



Short communication

The association between maternal depressive symptomology and child dinner dietary quality among Hispanic Head Start families

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ABSTRACT

Dietary quality is important for children's growth and development. Poor dietary quality and maternal depression are prevalent among low-income, Hispanic families. Maternal depression likely influences child feeding before and during the meal. This secondary data analysis of an observational feeding study (2007–2008) examined how maternal depressive symptomology relates to dietary quality of dinner served to and consumed by Head Start preschoolers in Houston, TX (n = 82 mother-child dyads). A digital photography method assessed food served and consumed by the child at three separate dinner meals in families' homes. Healthy Eating Index-2010 (HEI) was calculated and averaged across the three meals to measure dietary quality (possible range 0–100). Maternal depression was assessed by the Centers for Epidemiologic Depression Scale (CES-D, possible range 0–60). A series of linear regression models were developed, regressing the total CES-D score and all four CES-D subscales onto both the dietary quality of the meal served and consumed. Dinners served had a HEI of 45.70 ± 9.19 and dinners consumed had a HEI of 44.65 ± 7.34 . Clinically significant depressive symptomology (CES-D ≥ 16) was reported by 28% of mothers. Maternal depressive symptomology and the dietary quality served were not related. Controlling for dietary quality served, total CES-D and somatic complaints subscale scores were associated with lower dietary quality consumed (respectively, $\beta = -0.16$, $p < 0.05$ and $\beta = -0.23$, $p < 0.01$). Among low-income, Hispanic families, maternal depressive symptomology was predictive of the dietary quality consumed, but not served. Together, these findings reinforce the importance of parent feeding behaviors and emotional climates during dinner.

1. Introduction

Dietary patterns of high dietary quality are associated with reduced chronic disease (Onvani et al., 2017). Children develop food preferences based on their repeated exposure to various foods (Johnson, 2016) and child food preferences can carry into adulthood (Northstone and Emmett, 2008). Eating meals of high dietary quality at a young age is an important strategy for the promotion of a healthy diet throughout the lifespan to prevent chronic disease.

Maternal depression is highly prevalent among low-income populations for whom dietary quality is often inadequate (Gu and Tucker, 2017). Maternal depression is particularly concerning among low-

income, Hispanic mothers because they are unlikely to seek mental health treatment (Interian et al., 2010). Depression can influence how mothers promote healthy environments and behaviors for their children (Benton et al., 2015). Despite the relatively large number of studies examining the relationship between maternal depression and physical activity/sedentary time (Benton et al., 2015), the relationship between maternal depressive symptomology and dietary consumption is less studied (Hurley et al., 2015; Marshall et al., 2018; Ystrom et al., 2012; McCurdy et al., 2019).

The one study that directly examined the relationship between maternal depressive symptomology and child dietary quality consumed found dietary quality to be lower among mothers experiencing higher

Abbreviations: CES-D, Centers for Epidemiologic Depression Scale; HEI, Healthy Eating Index; NDSR, Nutrient Data System for Research

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levels of symptomology (Marshall et al., 2018). Maternal depressive symptomology could influence the dietary quality consumed by the child via the dietary quality of the meal that is served to the child. A mother with greater depressive symptomology may have a reduced capacity for healthy meal planning and preparation, which would influence the dietary quality of the meals she serves (McCurdy et al., 2014). Although dietary quality served is a strong predictor of that consumed (Arlinghaus et al., 2018), maternal depressive symptomology may also influence the dietary quality of the food consumed. For example, distressed parents are more likely to engage in feeding practices and have feeding styles (Hurley et al., 2008) that are associated with overall lower dietary quality among children (Arlinghaus et al., 2018). Additional studies are needed that separate dietary quality served from dietary quality consumed to better understand how maternal depressive symptomology and child dietary quality may be linked.

The increased autonomy and continued introduction of novel foods that occurs during preschool makes this life stage an important time for parents to help children establish healthy eating behaviors (Lagattuta et al., 2010) Head Start preschool students receive breakfast, lunch, and two snacks at school, making dinner the meal at which mothers have the most influence over their child's consumption. A prior observational study of dinner meals provides a unique opportunity to explore the relationship between maternal depressive symptomology and both the dietary quality of the meal served and consumed by the child. The purpose of this study was to explore the relationship between maternal symptomology and child dietary quality, both served and consumed, among Hispanic families with a child attending Head Start preschool. Considering prior literature (Marshall et al., 2018; Ystrom et al., 2012), we hypothesized a negative association between depressive symptomology and both dietary quality served and consumed.

2. Methods

2.1. Participants

Hispanic caregiver and child dyads were recruited at their child's Head Start preschool to participate in a study on the emotional feeding climate of dinner meals in Houston, Texas (Hughes et al., 2011). Data were collected in 2007 and 2008. Of the 145 families that completed dietary assessment, 86 self-identified as Hispanic. Of these 86 families, four did not have complete maternal depressive symptomology data, leaving an analytic sample size of 82. Written consent for the mother's and her child's participation in the study was obtained. This study was approved by the Institutional Review Board at Baylor College of Medicine.

2.2. Procedures and measures

As the present study is a secondary analysis of a larger study examining mother-child interactions at the dinner meal, detailed procedures are reported in prior publications (Arlinghaus et al., 2018; Hughes et al., 2011; Johnson et al., 2014). Briefly, researchers completed three in-home observations of usual dinner meals. Families were provided standardized plates, bowls, and cups such that food served could be documented using a digital photography method (Johnson et al., 2014).

2.2.1. Dietary quality

Trained dietitians estimated food and entered it into the Nutrient Data System for Research 2009 to analyze nutrient content. The dietary quality of each meal was evaluated using the Healthy Eating Index 2010 (HEI) (Guenther et al., 2014). HEI assesses dietary adherence to the Dietary Guidelines for Americans, with a maximum score of 100 indicating complete adherence. Higher HEI scores correlate with improved health outcomes (Onvani et al., 2017). HEI was chosen to assess dietary quality to be consistent with nutrition education and

experiences provided in Head Start which would likely have been based on the Dietary Guidelines for Americans. The mean HEI from the three meals was used in analysis. HEI was calculated separately for both the meals served and the food consumed by children.

2.2.2. Maternal depression symptomology

Depression symptomology was assessed by the Centers for Epidemiologic Depression Scale (CES-D). This commonly used and extensively validated 20-item self-report questionnaire assesses the frequency and severity of depressive symptomology (Weissman et al., 1977). Each item ranged from 0 to 3 and responses are summed to calculate a total CES-D score (range 0 to 60). Additionally, four subscales of the CES-D were calculated (Nguyen et al., 2004). These subscales include somatic complaints (e.g., restless sleep; seven items, range 0–21), depressive affect (e.g., feeling sad; seven items, range 0–21), positive affect (e.g., feeling hopeful; four items, range 0–12), and interpersonal problems (e.g., feeling disliked; two items; range 0–6), and have been found to better indicate depression symptomology among low-income, ethnic minority populations (Nguyen et al., 2004).

2.3. Statistical analysis

Statistical analysis was conducted using SPSS 25. Demographic statistics were computed. T-tests and chi-square testing examined differences in dietary quality and depressive symptomology by mother and child characteristics. Due to the small sample size, only those characteristics found to differ were considered in the models as covariates. Ten separate linear regression models were developed to estimate the association between the total CES-D score and each of the four subscales and child's dietary quality (HEI score), served and consumed. Because the dietary quality of food consumed by children is substantially influenced by the dietary quality of the food they are served (Arlinghaus et al., 2018), the dietary quality of the meal served to children was included as a covariate in models predicting dietary quality consumed.

3. Results

Demographic and descriptive information is provided in Table 1. Neither dietary quality nor depressive symptomology (i.e., CES-D total score and each of the subscales) differed by any child or caregiver characteristic. To preserve power, no covariates were included in the models predicting dietary quality served. Dietary quality served was the only covariate in the models predicting dietary quality consumed.

Regression model results are illustrated in Table 2. There were no significant associations between maternal depressive symptomology (total CES-D score or any subscale) and the dietary quality served. Controlling for dietary quality served, a greater total CES-D score was associated with lower dietary quality consumed ($\beta = -0.16$, 95% CI: -0.24 to -0.004 , $p < 0.05$). This model explained 55.8% of the variance in dietary quality consumed, with 2.3% explained by the total CES-D score. Controlling for dietary quality served, the CES-D somatic complaints subscale was inversely associated with dietary quality consumed ($\beta = -0.23$, 95% CI: -0.84 to -0.19 , $p < 0.01$). This model explained 58.7% of the variance in dietary quality consumed, with 5.2% explained by the CES-D Somatic Complaints subscale. No other CES-D subscale was significantly associated with dietary quality consumed.

4. Discussion

Contrary to our hypothesis, maternal depressive symptomology was not associated with the dietary quality of the meal served. However, consistent with our hypothesis, greater maternal depressive symptomology was associated with poorer dietary quality of the dinner consumed by children. Together, these findings illustrate that among low-income, Hispanic families the relationship between maternal depressive

Table 1
Household, child, and mother characteristics, n = 82, M (SD) or N [%].^a

Child characteristics	
Age (years)	4.42 (0.77)
Gender	
Female	39 [47.6]
Male	43 [52.4]
HEI served	45.70 (9.19)
HEI consumed	44.65 (7.34)
Mother and household characteristics	
Age (years)	31.84 (7.13)
Employment status	
Both mother and spouse employed	22 [26.8]
Either mother or spouse employed	52 [63.4]
Neither mother nor spouse employed	8 [9.8]
Marital Status	
Married/cohabitating	47 [57.3]
Single	35 [42.7]
Number of people living in home	4.82 (1.65)
Number of people < 18 years in home	2.82 (1.20)
Total CES-D score ^b	12.62 (9.23)
CES-D score ≥ 16 ^f	23 [28.0]
Somatic complaints subscale ^c	4.09 (3.32)
Depressive affect subscale ^c	3.66 (4.43)
Positive affect subscale ^d	4.06 (2.76)
Interpersonal problems subscale ^e	0.82 (1.22)

HEI = Healthy Eating Index; CES-D = Centers for Epidemiologic Depression Scale.

^a Secondary analysis of data collected as part of an observational feeding study that occurred from 2007 to 2008 in Houston, Texas.

^b possible range 0–60.

^c possible range 0–21.

^d possible range 0–12.

^e possible range 0–6.

^f A total CES-D score of 16 or greater is indicative of clinically significant depressive symptomology (Weissman et al., 1977).

symptomology and the dietary quality of the food consumed by children at dinner is likely explained through factors *during* the meal, not factors prior to the meal.

The lack of a relationship between maternal depressive symptomology and the dietary quality served found in this study could be due to the study population’s low-income status. Compared to affluent families, low-income families may face more obstacles preparing healthy meals including the relatively high cost of nutritious foods, access to transportation, and limited time/energy after working long hours

(Eikenberry and Smith, 2004). The addition of maternal depressive symptomology to these barriers may not meaningfully influence the dietary quality of the meal that is served to children as it might among a more affluent family who was not already facing such barriers. In other words, the poor dietary quality of dinner meals served in this study may be more due to the financial status of the family rather than the mother’s mental health.

The effect size of the association between maternal depression symptomology and child dietary quality consumed was small (i.e., a 0.12 and 0.51 decrease in total HEI score associated with a one-unit increase in total CES-D score and somatic complaints subscale, respectively). Importantly, this small effect size should be interpreted considering HEI in this study was based on a single meal. Determinants of child dietary quality are complex (Vaughn et al., 2016). While this study and others indicate that maternal depressive symptomology is negatively associated with the dietary quality children consume (Marshall et al., 2018), its influence is likely small. Greater maternal depressive symptomology has been associated with reduced maternal responsiveness (Marshall et al., 2018; Hurley et al., 2008), but maternal responsiveness did not mediate the relationship between maternal depressive symptomology and child dietary quality (Marshall et al., 2018). Analyses of the dataset used in this study found a positive association between the authoritative feeding style (characterized by high responsiveness) and child dietary quality consumed (Arlinghaus et al., 2018), but no association between caregiver feeding style and depressive symptomology (Hughes et al., 2015). These mixed findings indicate a need for further research to understand the mechanisms behind the negative association between maternal depressive symptomology and child dietary quality consumed during a meal.

The somatic complaint subscale may have been associated with child dietary quality because it may be most representative of depressive symptomology among Hispanic populations. Mental health stigmatization is high among Hispanic populations, and Hispanics are unlikely to seek treatment for depression (Ystrom et al., 2012). Hispanics may be more comfortable communicating their depressive symptomology through somatic complaints than more overt communication about emotions expressed in items from the other subscales (e.g. “I felt depressed,” “I felt that people disliked me,” or “I was happy.”). Additionally, some items of the somatic complaint subscale are closely related to eating behaviors. For example, “I did not feel like eating; my appetite was poor,” “I felt that everything I did was an effort,” and “I talked less than usual.” Mothers who have a poor appetite and/or talk less than usual, are unlikely to model eating healthful foods or create an

Table 2
Models regressing maternal depressive symptomology on child dietary quality, served and consumed; unstandardized β (95% CI).^a

Child HEI served ^b	Model 1	Model 2	Model 3	Model 4	Model 5
Total CES-D score	-0.16 (-0.38 to 0.06)				
Somatic complaints subscale		-0.50 (-1.11 to 0.10)			
Depressive affect subscale			-0.25 (-0.71 to 0.21)		
Positive affect subscale				-0.14 (-0.88 to 0.60)	
Interpersonal problems subscale					-0.14 (-3.08 to 0.22)
Child HEI Consumed ^c	Model 6	Model 7	Model 8	Model 9	Model 10
Total CES-D score	-0.12* (-0.24 to -0.004)				
Somatic complaints subscale		-0.51** (-0.84 to -0.19)			
Depressive affect subscale			-0.20 (-0.45 to 0.05)		
Positive affect subscale				-0.05 (-0.45 to 0.36)	
Interpersonal problems subscale					-0.39 (-1.32 to 0.54)
Child HEI served	0.56*** (0.44 to 0.68)	0.55*** (0.43 to 0.67)	0.57*** (0.45 to 0.69)	0.58*** (0.46 to 0.71)	0.57*** (0.45 to 0.70)

*, **, *** indicates significance at the 90%, 95%, and 99% level, respectively.

HEI = Healthy Eating Index; CES-D = Centers for Epidemiologic Depression Scale.

^a Secondary analysis of data collected as part of an observational feeding study that occurred from 2007 to 2008 in Houston, Texas.

^b Regression of total CES-D score (Model 1) and all four CES-D subscales (Models 2–5) onto the HEI of the dinner meal served. There were no covariates in these models.

^c Regression of total CES-D score (Model 6) and all four CES-D subscales (Models 7–10) onto the HEI of the dinner meal consumed. Child HEI served was a covariate in Models 6–10.

engaging, supportive feeding environment (Vaughn et al., 2016).

This study has multiple strengths and weaknesses. The observational nature of the dietary assessment in this study enabled analysis of the dietary quality of both the meal served and consumed, and observations from three separate dinner meals helped correct for possible day-to-day variation between meals. However, the presence of researchers in the home may have biased participants' behaviors. Importantly, this study also assessed maternal depressive symptomology using both the total CES-D score and its subscales, which have been identified as more accurately assessing depressive symptomology among low-income, ethnic minority samples (Nguyen et al., 2004). Despite its novel approach to understanding the relationship among an underserved population, the findings of this study are limited by the cross-sectional design, lack of data to address potential variability in poverty level within the sample, and a small sample size. Additional research with a larger sample size is needed to confirm these preliminary findings.

This study is the first to illustrate that the link between maternal depressive symptomology and child dietary quality among low-income, Hispanic families was not due to the dietary quality of the meals served. Instead, maternal depressive symptomology appeared to play a role during the meals to relate to the dietary quality of the meals consumed by the child. Answering practical questions like when in the feeding process maternal depressive symptomology may play the greatest role in child dietary quality can help inform future interventions. If the findings of this study are replicated among larger samples, among low-income, Hispanic families with mothers that experience depressive symptomology increasing child dietary quality may be more likely by prioritizing the improvement of maternal behaviors during meals over the improvement of meal preparation habits.

CRedit authorship contribution statement

Katherine R. Arlinghaus: Conceptualization, Formal analysis, Writing - original draft. **Thomas G. Power:** Investigation, Project administration. **Daphne C. Hernandez:** Supervision, Writing - review & editing. **Craig A. Johnston:** Supervision, Writing - review & editing. **Sheryl O. Hughes:** Funding acquisition, Investigation, Resources, Project administration.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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References

- Onvani, S., Haghghatdoost, F., Surkan, P.J., Larijani, B., Azadbakht, L., 2017. Adherence to the healthy eating index and alternative healthy eating index dietary patterns and mortality from all causes, cardiovascular disease and cancer: a meta-analysis of observational studies. *J. Hum. Nutr. Diet.* 30, 216–226.
- Johnson, S.L., 2016. Developmental and environmental influences on young children's vegetable preferences and consumption. *Adv. Nutr.* 7, 220s–231s.
- Northstone, K., Emmett, P.M., 2008. Are dietary patterns stable throughout early and mid-childhood? A birth cohort study. *Br. J. Nutr.* 100, 1069–1076.
- Gu, X., Tucker, K.L., 2017. Dietary quality of the US child and adolescent population: trends from 1999 to 2012 and associations with the use of federal nutrition assistance programs. *Am. J. Clin. Nutr.* 105, 194–202.
- Interian, A., Ang, A., Gara, M.A., Link, B.G., Rodriguez, M.A., Vega, W.A., 2010. Stigma and depression treatment utilization among Latinos: utility of four stigma measures. *Psychiatr. Serv.* 61, 373–379.
- Benton, P.M., Skouteris, H., Hayden, M., 2015. Does maternal psychopathology increase the risk of pre-schooler obesity? A systematic review. *Appetite* 87, 259–282.
- Hurley, K.M., Black, M.M., Merry, B.C., Caulfield, L.E., 2015. Maternal mental health and infant dietary patterns in a statewide sample of Maryland WIC participants. *Matern. Child Nutr.* 11, 229–239.
- Marshall, S.A., Ip, E.H., Suerken, C.K., Arcury, T.A., Saldana, S., Daniel, S.S., Quandt, S.A., 2018. Relationship between maternal depression symptoms and child weight outcomes in Latino farmworker families. *Matern Child Nutr.* 14, e12614.
- Ystrom, E., Barker, M., Vollrath, M.E., 2012. Impact of mothers' negative affectivity, parental locus of control and child-feeding practices on dietary patterns of 3-year-old children: the MoBa cohort study. *Matern Child Nutr.* 8, 103–114.
- McCurdy, K., Tovar, A., Kaar, J.L., Vadiveloo, M., 2019. Pathways between maternal depression, the family environment, and child BMI z scores. *Appetite* 134, 148–154.
- McCurdy, K., Gorman, K.S., Kisler, T., Metallinos-Katsaras, E., 2014. Associations between family food behaviors, maternal depression, and child weight among low-income children. *Appetite* 79, 97–105.
- Arlinghaus, K.R., Vollrath, K., Hernandez, D.C., Momin, S.R., O'Connor, T.M., Power, T.G., Hughes, S.O., 2018. Authoritative parent feeding style is associated with better child dietary quality at dinner among low-income minority families. *Am. J. Clin. Nutr.* 108, 730–736.
- Hurley, K.M., Black, M.M., Papas, M.A., Caulfield, L.E., 2008. Maternal symptoms of stress, depression, and anxiety are related to nonresponsive feeding styles in a statewide sample of WIC participants. *J. Nutr.* 138, 799–805.
- Lagattuta, K.H., Nucci, L., Bosacki, S.L., 2010. Bridging theory of mind and the personal domain: Children's reasoning about resistance to parental control. *Child Dev.* 81(1), 616–635.
- Hughes, S.O., Power, T.G., Papaioannou, M.A., Cross, M.B., Nicklas, T.A., Hall, S.K., Shewchuk, R.M., 2011. Emotional climate, feeding practices, and feeding styles: an observational analysis of the dinner meal in Head Start families. *Int. J. Behav. Nutr. Phys. Act* 8, 60.
- Johnson, S.L., Hughes, S.O., Cui, X., Li, X., Allison, D.B., Liu, Y., Goodell, L.S., Nicklas, T., Power, T.G., Vollrath, K., 2014. Portion sizes for children are predicted by parental characteristics and the amounts parents serve themselves. *Am. J. Clin. Nutr.* 99, 763–770.
- Guenther, P.M., Kirkpatrick, S.I., Reedy, J., Krebs-Smith, S.M., Buckman, D.W., Dodd, K.W., Casavale, K.O., Carroll, R.J., 2014. The Healthy Eating Index-2010 is a valid and reliable measure of diet quality according to the 2010 Dietary Guidelines for Americans. *J. Nutr.* 144, 399–407.
- Weissman, M.M., Sholomskas, D., Pottenger, M., Prusoff, B.A., Locke, B.Z., 1977. Assessing depressive symptoms in five psychiatric populations: a validation study. *Am. J. Epidemiol.* 106, 203–214.
- Nguyen, H.T., Kitner-Triolo, M., Evans, M.K., Zonderman, A.B., 2004. Factorial invariance of the CES-D in low socioeconomic status African Americans compared with a nationally representative sample. *Psychiatry Res.* 126, 177–187.
- Eikenberry, N., Smith, C., 2004. Healthful eating: Perceptions, motivations, barriers, and promoters in low-income Minnesota communities. *J. Am. Diet. Assoc.* 104, 1158–1161.
- Vaughn, A.E., Ward, D.S., Fisher, J.O., et al., 2016. Fundamental constructs in food parenting practices: a content map to guide future research. *Nutr. Rev.* 74, 98–117.
- Hughes, S.O., Power, T.G., Liu, Y., Sharp, C., Nicklas, T.A., 2015. Parent emotional distress and feeding styles in low-income families. The role of parent depression and parenting stress. *Appetite* 92, 337–342.