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Mealtime emotional climate and child health: A systematic review

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Abstract

Background: Positive mealtime emotional climate (MEC) has been linked to better nutrition, psychosocial, literacy and academic outcomes, and fewer behavior problems. However, MEC has been defined in a variety of ways across studies, limiting the ability to synthesize findings and plan future research.

Objective: To identify which child characteristics are associated with MEC and to determine how previous studies have measured MEC.

Methods: We searched three databases (1980–2020) for peer-reviewed articles measuring MEC. Inclusion criteria required at least one child-level outcome related to physical, nutritional, or developmental health; children aged 0–18 years old; and quantitative data using cohort, case-control, intervention, or experimental designs. We used a previously published taxonomy to categorize child/adolescent characteristics as correlates, non-correlates, unclear, or as having insufficient evidence, according to the amount of evidence linking them to MEC. Additionally, we extracted data about the measures and definitions of MEC from each included article.

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Results: Out of 668 unique studies identified in the initial search after duplicates removed, 14 met inclusion criteria, and only three used the same measure of MEC. Healthful dietary intake, disordered eating behaviors, and weight/BMI were categorized as correlates of MEC, but links to unhealthy dietary intake are unclear. Several characteristics (e.g. temperament, academic success) were examined in one study only.

Conclusions: Future research should examine the relationship between MEC and child psychosocial child outcomes and utilize a preschool age group. These findings aid in conceptualizing how MEC has been defined and measured and illuminate the importance of MEC on children's health.

Keywords: Mealtime emotional climate, Child health, Dietary intake

1. Background

Mealtime emotional climate (MEC) has previously been defined as the level of positive and negative interpersonal interactions and emotional expression during mealtimes (Fosco & Grych, 2013; Hughes et al., 2011; Saltzman et al., 2017). A negative mealtime emotional climate can involve expressions of negative emotion, hostile interpersonal dynamics, food lecturing/moralizing, frequent silence, food controlling, indulgence (Berge et al., 2014; Saltzman et al., 2017). A positive mealtime emotional climate can involve expressions of positive emotion, warm or nurturing interpersonal dynamics, high levels of group cohesion or enjoyment, and positive communication about food (Berge et al., 2014; Saltzman et al., 2017).

Mealtime emotional climate has been linked previously to certain health characteristics in children. For example, in a small longitudinal study that observed meals in the family home, mother-child dyads that expressed mostly positive emotions at meals had children who ate more healthy foods than children in dyads who expressed about equal levels of positive and negative emotion in surveys 6-months later (Saltzman et al., 2017). However, another study found a significant correlation of positive MEC with weight status but not healthful eating (Tremblay & Rinaldi, 2010). Another study found that families with a more negative mealtime emotional climate (characterized by higher levels of hostility) had children who were more likely to be overweight (Berge et al., 2014). Additionally, parents of overweight/

obese children were found to be more likely to engage in hostility and to lecture about food which contributes to a negative mealtime emotional climate (Berge et al., 2014).

Although these findings compellingly point to a possible correlation between MEC and children's weight-related health, the breadth of the aforementioned findings underscore the need to systematically review the literature to determine significant correlates of MEC. Further, there is a need for a consistent operational definition of MEC and how it is measured. Studies often either failed to define MEC as a whole or used constructs in the measure to describe and create a definition of MEC. For example, Czaja et al. (2011) operationalized MEC by evaluating parent–child interactions in a naturalistic home setting during family mealtimes (Czaja et al., 2011). In contrast, a study conducted by Zeller et al. (2007) operationalized MEC by using a self-reported questionnaire to analyze mealtime challenges and positive mealtime interactions (Zeller et al., 2007). These disparate operational definitions highlight the first of two significant gaps in the current literature. Although each approach to defining and measuring MEC has its merits, it is important for the field to coalesce on a consistent operational definition if we are going to continue examining—and perhaps ultimately intervening on—associations between emotions at mealtimes and health. However, it would be unnecessary to operationalize the MEC construct if it were not reliably associated with outcomes of interest, which highlights the second clear gap in the literature. There has not yet been a synthesis of existing literature to determine whether future studies are needed to explore the relationship between MEC and child characteristics such as temperament, physical health, and disordered eating behaviors are warranted. Although much of the research described above is focused on relationship of MEC with child weight-related correlates, it is unclear whether MEC is consistently associated with these potential correlates, or whether MEC may be linked to other child characteristics. Therefore, to address these gaps, the current study aims to address the following research questions: (1) what are the child/adolescent level correlates of MEC?; and (2) how have researchers measured MEC in past studies?

2. Methods

2.1. Protocol registration

This review focuses on MEC and child/adolescent nutrition status, physical status, and developmental outcomes. The protocol was registered on the International Prospective Register of Systematic Reviews (PROSPERO; see Smith, Saltzman, & Dev, 2019). PROSPERO is used to register and maintain a record of systematic reviews in order to avoid duplication of studies and reduce reporting bias (National Institute for Health Research, 2019). Guidelines for the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA; Moher et al., 2009) system were utilized to improve the reporting quality. Both PROSPERO and PRISMA were used to ensure transparency throughout the process, organize the search, and present findings.

2.2. Eligibility criteria

Studies were included if they met all of the following criteria: (a) measured emotional climate during mealtime; (b) included at least one measure of child nutrition, child physical health, or a child developmental outcome; (c) measured emotion in more than one person; (d) included typically developing children or a control group with typically developing children; (e) included parents that were healthy or free of disease; (f) published in a peer-reviewed journal; (g) published in English or an English translation was available; (h) conducted with humans; (i) published between January 1, 1980, and April 30, 2020; and (j) included human children and adolescents from birth to age 18. Studies included were quantitative cohort (cross-sectional or longitudinal), case-control (cross-sectional or longitudinal), intervention (randomized or nonrandomized) or experimental designs. Studies were excluded if, in case-control studies or interventions, the sample size was $n \leq 10$ per group or $n \leq 20$ total, or in cohort studies, the sample size was $n \leq 20$.

2.3. Search strategy

A wide search of published literature was conducted in the following databases: PsycINFO, PubMed, and ERIC (Education Resources

Information Center). Databases were selected based on the feedback of an expert librarian because they yielded the most relevant articles based on our topic of interest. Articles were searched for publication between January 1, 1980 and April 30, 2020 with key terms related to MEC and child outcomes. As there is a lack of commonality among terminology for MEC, the following search string was used to encompass emotions surrounding various mealtimes ("emotion" or "conflict" or "argument" or "atmosphere" or "climate" or "environment" or "pleasant" or "interpersonal" or "dynamics" or "routine") AND ("meal" or "mealtime" or "feed" or "dinner" or "breakfast" or "lunch" or "supper") AND ("child" or "children" or "teen" or "adolescent" or "youth" or "family") NOT ("global warming" or "climate change") NOT ("qualitative" OR "systematic review" OR "focus group"). Filters for language and document type were also applied for all databases.

2.4. Study selection

Two researchers used DistillerSR to independently screen a different half of the article abstracts identified through the literature search (Fig. 1). DistillerSR is an online software used to expedite the review process by increasing transparency, facilitating form creation for abstract screening and data extraction, tracking progress, providing included/excluded reference counts, and conducting kappa interrater reliability scoring (Evidence Partners, 2019). Of the 668 abstracts reviewed, 20% were screened by the first and third authors to ensure the inclusion/exclusion criteria were being applied consistently. Inconsistencies were then discussed and resolved by consensus. After abstracts were reviewed and 529 excluded, 66 full-text articles were screened by the first author and comprehensively assessed against the inclusion/exclusion criteria and data extraction and coding was completed.

2.5. Data extraction and coding

A standardized form was utilized to extract and record the following information about the studies selected for inclusion: sample size, sample characteristics (Race/ethnicity, age, gender breakdown, SES, weight status, etc.), operational definition of mealtime emotional climate, research method (study design, measure), potential correlates, analysis, results, and conclusions (association, no association).

Correlates were identified for the included studies. If three or more of the studies assessing a construct found consistent results, the construct was classified as a "non-correlate" (no association) or a "correlate" (positive or negative associations). If three or more of the studies assessing a construct had inconsistent results, the construct was classified as "unclear." However, if only two studies assessed a construct then it was not classified due to inadequate evidence but was instead labeled "N/A.". This method of classifying correlates is consistent with previously published taxonomy to categorize child/adolescent characteristics as correlates, non correlates, unclear, or as having insufficient evidence, according to the amount of evidence linking them to the study variable (Jacobi et al., 2004; Kraemer et al., 1997; Saltzman & Liechty, 2016).

2.6. Risk of bias assessment

The first author independently assessed each article for risk of bias using the National Heart, Lung, and Blood Institute's (NHLBI's) quality assessment tools (National Heart, Lung, 2020). A second researcher then independently assessed risk of bias using NHLBI's quality assessment tool for half of the articles. There was a consensus of 81% between the two researchers. Disagreements were resolved via consensus. Based on the questions from the NHLBI's quality assessment, 4 key questions were identified that could pose a fatal risk to the study and impact the results of interest based on the answer to the following four questions (a) was the research question or objective in this paper clearly stated; (b) were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants; (c) were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants; (d) were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)? Questions were chosen to identify the potential for posing a fatal risk to the study if they directly measured an aspect related to the study aims. This allowed for examining how the study's risk of bias directly impacted the aims. If the study received a yes for all identified key questions or only one no or not reported then the study was classified as low risk.

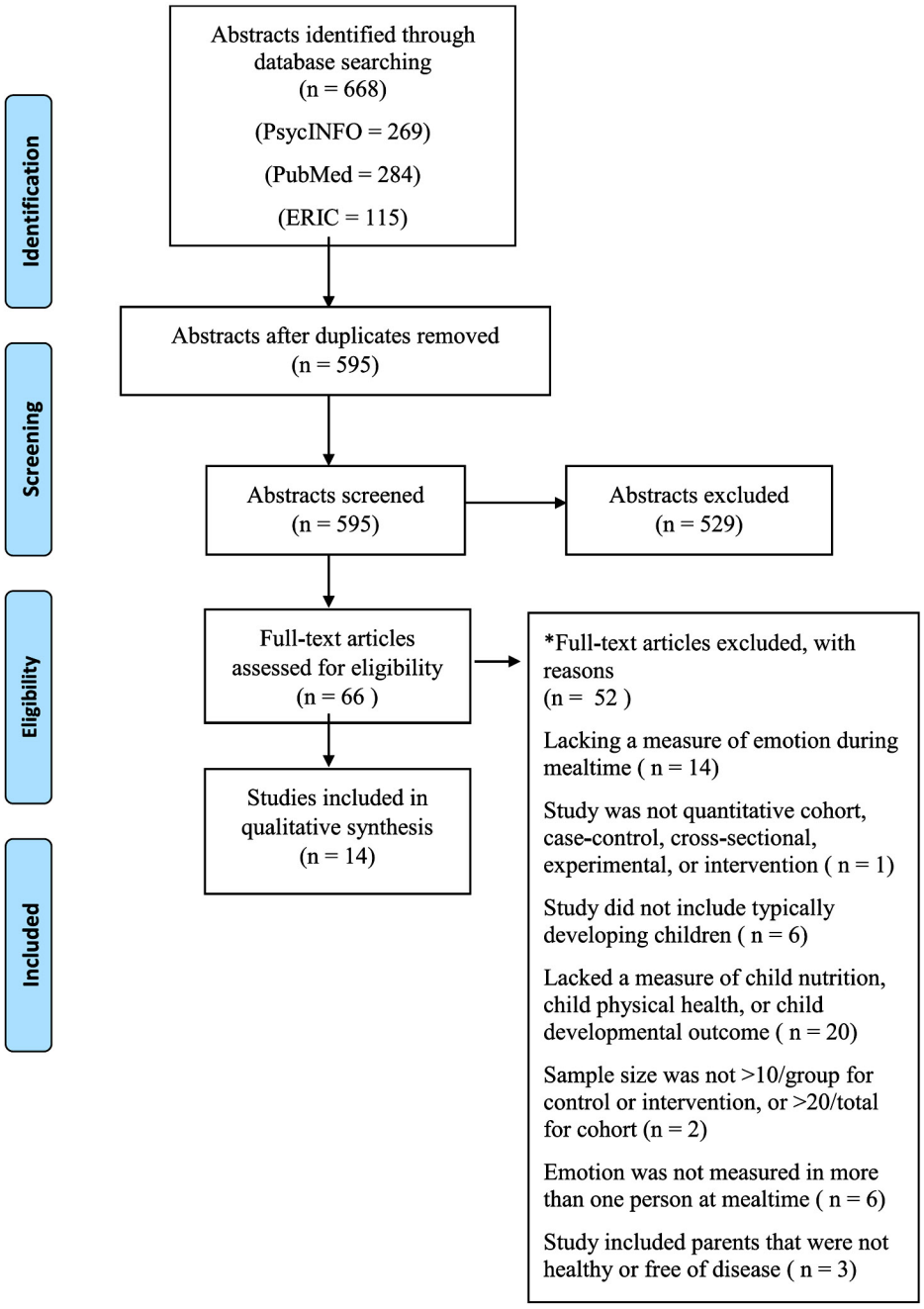

Fig. 1. Flow chart of article search and selection process following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (www.prisma-statement.org).

*Some studies had multiple reasons for exclusion.

If the study received a no or not reported for two or more identified key questions the study was classified as moderate risk. If the study received a no or not reported for three or more questions the study received a high-risk categorization.

3. Results

For this review 668 articles were identified through PsycINFO (n = 269), PubMed (n = 284), and ERIC (n = 115). Once duplicates were removed, 595 abstracts were screened. Sixty-six full-text articles were screened, and 14 articles were included in the qualitative synthesis. Of the studies included in the review (n = 14), eleven were cross-sectional and three were longitudinal. One study was experimental (this study was longitudinal/cross-sectional) and thirteen were observational. Of the 14 articles includes, 6 of the studies were conducted outside of the United States of America (see Table 1).

3.1. Aim 1: correlates of MEC and health/developmental outcomes

Findings are summarized in Table 2.

3.1.1. Dietary intake

Three studies of the 14 examined associations between MEC and healthful dietary intake. All three studies found an association and had low risk of bias. Additionally, healthful dietary intake was classified as a correlate of positive MEC. Of the studies finding an association between MEC and unhealthful dietary intake, two had low risk of bias and one had moderate risk of bias. Two studies found a positive association between MEC and unhealthful dietary intake (Fiese et al., 2015; Harbec & Pagani, 2018), and one found no association (Saltzman et al., 2017). One study reported the amount of time spent not engaging in the mealtime being negatively associated with consumption of carrots, pizza, and diet soda and positively associated with the consumption of cookies and sugary sodas (Fiese et al., 2015). Higher family environment quality during mealtime was positively associated with less soft drink consumption (Harbec & Pagani, 2018).

Table 1 Summary of sample characters and findings.

Citation	*Sample size*	*Sample characteristics*	*Key findings*	*Implications & future directions*
Aviram et al., 2015	97 families of children with a feeding disorder, sleep problem, or typically developing	Gender: 56% girls Age: M [SD] = 1.89 [0.77], Range: 1–3 years Nationality: Hebrew-speaking families in Israel. SES: NR	Among typically developing children, temperament was associated with mealtime dynamics (conflict and control during mealtime).	"Longitudinal studies needed to determine directionality. Examine interactions between family dynamics, paternal involvement, and child temperament."
Berge et al., 2013	41 families	Gender: 53.2% girls Age: M [SD] = 14.4 years [2.0], Range: NR Race/Ethnicity: 18.9% white, 29.0% African American or Black, 19.9% Asian American, 16.9% Hispanic, 3.7% Native American, and 11.6% mixed/other. SES: 29.4% low, 24.3% low-middle, 33.3% middle, 6.4% upper-middle, and 2.8% high SES	Positive interpersonal dynamics during family meals were associated with lower adolescent BMI and higher vegetable intake, but not fruit consumption.	"Examine interpersonal dynamics among other family members (e.g. siblings) and weight/dietary intake outcomes."
Berge et al., 2014	120 children	Gender: 53% boys Age: M [SD] = 9 [3.3], Range: 6–12 years Race/Ethnicity: 74% African American, 18% white, 9% American Indian, 6% Asian, and 3% mixed or other race/ethnicity; parents were similarly diverse. SES: >50% of children in the sample were from very low SES households.	Negative family dynamics were associated with overweight/obese children.	"Examine interpersonal dynamics among other family members (e.g. siblings) and weight/dietary intake outcomes."

Table 1 Summary of sample characters and findings. *(Continued)*

Citation	*Sample size*	*Sample characteristics*	*Key findings*	*Implications & future directions*
Boyum & Parke, 1995	50 kindergarten children	Gender: 52% girls Age: M [SD] = 6 [0.37], Range: 5–7 years Race/Ethnicity: All parents were White, except for one Black father. SES: Median family income was $40,000 to $49,000.	Parent to child affect during meals was associated with children's social acceptance by classroom peers.	"Analyze child to parent interactions during meals, and children's understanding and awareness of parent affect."
Czaja et al., 2011	74 children	Gender: 57% girls Age: M [SD] = NR [NR], Range: 8–13 years Race/Ethnicity: NR SES: 46 were low SES.	Maladaptive overall family functioning was positively associated with loss of control eating among adolescents.	"Longitudinal studies should examine interaction styles during mealtimes and the development of Loss of Control eating in children."
Fiese et al., 2015	60 families, with a total of 235 individuals	Gender: 50.6% boys Age: M [SD] = 8.87 [3.21], Range: 1–17 years Race/Ethnicity: Participants were mainly white (84%), Asian (4.1%), Hispanic (1.8%), Native American (1.2%), or multiracial (5.3%). SES: The sample was mainly middle to high socioeconomic status.	Time spent in action was positively associated with the consumption of cookies and sugary sodas but negatively associated with consumption of carrots, pizza, and diet soda.	"Eating together as a family may not be enough to promote healthy behaviors and dynamics. Future research should examine if families of children who are trying to lose or maintain weight are impacted by the mealtime environment differently."
Harbec & Pagani, 2018	1492 children	Gender: NR Age: M [SD] = 6 years [NR], Range: NR Race/Ethnicity: white (91.2%), black (3%), Arab and Western Asians (1.7%), Latino (1.6%), East/South Asian (0.9%), American Indian (0.6%), and others (1%). SES: NR	Higher family meal environment quality was positively associated with better general fitness and less soft drink consumption. An increase in the family meal environment quality was positively associated with decreases in physical aggression, oppositional behavior, nonaggressive delinquency, and reactive aggression.	"Positive parenting during mealtimes allow children to socialize and learn social behavioral skills. Future research should include observational measures of family meal quality."

Table 1 Summary of sample characters and findings. *(Continued)*

Citation	*Sample size*	*Sample characteristics*	*Key findings*	*Implications & future directions*
Mitchell et al., 2004	66 infants and toddlers and their families	Gender: 52% male Age: M [SD] = 18.6 [NR], Range: 7–35 months Race/Ethnicity: The entire sample was white. SES: The mean social status index score was 4.03 (SD = 0.77).	MEC as measured by the Mealtime Interaction Coding System (MICS) was not shown to be associated with mealtime behavioral problems.	"For families of children with Cystic Fibrosis, accomplishing the task of feeding may hinder positive interactions during mealtimes. Future research should examine families of children at the extremes for weight for differing patterns in family interactions."
Neumark-Sztainer et al., 2004	4746 middle and high school students	Gender: NR Age: M [SD] = 14.9 years [1.7], Range: NR Race/Ethnicity: NR SES: NR	Atmosphere at family meals (enjoying meals, time for talking) was shown to be inversely associated with binge eating. In terms of less extreme unhealthy weight control, rating of priority and atmosphere of family meals were inversely associated with behaviors. Among girls, having a high priority and a positive atmosphere during family meals was a protective factor for all studied disordered eating practices.	"Future research is needed to examine the relationship between characteristics of family meals and adolescent eating behaviors."

Table 1 Summary of sample characters and findings. *(Continued)*

Citation	*Sample size*	*Sample characteristics*	*Key findings*	*Implications & future directions*
Saltzman et al., 2017	74 families	Gender: 50% girls Age: M [SD] = 41 [5.23], Range: NR months Race/Ethnicity: 76% White, 10% Black, 11% Hispanic/Latino, 7% mixed, 4% Asian. SES: Household income included 12% from $24,999 or less, 14% from $25,000– $39,000, 15% from $40,000–$69,999, 30% from $70,000–$99,999, and 26% from $100,000 or more.	The likelihood of being an all expresser (similar level of positive and negative emotions in parents and children) decreased significantly as food involvement increased.	"Research should examine the role of additional family members and factors of MEC and child outcomes. Parent emotion socialization training should also be researched for its impact on family MEC and thus child food consumption."
Tremblay & Rinaldi, 2010	1192 children	Gender: 51% boys Age: M [SD] = 4 years [NR], Range: NR Race/Ethnicity: NR SES: Nineteen percent of families had annual incomes lower than $30,000, 39% earned between $30,000 and $59,999, and 42% earned more than $60,000.	More meal conflicts were associated with heavier weight, but with healthier eating. More meal conflicts predicted less time spent watching TV.	"Future research should examine the role of general parenting style, parent feeding strategies, and parental beliefs and children's procurement of eating habits and physical activity."

Table 1 Summary of sample characters and findings. *(Continued)*

Citation	*Sample size*	*Sample characteristics*	*Key findings*	*Implications & future directions*
White et al., 2014	535 adolescents	Gender: 54% girls Age: M [SD] = 15.9 [1.11], Range: 14.5 to 18.7 years Race/Ethnicity: The sample was 74% white British, ethnicity data were missing for 14% of the sample. SES: NR	Lower depression among boys was associated with higher mealtime frequency, more positive mealtime atmosphere, greater priority of mealtimes and higher levels of mealtime structure. Among girls, an inverse relationship was found between the characteristics of family mealtimes (frequency, priority and atmosphere) and disordered eating behaviors.	"Families should focus on not only the number of family meals but also the quality and positivity of those family meals and the environment and how they are influenced by depression and gender among family members."
White et al., 2019	495 adolescents	Gender: 54% girls Age: M [SD] = 15.9 [1.11], Range: 14.5 to 18. years Race/Ethnicity: The sample was 78.5% white British. SES: NR	No differences were found in family mealtime atmosphere for adolescents who reported binge-eating and those who did not.	"Future research should examine a wider range of emotions and mealtime interactions in association with binge eating."
Zeller et al., 2007	149 children and adolescents	Gender: 59% girls Age: M [SD] = NR [NR], Range: 8–16 years Race/Ethnicity: 49% African-American, 51% non-Hispanic white. SES: NR	Higher reports of maternal distress were associated with increased odds of a child being classified as obese. Mothers of obese youth characterized mealtimes as more challenging behaviorally.	"Maternal perceptions of greater family conflict and lower cohesion in families of obese youth may be related to higher maternal distress. Future research should examine family conflict in terms of adherence to treatment for weight." Note: NR = Not Reported.

Table 2 Potential correlates of mealtime emotional climate.

Potential correlate	*Study*	*Type of association*				*Study design*	
		Positive	*Negative*	*Mixed*	*None*	*Cross-sectional*	*Longitudinal*
Healthful dietary intake (Higher fruit/vegetable consumption, servings of healthy food)	Berge et al., 2013	X				X	
	Tremblay & Rinaldi, 2010	X					X
	Saltzman et al., 2017	X					X
Unhealthy dietary intake (unhealthy food consumption, consumption of cookies and sugary sodas, soft drink consumption)	Fiese et al., 2015	X				X	
	Saltzman et al., 2017				X		X
	Harbec & Pagani, 2018	X					X
Disordered eating behaviors (binge eating, girls disordered eating, loss of control)	Czaja et al., 2011		X			X	
	Neumark-Sztainer et al., 2004		X			X	
	White et al., 2014		X			X	
	White et al., 2019				X	X	
Weight status/body mass index (normal weight, overweight, obese)	Zeller et al., 2007	X				X	
	Berge et al., 2014			X		X	
	Tremblay & Rinaldi, 2010	X					X
	Berge et al., 2013	X				X	
	Saltzman et al., 2017				X		X
Child temperament (expression and regulation of emotions)	Aviram et al., 2015	X				X	
	Aviram et al., 2015				X	X	
Mealtime behavioral problems (mild, chaotic, or rigid pattern of dealing with behavioral issues during meals)	Mitchell et al., 2004		X			X	
Aggression (physical aggression, oppositional behavior, non-aggressive delinquency, and reactive aggression)	Harbec & Pagani, 2018	X					X
Child prosocial behavior (how well a child is liked, not liked, and good at helping/sharing/taking turns)	Boyum & Parke, 1995	X				X	
Children's sociometric ratings (how well a child is socially accepted by classroom peers)	Boyum & Parke, 1995	X				X	
Adolescent depression (psychopathology for depression)	White et al., 2014	X				X	
Children's physical activity (physical fitness compared to other children)	Harbec & Pagani, 2018	X					X
Academic success (reading and math)	Harbec & Pagani, 2018				X		X

Notes: Bolded items indicate an identified correlate.

However, Saltzman et al. (2017) found no association between families expressing equal amounts of positive and negative emotions during mealtimes and unhealthy food consumption by children. As such, the relationship between unhealthy dietary intake and mealtime emotional climate was classified as unclear.

3.1.2. Body mass index/weight status

Five studies examined the relationship of MEC with body mass index (BMI) among children. Of those studies, five had low risk of bias. Four studies found an association between MEC and BMI (Berge et al., 2013; Berge et al., 2014; Tremblay & Rinaldi, 2010; Zeller et al., 2007), and one study found no association (Saltzman et al., 2017). BMI was classified as a correlate of MEC. Three studies examined correlations between MEC and weight status. Altogether, five unique studies examined an association between weight status or BMI and MEC. Of these, three found a positive association (Berge et al., 2013; Tremblay & Rinaldi, 2010; Zeller et al., 2007), one had mixed findings (Berge et al., 2014), and one found no associations (Saltzman et al., 2017). Thus, in our review, weight status/BMI were also classified as correlates of MEC.

3.1.3. Disordered eating behaviors

Four studies examined associations between MEC and disordered eating behaviors, and three found significant correlations. Of the four studies examining disordered eating, all had low risk of bias. Generally, more negative MEC was associated with greater levels of disordered eating, particularly among girls and adolescents. Czaja et al. (2011) found that maladaptive overall family functioning was associated with more loss of control eating among adolescents. However, interpersonal involvement and communication patterns were negatively associated with loss of control eating (Czaja et al., 2011). One study found that a positive atmosphere during family meals was negatively associated with unhealthy eating and weight control behaviors including binge eating, and use of diet pill, laxatives, and diuretics (Neumark-Sztainer et al., 2004). White et al. (2014) found high frequency, high priority, and positive atmosphere of family meals to be negatively associated with disordered eating behaviors among adolescent girls. However, one study found no association between binge-eating behaviors and MEC (White et al., 2019). Therefore, disordered eating behaviors were classified as correlates of MEC.

3.1.4. Other correlates

Several other potential correlates were examined by only one study each. Among these studies, 4 had low risk of bias and 1 had moderate risk of bias. These correlates include: child temperament (Aviram et al., 2015), mealtime behavioral problems (Mitchell et al., 2004), aggression (Harbec & Pagani, 2018), prosocial behavior (Boyum & Parke, 1995), sociometric ratings (Boyum & Parke, 1995), depression (White et al., 2014), physical activity (Harbec & Pagani, 2018), and academic success (Harbec & Pagani, 2018). Findings are summarized in Table 2, but there was not enough evidence to evaluate the body of literature relevant to these potential correlates.

3.2. Aim 2: measures of MEC

Definitions and measures are summarized in Table 3. Regarding the definition of MEC, across studies, definitions focused generally on dyadic interactions during mealtimes, mealtime atmosphere, conflict during or because of meals, emotional expression, or communication during meals. Thus, to the best of our knowledge, no consistent definition or operationalization of MEC has been identified.

Regarding the measurement of MEC, eight studies measured MEC using an observational coding system and seven utilized self-report measures completed by parents or adolescents. One study utilized both an observational and self-report measure and thus was included in both counts (Harbec & Pagani, 2018). Further, twelve studies in the current review were conducted in home-based settings, one was conducted in a laboratory-based setting, and one was conducted in both laboratory and home-based settings (see Table 3).

The measures included varying degrees and types of validity including factors analysis and intraclass correlations. Of the eight studies that used an observational coding system, three utilized the Family Mealtime Interaction Coding System (MICS) in children aged 12–17 years (Berge et al., 2013), 8–13 years (Czaja et al., 2011), and 6–36 months (Mitchell et al., 2004). Other observation coding systems utilized included: dyadically coding the affect directed by one family member to a specific partner, (children aged 5–7 years; Boyum & Parke, 1995); the Toddler Feeding Scale (children aged 1–3 years; Aviram et al., 2015); an adapted version of the D.O.T.S. emotion coding

Table 3 Mealtime emotional climate (MEC) definition and measures.

Citation	*MEC definition*	*Measure*	*Example variables/sub-scales*	*Setting; target age*	*Validity & reliability*
Aviram et al., 2015	Mealtime dynamics involving the level of conflict and control between parents and children during mealtime.	Mother–Infant/Toddler Feeding Scale (Chatoor et al., 1997) Videotapes were coded by researchers Blinded to study.	Subscales: dyadic conflict and struggle for control	Home; 1–3-years old	Factor analysis yielded a composite score for "Dyadic conflict and control" of (α = 0.80 for fathers and α = 0.85 for mothers).
Berge et al., 2013	Mealtime interactions involving interpersonal dynamics that occur during family meals.	Mealtime Interaction Coding System (MICS) Videos were coded based on two family mealtimes.	MICS Interpersonal Dynamics Subscales: task accomplishment, communication, affect management, interpersonal involvement, behavior control, roles, overall family functioning.	Home; 12–17 years old	Intraclass correlations calculated for interrater reliability were high (range = 0.89–0.98).
Berge et al., 2014	Dyadic interpersonal and food-related dynamics that occur during family meals between family members.	Adapted Iowa Family Interaction Rating Scales (IFIRS) Videos were coded for positive and negative family functioning.	Subscales for adapted IFIRS: interpersonal and food-related family level dynamics, interpersonal and food-related parent level dynamics	Home; 6–12 years old	Practice video-recordings were used until coders reached 95% reliability with a gold standard and then 95% inter-rater reliability among coders.
Boyum & Parke, 1995	Frequency, intensity, and clarity of emotional expressiveness of parent affect during dinner and frequency and type of affect exchanged between parent-parent and parent-child dyad during dinner.	The Halberstadt Family Expressiveness Questionnaire (FEQ; Halberstadt, 1986) Parents completed the FEQ. Additionally, videotapes of mealtimes were coded dyadically focusing on the affect directed by one family member to a specific partner.	Mealtime Variables: questioning/ puzzled, humor/tease/laugh, excitement/ joy/surprise, happy/ low-level positive/smile, neutral, low-level negative/ disapproval, anger/ mad/ hostility, disgust/ sarcasm	Home; 5–7 years old	Prior studies have found high levels of internal reliability (α = 0.91, 0.89, 0.87) (Cassidy & Asher, 1992). They were stable for mothers and fathers ranging a 8 to 12 month period (Halberstadt et al., 1995).

Table 3 Mealtime emotional climate (MEC) definition and measures. (*Continued*)

Citation	*MEC definition*	*Measure*	*Example variables/subscales*	*Setting; target age*	*Validity & reliability*
Czaja et al., 2011	Parent-child mealtime interactions which examine family functioning, emotional involvement, and/or communication.	The Adapted Mealtime Family Interaction Coding System (MICS; Dickstein, Hayden, Schiller, Seifer, & San Antonio, 2004; Hayden et al., 1998) Parent–child interactions as well as children's eating behavior during a mealtime were coded.	MICS Subscales: task accomplishment, communication affect management, interpersonal involvement, behavior control, overall family functioning	Home; 8–13 years old	Intraclass correlations (ICCs) for the dimensions were reported as $0.96 \leq ICC \leq 0.97$.
Fiese et al., 2015	Mealtime environments which include positive social interactions and are free of noisy distractions. Social interactions during mealtimes that capture the domains of distractions, behavior control, and communication critical, mealtime, interpersonal[a].	Action, Behavior Control, and Communication (ABC) mealtime coding scheme Researchers that were blinded to the study objectives coded each mealtime video.	ABC Subscales: action-oriented, behavior control, mealtime communication, critical communication, interpersonal communication	Lab; 5–13 years old	Coders were trained on mealtime videos to achieve 90% interrater agreement.

a The authors measured emotional expression among more than one individual at the mealtime, or the perception of emotional climate in the family as a whole through critical and interpersonal communication. Therefore, although the authors called this construct as mealtime dynamics, we decided to include measurement of this construct in the current study to ensure we provided a comprehensive review of all possible approaches to measuring and operationalizing MEC.

Table 3 Mealtime emotional climate (MEC) definition and measures. (*Continued*)

Citation	*MEC definition*	*Measure*	*Example variables/subscales*	*Setting; target age*	*Validity & reliability*
Harbec & Pagani, 2018	Positive environmental experiences that occur during mealtimes.	Family Meal Environment Quality The authors created a scale to measure family meal environment quality, as reported by parents. This scale was created using statements from other studies assessing meal enjoyment or atmosphere at family meals, as well as some statements from the McMaster Model of Family Functioning.	Variables: mealtime is enjoyable for all; meal time is an opportunity to talk; we confide in each other; we feel accepted for what we are; there are lots of bad feelings in the family.	Home; 6 years old	Internal consistency of the created scale is low, and below satisfactory for judging a reliable scale (0.60) (Bland & Altman, 1997).
Mitchell et al., 2004	Parent-child mealtime behaviors where children may learn about behaviors such as communicating with others about current events or about appropriate behavior during mealtime.	Mealtime Family Interaction Coding System (MICS). The MICS is used to assess family functioning during an unstructured and naturalistic situation and was adapted from the McMaster Structured Interview of Family Functioning (McSIFF). Observations occurred during a family dinner meal and examined the relationships between family functioning and parent-child mealtime behavior.	MICS Subscales: task accomplishment, communication, affect management, interpersonal involvement, behavior control, roles, and overall family functioning.	Home; 6–36 months old	Intraclass correlations calculated for interrater reliability were high (range = 0.89–0.98).

Table 3 Mealtime emotional climate (MEC) definition and measures. (*Continued*)

Citation	*MEC definition*	*Measure*	*Example variables/subscales*	*Setting; target age*	*Validity & reliability*
Neumark-Sztainer et al., 2004	Adolescents and families participate in regular family meals through an enjoyable atmosphere that is free from conflict around food or other issues.	Created Project EAT survey. Questions for family meal environment constructs were adapted from the Family Eating Attitude and Behavior Scale (FEABS). Adolescents completed the survey at school.	Family Meal Environment Subscales: priority, atmosphere, and structure/rules.	Home; 12–17 years old	Priority of family meals: (α = 0.82) Atmosphere: (α = 0.73) Structure/rules: (α = 0.60)
Saltzman et al., 2017	Mealtime emotional climate (MEC)—positive and negative emotion expression frequency.	Adapted D.O.T.S. emotion coding system (Cole, Wiggins, Radzioch, & Pearl, 2007) Videos were coded separately for maternal and child affect. Authors coded behaviors, facial expressions, and vocalizations.	D.O.T.S Variables: maternal and child positive and negative affect (ex. behaviors, facial expressions, and vocalizations).	Home; 37–70 months old	For 20% of the cases that were double coded observed agreement was reached with Intraclass correlation = 0.73 to 0.90.
Tremblay & Rinaldi, 2010	Meal interactions and conflicts were based on mealtimes being enjoyable for everyone, rushed, a time to talk to each other, including arguments between the children, having arguments between adults and children, and/or including arguments between adults.	Meal Interactions Parents completed six questions assessing family interactions and conflicts during meals.	Meal Interactions Variables: family interactions and conflicts during meals (ex. mealtimes are enjoyable for everyone)	Home; 5 months to 4 years old	Internal consistency index is below satisfactory with α = 0.55. (Bland & Altman, 1997)

Table 3 Mealtime emotional climate (MEC) definition and measures. (*Continued*)

Citation	*MEC definition*	*Measure*	*Example variables/subscales*	*Setting; target age*	*Validity & reliability*
White et al., 2014	Positive family mealtime environments consist of placing a high priority on family meals, positive mealtime atmosphere and greater mealtime structure.	Created Project EAT-I (Eating Among Teens) Survey was completed by adolescents about family's mealtime environment.	Family Meal Environment Subscales: priority, atmosphere, and structure/rules.	Home; 14.5 to 18.7 years old	Priority of family meals: (α = 0.78) Structure/rules: (α = 0.70) Atmosphere of family meals: (α = 0.84).
White et al., 2019	Family mealtime atmosphere involves the perception of enjoyment and communication of those present during mealtime.	Created Project EAT-I (Eating Among Teens) Survey was completed by adolescents about family's mealtime environment.	Family Meal Environment Subscales: priority, atmosphere, and structure/rules.	Home; 14.5 to 18.7 years old	Priority of family meals: (α = 0.78) Structure/rules: (α = 0.70) Atmosphere of family meals: (α = 0.84).
Zeller et al., 2007	Mealtime climate consists of examining support, conflict in the family environment, mealtime challenges, and if the interactions were positive or negative.	About Your Child's Eating-Revised (AYCE-R). Caregivers complete the questionnaire using a rating scale of "never" to "nearly all of the time" about how often a various situations occur in their family surrounding children's eating.	AYCE-R subscales: resistance to rating, positive mealtime interaction, and child aversion to mealtime. The current study utilized the Positive Mealtime Interaction subscale and revised the Resistance to Eating scale and renamed it "Mealtime Challenges".	Home/Lab; The mean age of the study population was 12.50 years (SD = 1.93)	Adequate internal consistency was shown for the scales. Mealtime Challenges: α = 0.69 Positive Mealtime Interaction: α = 0.82

system (children aged 37–70 months; Saltzman et al., 2017); the Action, Behavior Control, and Communication (ABC) mealtime coding scheme (children aged 5–13 years; Fiese et al., 2015), and an adapted version of the Iowa Family Interaction Rating Scales (IFIRS) (children aged 6–12 years; Berge et al., 2014). The MICS was the most utilized observation coding system for MEC and has been highly validated across the literature (Dickstein & Martin, 2002; Jacobs & Fiese, 2007; Janicke et al., 2005; Mitchell et al., 2009).

In terms of self-report measures, seven studies utilized questionnaires to measure MEC. Three studies used items from the Project EAT (Eating Among Teens) survey with adolescents aged 12–17 years (Neumark-Sztainer et al., 2004), and aged 14–18 years (White et al., 2014). One study utilized the About Your Child's Eating-Revised (AYCER) with children aged 12 years (Zeller et al., 2007). One study utilized the Halberstadt Family Expressiveness Questionnaire (FEQ) in addition to an observational measure with children aged 5–7 years (Boyum & Parke, 1995). Two studies utilized a questionnaire completed by the parents developed as part of a larger study with children aged 6 years (Harbec & Pagani, 2018) and aged 5 months to 4 years old (Tremblay & Rinaldi, 2010). The most used survey to measure MEC were the items from the Project EAT survey, but two studies came from the same dataset. Otherwise, there was no commonality in the type of questionnaire used across studies.

4. Discussion

This study aimed to understand which child or adolescent characteristics were associated with MEC, and how MEC has been measured across studies. Overall, a positive association was found between MEC and dietary intake and MEC and weight status/BMI. A negative association between MEC and disordered eating behaviors was found. However, more research is needed to understand the relationship between MEC and developmental outcomes such as aggression, temperament, depression, and academic success. Additionally, to the best of our knowledge, no consistent definition of operationalization of MEC has been identified.

Overall, positive MEC was associated with healthful dietary intake (e.g., higher fruit and vegetable consumption) and less unhealthy food

intake (e.g. less high sugar foods and drinks consumption) among children and adolescents. Notably, associations between healthful dietary intake and MEC were consistent across cross-sectional and longitudinal studies in preschool aged children and adolescents, and in American and Canadian populations. Two of the studies Tremblay and Rinaldi (2010) and Saltzman et al. (2017), used a longitudinal design, suggesting that positive MEC may have long term implications for children's dietary intake. To the contrary, negative MEC was associated with unhealthful dietary intake where two studies found positive association (Fiese et al., 2015; Harbec & Pagani, 2018) and one found no association (Saltzman et al., 2017). However, the two finding an association between MEC and dietary intake were done with school-aged children and used a cross-sectional and longitudinal study design while the one finding no association was conducted with preschoolers and used a longitudinal design. During the toddler and preschool age range, mealtimes may be more stressful for caregivers and children. Specifically, toddlers and preschoolers may seek more independence and therefore refuse to eat at the table, leave the table before the mealtime is over, or refuse to eat which can make observing a positive MEC more difficult if children do not participate in mealtimes (Tynan et al., 2009). As children age and reach school age they have more self-control and social skills around eating (Fiese & Schwartz, n.d.). Moreover, families of older children may expect more structure such as establishing a regular mealtime routine, having a regular family meal where the child eats at the table, or avoid screens and other distractions during mealtime (Fiese et al., 2006; Tynan et al., 2009). These mealtime routines and rituals for older children may help them establish concepts related to MEC such as communication, bonding, affect management, and interpersonal involvement (Fiese & Schwartz, n.d.; Fiese et al., 2006; Tynan et al., 2009). Also, creating a positive MEC involves setting expectations for behavior and the setting of mealtimes in addition to creating routines and consistency (Fiese & Schwartz, n.d.; Eisenberg et al., 2004). These concepts may be hard to grasp and implement with toddlers when compared to school-aged children. However, as infants and toddlers are developing eating behaviors, they reject new foods, have food neophobia, and a preference for certain foods such as sweet and salty foods (Birch & Fisher, 1998). These behaviors are often formed during the transition from a milk diet to an omnivore diet that occurs during early childhood (Birch

& Fisher, 1998). The food environment has a major role on children's food preferences and dietary intake. Caregivers often shape children's experience with food and young children tend to be influenced by and follow the example of their caregiver (Birch & Fisher, 1998). Thus, while infants and toddlers may not be able to readily understand the need for routines and engagement with adult caregivers for a positive MEC, is it still important for families to practice behaviors contributing to a positive MEC with young children as they are developing their food preferences. Additionally, certain child characteristics of interest may be more targeted at specific age groups such as positive language development for preschool-aged children, academic achievement for school-aged children, and substance usage and disordered eating for adolescents. Therefore, research is needed to better understand the factors influencing MEC across different age groups.

Although consistency across study design and population variations strengthens our confidence in findings linking MEC and healthy food intake, these variations may account for some studies finding positive associations while others found none between MEC and unhealthy dietary intake. Therefore, additional studies are warranted for examining different age groups and longitudinal study design to determine the relationship between MEC and unhealthy dietary intake. Regarding the strength of the study design, the correlates currently presented should consider the study design when appropriate. The following correlates were derived from the longitudinal and cross-sectional studies: healthful dietary intake, unhealthy dietary intake, and weight status/BMI. The correlate disordered eating behaviors was derived from cross-sectional studies. Future studies utilizing a longitudinal design are needed to strengthen the evidence of a relationship with MEC on behaviors identified by cross-sectional studies especially with the correlate disordered eating behaviors and other potential child/adolescent correlates. The cross-sectional studies identified in the current review provide valuable insights into the associations between MEC and child/adolescent characteristics. However, due to the study design they are not able to show associations overtime and may be impacted by weaker evidence for a causal relationship.

More negative MEC was correlated with more disordered eating behaviors. All studies were conducted among adolescents and three studies used the same self-report measure of MEC. Future research

is needed to examine the relationship between MEC and disordered eating behaviors for a wider ager range of children. Furthermore, as some associations for MEC and disorder eating behaviors were only found among girls, future studies are needed to examine how MEC is influenced by gender (White et al., 2014). Additionally, since there are gender differences among risk and protective factors, future studies should consider stratification as opposed to controlling for gender. Overall, more research is needed to examine the association between MEC and child temperament (Aviram et al., 2015), mealtime behavioral problems (Mitchell et al., 2004), aggression (Harbec & Pagani, 2018), child prosocial behavior, sociometric ratings (Boyum & Parke, 1995), depression (White et al., 2014), physical activity, and academic success (Harbec & Pagani, 2018). These outcomes were only examined in one study each in terms of association with MEC and thus no conclusions could be drawn. Almost all these potential correlates were associated with indicators of MEC, but given the risk of study design bias, it is unclear whether these factors are truly linked to emotionality during mealtimes. In addition, children's physical activity, academic success and aggression show promising areas of future research as these were examined in a recent study using a longitudinal design (Harbec & Pagani, 2018).

Among included studies, MEC was measured more commonly with direct observation of mealtimes than with parent or primary giver reported questionnaires. However, for direct observation only, three studies (the MICS; Berge et al., 2013; Czaja et al., 2011; Mitchell et al., 2004) used the same coding scheme to assess MEC, limiting our capacity to compare findings across studies. Based on the extant literature, we recommend that future studies consider validating a measure for observational coding of MEC while considering the existing measures' strengths, limitations, target age group and relevance of constructs with MEC. Specifically, the MICS coding scheme has strengths because it allows for direct observation in a natural family mealtime setting, it has been published more often than other coding schemes and validated through construct validity, and allows for coding of interactions occurring between all family members (Mitchell et al., 2009). Additionally, given that five of the seven sub-scales of MICS were directly correlated with MEC, future studies may consider using specific subscales of the MICS when coding for MEC. However, the MICS

is related to overall family functioning and may not include relevant constructs related to MEC that are captured by other observational instruments. Specifically, the Iowa Family Interaction Rating Scales (IFIRS), as adapted by Berge et al. (2014) is another promising measure because it captures relevant MEC constructs such as relationship quality, food hostility, and positive reinforcement. Further, while the MICS focuses on overall family functioning during mealtimes, IFIRS focuses on overall family dynamics in addition to individual parent-child dyads. While self-report measures also have merit, they have yet to be validated to measure MEC. In addition, given that MEC generally seems to be associated with some child or adolescent outcomes, the field needs a common definition and validated and reliable measures for MEC.

This review identified areas where future research would be most beneficial to advance the field of MEC research. As reported MEC has been measured across various age ranges. However, the body of literature examining MEC is lacking in terms of preschool outcomes. More research is needed to examine MEC in the preschool age group. This is an important age range to examine in terms of MEC as various transitions in mealtimes occur during this time- period. Additionally, preschool age is a formative period where children are developing their likes, dislikes, and nutrient intake patterns (Paroche et al., 2017; Skinner et al., 2002). While fostering positive MEC, parents and primary caregivers can offer a promising opportunity for young children to develop healthful eating behaviors that can transition into adolescence and adulthood.

Additionally, future research should examine factors that influence MEC. While the focus of the present study was to determine the correlates of MEC in healthy parents, studies have shown that parental disordered eating (Stein et al., 1994; Stein et al., 2006) and parental mental health such as depression, anxiety, obsessive-compulsive disorder, and chronic conditions such as diabetes can influence MEC (Harbec & Pagani, 2018; Stein et al., 2006). Specifically, Stein et al. (1994) found that mothers who experienced eating disorders displayed more negative emotions during meals, more conflictual mealtimes, and their infants were at the lower end of the BMI percentile. In terms of parental mental health, Harbec and Pagani (2018) found that higher levels of maternal depression predicted lower quality of the family meal

environment. One study found that lower parental BMI was correlated with dinner rituals that are attributes a positive MEC (Wansink & van Kleef, 2014). However, another study found that less media usage and more dinnertime routines which are both aspects of a positive MEC were associated with child BMI but not parent BMI (Horning et al., 2017). Additionally, Wendt et al. (2015) found that MEC was not correlated with any maternal weight status or fathers who were obese or overweight. However, fathers who were overweight were more likely to control feeding during mealtimes (Wendt et al., 2015). In a study of families that were food insecure, more positive MEC was linked to lower emotional overeating for children (Eagleton et al., 2021). Therefore, given that this study has established a relationship between MEC and child dietary and weight outcomes, future studies are needed to address and better understand the role of factors such as parental mental and physical health as a distinct influence on MEC.

The current review was limited to articles published in English or an English translation was available. Thus, relevant international research on the topic may have been missed. Additionally, as a consistent definition of MEC is missing it may have led to exclusion of literature examining this topic. To address this limitation, a wide range of search terms were used to capture research examining emotions present during mealtimes. Additionally, publication bias and methodological issues in primary studies and article selection bias were limitations. These occurrences may have influenced the results of the current study such that previous studies did not find statistical significance between MEC and child outcomes may not have been published and thus were not included in the current examination. Additionally, due to selection bias all articles on the topic may not have been found in the databases to be included in the current review. Further, the present systematic review was unable to estimate the effect from each study as is done in a meta-analysis.

5. Conclusions

While no mutual definition or commonly identified measure of MEC was found, differing operationalizations has the potential to advance the field of work on MEC. As researchers are working with different

data sets, age groups, settings, and may be interested in various aspects of MEC it is important for them to be able to operationalize MEC as it best attunes to their specific research question. In terms of the association between MEC and child outcomes, evidence is present for dietary intake, disordered eating behaviors and weight status/BMI. Research suggests it is important to not only study the frequency of family meals but also the impact of MEC on children's physical activity, academic success, and aggression as mealtimes are a time to encourage communication, bonding, and monitoring (Harbec & Pagani, 2018). However, more research is needed to examine the impact of MEC on psychosocial child outcomes such as depression, temperament, and aggression. There is also a need for research examining MEC in the preschool age group, more longitudinal study designs, and outside the home setting.

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