similarly, mothers with depression might have a negative outlook that could either downplay or exaggerate aspects of children's eating. Third, although we adjusted for selected covariates (child sex, maternal age, ethnicity, education, parity), residual and unmeasured confounding remains possible (e.g., maternal BMI, and child temperament). In many Asian households, fathers, grandparents, or other caregivers share feeding responsibilities. Because our measures relied on maternal report, multi-caregiver dynamics may not have been fully captured. Furthermore, the PFQ may not have captured all nuanced feeding practices and concerns, potentially missing some mediation pathways. Because BDI-II and STAI were correlated, we estimated separate exposure-specific models to avoid unstable estimates (Kline & Little, 2016). This choice manages multicollinearity but may still yield omitted-variable bias if the unmodelled dimension of mental health carries shared variance. Although we used established instruments, these were not validated locally. Further, direct effects were statistically significant but small in magnitude (per 1-SD increase in mental health symptoms), which may limit individual-level clinical significance even if patterns could matter at the population level or accumulate over time. Our preliminary mediator screening used a relatively liberal *p*-value and backward elimination, which can introduce model instability and overfitting; blanket multiplicity corrections were not applied. Accordingly, testing multiple outcomes and mediators may inflate the risk of Type I error. Finally, indirect effects were evaluated via joint-significance tests rather than bootstrap-based estimates, which would provide more distribution-robust inference.

#### 4.5. Generalizability of results

Although the dimensions of mental health symptoms, feeding practices and concerns, and eating behaviours are widely observed, their expression and reporting are shaped by culture. For example, somatic idioms of distress are more frequently emphasized in Asian contexts compared to Western contexts (Choi et al., 2016). Even where measures such as the BDI-II show broad cross-cultural measurement invariance, subgroup differences and item functioning nuances remain, motivating local validation and invariance testing (Dere et al., 2015). Several studies have also found that the links between feeding practices and children's eating behaviours or weight differ across cultural groups (Blissett & Bennett, 2013; Hughes et al., 2011). In addition, the extent to which alternative caregivers participate in child feeding varies across cultures and households; this may further shape both the strength and the mechanisms of observed pathways. Overall, these considerations suggest that while underlying associations between maternal mental health symptoms, feeding practices and concerns, and child eating behaviours may extend beyond this cohort, their magnitude and meaning are likely culturally-informed. Replication in diverse populations,



alongside measurement invariance testing, will be critical for establishing the external validity of these findings.

#### 4.6. Implications and future directions

Future research and interventions may need to be tailored to the specific mechanisms at play for mothers experiencing anxiety versus depression symptoms, given the differential pathways observed in our study. For mothers experiencing elevated anxiety, support should prioritise reassurance and calibration of feeding-related concerns; for mothers with depressive symptoms, guidance should emphasise alternatives to using food to calm and promote responsive feeding. To reduce maternal reporting bias, researchers should consider using both questionnaire data and objective measures of child eating behaviours, such as video-recorded mealtime observations. Reciprocal influences should be investigated using cross-lagged models that capture how children's eating behaviours can influence maternal mental health and subsequent feeding practices and concerns, potentially creating feedback spirals. The use of validated instruments, bootstrapped mediation testing, and stricter control of multiple testing will also strengthen confidence in replication. Finally, gathering data on how fathers, grandparents, and alternative childcare providers feed children is pivotal for a comprehensive understanding of the mechanisms underlying child eating behaviours.

#### 4.7. Summary and conclusion

In summary, this study provides evidence that maternal depression and anxiety symptoms are each linked to young children's eating behaviours, but through different pathways. Maternal depression symptoms were associated with both direct differences in how children eat (greater enjoyment of food and slower eating) and indirect effects mediated by a specific feeding practice (using food to calm) which led to more food responsiveness and emotional overeating. Maternal anxiety symptoms, on the other hand, showed no direct impact on the child's eating tendencies; instead, anxiety exerted its influence via the mother's feeding-related concerns, which were associated with the child's eating behaviours. These findings underscore that the type of psychological distress matters, and it can shape parenting and child behaviour in distinct ways.

#### CRedit authorship contribution statement

**Monica A. Lazarus:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Conceptualization. **Beatrice Franzolini:** Writing – review & editing, Formal analysis. **Johan G. Eriksson:** Writing – review & editing, Supervision, Resources, Funding acquisition. **Mary F-F. Chong:** Writing – review & editing, Conceptualization. **Toh Jia Ying:** Writing – review & editing, Data curation. **Maria de Iorio:** Writing – review & editing, Supervision. **Michael J. Meaney:** Writing – review & editing, Conceptualization. **Keith M. Godfrey:** Writing – review & editing, Conceptualization. **Fabian Yap:** Writing – review & editing, Conceptualization. **Helen Chen:** Funding acquisition, Conceptualization. **Yap Seng Chong:** Writing – review & editing, Funding acquisition, Conceptualization. **Michelle Z.L. Kee:** Writing – review & editing, Methodology, Data curation, Conceptualization. **Anna M. Fogel:** Writing – review & editing, Supervision, Methodology, Conceptualization.

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#### Ethical statement

This study formed part of the Growing Up in Singapore Towards healthy Outcomes (GUSTO) cohort and received ethics approval from the National Healthcare Group Domain Specific Review Board (D/2009/021, B/2014/00406 and D/2010/210) and the SingHealth Centralised Institutional Review Board (CIRB 2018/2767 and CIRB 2018/3138). The study has also been registered on August 4, 2010 and is available online at ClinicalTrials.gov: NCT01174875. All participating mothers provided written informed consent prior to enrolment, and all procedures involving human participants complied with the ethical standards of the institutional committee and with the 1964 Declaration of Helsinki and its later amendments. Data were de-identified prior to analysis, and no incentives were offered that might unduly influence participation.

#### Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the author(s) used Generative AI to improve the clarity of selected portions of the text. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

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#### Declaration of competing interest

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.appet.2025.108340>.

## Data availability

Data described in the manuscript, code book, and analytic code will be made available upon request pending (e.g., application and approval, payment, other).

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