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Parenting styles and body mass index: A systematic review of prospective studies among children

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Abstract

Background—Parenting style may be an important determinant of an individual's future weight status. However, reviews that evaluate the relationship between parenting style and weight-related outcomes have not focused on prospective studies.

Methods—We systematically searched PubMed, Embase, and PsychInfo for studies published between 1995-2016 that evaluated the prospective relationship between parenting style experienced in childhood and subsequent weight outcomes.

Results—We identified eleven prospective cohort studies. Among the eight studies that categorized parenting style into distinct groups (i.e. authoritative, authoritarian, permissive, and neglectful), five provided evidence that authoritative parenting was associated with lower body mass index gains. Among the six highest quality studies, four suggested a protective role of authoritative parenting style against adverse weight-related outcomes. However, only one study controlled for a comprehensive set of confounders, and the small number of studies conducted within certain age groups precluded our ability to ascertain critical periods when parenting style is most strongly related to child weight.

Conclusions—The present literature supports the idea that authoritative parenting may be protective against later overweight and obesity, although findings are mixed. More prospective cohort studies of longer durations, with more sophisticated methods that examine age-varying relationships, and that control for a comprehensive set of confounders, are needed.

Keywords

parenting style; dietary intake; obesity; children

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Introduction

Obesity among children has negative mental and physical repercussions, which are both immediate and delayed. Obesity is associated with concurrent low self-esteem, depression, stigma, and decreased quality of life.¹ However, obesity's most significant impacts may not be realized until after an individual exits youth. The onset of physical disorders—such as type 2 diabetes—in obese children results in an acceleration of disease later in life.^{2, 3} Even when such conditions do not emerge during childhood, these individuals are more likely to remain obese in adulthood and suffer associated health complications.³ Considering approximately 17% of U.S. children are obese,⁴ these costs are substantial.

The family environment influences the formation of health practices that persist throughout life.⁵⁻⁸ Therefore, we need to further understand the evidence regarding how the family context influences weight-related outcomes—and parenting styles are part of this context.⁹ Parenting style describes the general interactions between a parent and child. Initially defined by Baumrind in 1966 and expanded upon by Maccoby and Martin, four parenting styles occur along two dimensions: responsiveness and demandingness, sometimes also referred to as warmth and control.^{10, 11} Responsiveness entails nurturing and warmth, whereas demandingness is characterized by establishing and enforcing boundaries. The four general parental styles include the responsive but demanding authoritative parents, the unresponsive and demanding authoritarian parents, the responsive and undemanding permissive parents, and the neither responsive nor demanding neglectful parents (Figure 1).^{10, 11}

Parenting styles are important to study in the context of childhood obesity because: 1) Parenting styles are correlated with outcomes that impact eating behaviors and physical activity; and 2) Their classification schema provides a clear intervention target. Although not all, some prospective and cross-sectional studies have demonstrated associations between experienced parenting style and various psychological outcomes that influence physical activity and eating behaviors,¹²⁻¹⁴ including self-control, depression, and risk-taking behaviors.¹⁵⁻¹⁷ Our hypotheses regarding how parenting style influences weight status are best understood through the influence of parenting style on self-regulation. According to the resource model of self-control,¹⁸ when a child's innate self-regulatory responses are overridden by parental constraints, the child depletes her or his capacity to exercise self-control; this depletion carries into various self-control domains, including eating behaviors and physical activity patterns. Applying Baumrind's and Maccoby and Martin's definition of parenting styles,^{10, 11} constraints could include: 1) insufficient opportunities to exert self-regulation as characterized by the low demandingness of neglectful or permissive parents; and 2) too many expectations that override child self-control as characterized by the unresponsive demandingness of authoritarian parents. Indeed, observational studies have supported this resource model of self-control and demonstrated the associations of permissive, neglectful, and authoritarian parenting with low self-control,¹⁹⁻²¹ as well as the relationship between authoritative parenting and high self-control.^{15-17, 22} Studies have also demonstrated an association between neglectful parenting and higher rates of depression and poorer psychosocial development.^{15, 22} The psychological outcomes of self-control, depression, and psychosocial development are each associated with physical activity and

eating habits.¹²⁻¹⁴ Thus, parenting style may have a role in establishing life-long healthy diet and activity habits that influence later weight status.

However, reviews that evaluate the relationship between parenting styles and weight-related outcomes have not focused on prospective cohort studies; rather, they have largely evaluated cross-sectional evidence.^{23, 24} In 2011, Sleddens and colleagues published a systematic review regarding the relationship between parenting style and weight-related behaviors and outcomes. Of the 36 studies included in this review, only seven were prospective cohort studies.²⁵ In another review, Vollmer and colleagues identified 40 studies regarding the influence of parenting style on childhood obesogenic behaviors and body weight, of which eight were prospective.¹⁴ Based on primarily cross-sectional evidence, both reviews suggested that children raised in authoritative homes had lower body mass index (BMI) levels compared to children raised with other styles.^{14, 25} These reviews also concluded that a focus on prospective studies is needed to better understand these relationships.^{14, 25, 26} Cross-sectional data bear several limitations, including the inability to establish temporality. Scholars suggest that the relationships between parenting and child weight are bi-directional,²⁶⁻²⁹ and thus a major limitation of this literature is its inability to describe the interplay between parenting styles and obesity risk.

Additional prospective cohort studies have been conducted in this area since Sleddens' and Vollmer's reviews were published. Moreover, reviews in this area have focused on weight-related behaviors in general rather than weight outcomes specifically. Therefore, the aim of this paper is to provide a comprehensive review of the existing prospective cohort studies that examine the relationship between parenting styles and subsequent weight-related outcomes. Through this aim, we seek to answer two questions: 1) Is authoritative parenting associated with less BMI gains and lower likelihood of later overweight/obesity compared to authoritarian, permissive, and neglectful parenting styles; and 2) Are there critical ages where parenting style has a more pronounced association with later weight outcomes?

Methods

Search strategy

Studies in this review evaluated the prospective relationship between parenting style experienced in childhood and subsequent weight outcomes. We systematically reviewed the literature using a protocol informed by the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines to search research databases, screen published studies, apply inclusion and exclusion criteria, and select relevant literature for review.³⁰ We searched for articles published in English, peer-reviewed journals from January 1st, 1995 to March 7th, 2016 in PubMed, Embase, and PsychInfo databases. We developed the search syntax in collaboration with a reference librarian (Supplemental Table 1). Briefly, our queries included the following terms, their cognates, and synonyms: children AND parenting style AND weight AND prospective. We also reviewed the reference lists of included texts for relevant studies to include.

Inclusion/exclusion criteria

We included cohort studies which appraised both the “demandingness” and “responsiveness” dimensions of parenting style at baseline and reported a weight-related outcome (e.g. BMI, obesity, weight change) during follow-up. To maintain comparability across studies, we restricted our analysis to studies that measured general parenting style according to Baumrind's classification,³¹ which requires studies to assess both demandingness and responsiveness. Parenting style experienced in childhood needed to be measured when the child was less than 18 years of age or prior to the end of high school. To be included in this review, articles also had to be peer-reviewed full report and be published in English. Following these inclusion criteria, we excluded studies that were book chapters, reviews, letters, abstracts, or dissertations; or any cross-sectional or retrospective analyses.

Study selection and data extraction

We used Covidence, an online platform, to manage screening and selections of studies. Two reviewers (RLS and BQ) completed an initial independent screen of all titles and abstracts retrieved from the database searches, and independently reviewed the full texts of studies. A third reviewer (JMP) resolved any conflicts at both stages. In an effort to prevent the false exclusion of a relevant study, among any conflicted decisions in which the third reviewer moved to exclude the study, all three reviewers discussed the article and came to a consensus.

After reviewing the full texts of studies, the research team developed a data extraction tool to capture the necessary information, and extraction fields included: study and participants' characteristics, assessment methods of parenting style and weight-related outcome, statistical methods, and findings. To answer our first research question— Is authoritative parenting associated with less BMI gains and lower likelihood of overweight/obesity?—we extracted data regarding weight-related outcomes. To answer our second research question— Are there critical ages where parenting style has a more pronounced association with later weight outcomes?—we stratified studies into three timeframes based on the baseline/follow-up age of included studies and cohort duration: 1) Early childhood to early/mid-childhood (cohorts spanning two to three years between the ages of birth and ten years); 2) early childhood to adolescence (cohorts spanning nine or more years between the ages of birth and sixteen years); and 3) adolescence to young adulthood (cohorts spanning five years between the ages of fifteen and twenty-two). One reviewer (RLS) extracted data from all studies that passed the research team's full-text review, and two reviewers (BQ and JMP) confirmed the extraction to ensure that the first author recorded proper and accurate information. The team resolved any discrepancies through discussion and consensus.

Quality assessment

After extracting data from the included full texts, the research team developed a quality assessment tool, modified from the Newcastle-Ottawa Quality Assessment Scale for Cohort Studies.³² This tool assesses the quality of observational studies with regards to: 1) Selection of participants and generalizability of findings; 2) Accounting for potential confounders; 3) Measurement of the exposure; and 4) Measurement of the outcome. We assessed each reviewed article on fifteen yes/no questions that spanned these four domains. We allotted

articles one point for each respective question it addressed, for fifteen possible points per article. Two reviewers (RLS and BQ) independently applied the quality assessment checklist to each individual study, and a third reviewer (JMP) resolved discrepancies.

Results

Study selection

The electronic search of databases returned 1,277 references—of which 167 were duplicates—resulting in 1,110 studies. In the initial title and abstract screen, the research team deemed 1,042 studies irrelevant, leaving 68 full-texts to review. We retained and abstracted nine studies. From searching the reference lists of these nine included studies, we found two additional studies to include, yielding a total of eleven studies in this systematic review. We present exclusion reasons along with the inclusion flow diagram in Figure 2.

Study characteristics

Table 1 depicts various study characteristics from eleven studies that span seven unique cohorts. Study populations consisted of children from the United States (n=7), and Australia (n=4). Sample sizes from these populations ranged from 69 to 12,550 participants. At baseline, the majority of studies comprised preschool-aged children age two to five years (n=6), followed by school-age children age six and older (n=3), and infants and toddlers age zero to two years (n=2). Length of follow up ranged from one to eleven years, with a median of three years. With regards to our predictor of interest, researchers measured parenting style via six different instruments across the eleven studies, and conceptualized parenting style as either: 1) four (or three) distinct categories (n=7); 2) scores on a *responsiveness* and *demandingness* dimension (n=3); or 3) a combination of the two approaches (n=1) (Table 2). The majority of studies assessed maternal parenting style (n=7), followed by maternal and paternal parenting style (n=4); no studies exclusively assessed paternal parenting style. Six studies assessed parenting style via parent self-report, three studies via a combination of parent self-report and researcher observation, and two studies via adolescent report.

Association between parenting style and weight

Table 2 presents the findings of each study regarding whether certain parenting style categories and/or dimensions were risk factors for, protective against, or exhibited no relationship with adverse weight-related outcomes. The table also includes the studies' statistical approaches and methods for operationalizing parenting style.

Parenting style categories—Among the eight studies that categorized parenting style into distinct groups (i.e. authoritative, authoritarian, permissive, and neglectful), five studies provided evidence that maternal and/or paternal authoritative parenting was associated with lower BMI gains and risk of obesity among boys and/or girls in comparison to at least one other parenting style.³³⁻³⁷ Two studies found no association between authoritative parenting and weight-related outcomes,^{38, 39} while one study found evidence that authoritative parenting was associated with higher gains in overweight/obesity compared to neglectful parenting.⁴⁰

While five studies found evidence that authoritative parenting was protective against adverse weight-related outcomes, this was usually in comparison to certain parenting styles, not all other parenting styles (e.g. authoritative parenting was protective compared to authoritarian parenting, but not compared to permissive parenting). Only one, two-year study among 872 children in the United States found evidence that authoritative parenting was associated with smaller gains in overweight/obesity prevalence compared to all other parenting styles.³⁷ In Fuemmeler and colleagues analysis of 12,550 adolescents over seven years, they found that authoritarian and neglectful—but not permissive—parenting styles were associated with less leveling off of BMI compared to authoritative parenting style.³³ In a nine-year prospective cohort study of 1,238 children in the United States, Lane and colleagues demonstrated that maternal authoritative parenting style was associated with a lower likelihood of being in an elevated BMI percentile class than a stable class compared to permissive parenting, but not compared to authoritarian or neglectful parenting.³⁶

Moreover, authoritative parenting was not the only parenting style associated with lower risk for overweight/obesity. In a study of 69 low-income Mexican American children followed over three years, maternal authoritative *and* authoritarian parenting were associated with decreases in the prevalence of child overweight/obesity compared to permissive parenting.³⁴ In an eleven-year study of 778 United States children, Connell and colleagues demonstrated that maternal permissive or authoritative parenting styles were associated with lower gains in BMI compared to neglectful or authoritarian parenting for boys, but there was no association for girls.³⁵

Parenting style dimensions—Four studies conducted among Australian children conceptualized parenting style along the responsiveness (defined as warmth and nurturance; a characteristic of both authoritative and permissive parenting) and demandingness (defined as boundary-setting; a characteristic of both authoritative and authoritarian parenting) dimensions, but the evidence was less consistent than studies using the four parenting-style dimensions. Two of these studies were small ($n=201$ & 79) and found that neither responsiveness nor demandingness were associated with child BMI z-score one year later ($p>0.05$).^{41, 42} Two other studies were able to detect associations between parenting and weight outcomes for mothers or fathers, yet these associations differed across the studies.^{40, 43} Taylor and colleagues found among 4,934 children followed over two years that paternal responsiveness was positively associated with the risk of being in a higher weight category (OR = 1.54; 95% CI: 1.16–2.06), but paternal demandingness and maternal responsiveness and demandingness were not.⁴⁰ However, a smaller study ($n=117$) found that maternal demandingness, but not responsiveness, was negatively associated with BMI Z score one year later ($\beta=-0.20$; $p<0.05$).⁴³

Findings stratified by age categories

Table 3 stratifies findings of the studies that categorized parenting styles by timeframe. Among the three short-term studies that followed children from early childhood to early/middle childhood and measured parenting style categorically, two studies found evidence for the protective role of authoritative parenting,^{34, 37} and one found evidence for its risk factor role.⁴⁰ Similarly, among three long-term studies that followed children from infancy/early

childhood to early adolescence, two found evidence for the protective role of authoritative parenting,^{35, 36} and the other found no association between authoritative parenting and later weight outcomes.³⁸ Lastly, among the studies that followed children from adolescence to early adulthood (n=2), one study found evidence for the protective role of authoritative parenting,³³ and another study found no significant effect of authoritative parenting on later overweight/obesity risk.³⁹ This same pattern of evidence exists for permissive, neglectful, and authoritarian parenting styles.

Findings among the seven unique cohorts

Among the eleven included studies, there were seven unique cohorts. Studies that observed the same cohort each evaluated weight at different stages of child development and so measured a unique relationship. For instance, among the studies that employed data from the Study of Early Child Care and Youth Development (SECCYD), the age of the cohorts spanned 4.5-6.5 years,³⁷ 2.0-11.0 years,³⁶ and 4.5-15.5.³⁵ For these different age spans within the same cohort, different findings emerged regarding the relationship between parenting style and future weight outcomes (Table 2), yet all found that authoritative parenting was associated with lower BMI gains or risk of obesity compared to at least one other parenting style. If we only consider one article per unique cohort, three out of six studies which categorized parenting style into distinct groups found authoritative parenting protective against obesity-related outcomes compared to other parenting styles.

Quality assessment

As illustrated in Table 4, the quality of studies varied across this review. Three studies scored twelve out of fifteen points on our quality assessment tool.^{36, 37, 40} When we consider the six studies that scored an eight or higher out of fifteen on the quality assessment,^{33, 35-37, 39, 40} four suggest a protective role of authoritative parenting style against adverse weight-related outcomes.^{33, 35-37}

While the overall scores on the quality assessment varied, reviewed studies were similar in their scoring on several items. Loss to follow-up was high (>30%) in seven out of these eleven prospective studies, and it was unclear in all but two studies^{35, 42} if characteristics of lost participants were independent of parenting styles. Ten out of the eleven studies controlled for the weight outcome at baseline as well as clearly described the analytic sample's characteristics.^{33-37, 39-43} Nine of the studies also used either a previously validated method for assessing parenting style, or reported psychometric properties of their assessment method.^{34-39, 41-43}

However, only four out of the eleven studies adjusted for all key confounders (age, sex, race/ethnicity, and socioeconomic status),^{33, 37, 39, 40} and only one study considered a comprehensive list of potential confounders which included other parent's parenting style, maternal or paternal weight status, and family structure.⁴⁰ Three of the four studies that assessed both maternal and paternal parenting style found no association for maternal parenting style after adjusting for paternal parenting style.³⁸⁻⁴⁰ Moreover, for the five studies that found that authoritative parenting style was significantly associated with more favorable

weight outcomes,³³⁻³⁷ four examined only maternal parenting style,³⁴⁻³⁷ and one assessed parenting style for both parents, but represented this as a single measure.³³

Discussion

Exploring the relationship between general parenting style and weight-related outcomes has been a popular line of inquiry.^{25, 26, 44} However, the vast majority of this work has been cross-sectional,⁴⁴ which inhibits the ability to establish temporality and explore potential critical periods of development during which parenting style might have differential influence on weight status.²⁶⁻²⁹ The present review is the first review to exclusively collate the prospective evidence of the relationship between general parenting style and weight-related outcomes in order to address the shortcomings of cross-sectional data.

With regard to our first research question, although there is a suggestion that authoritative parenting is associated with smaller gains in BMI and a lower likelihood of overweight/obesity, the findings of 11 prospective studies were heterogeneous. Moreover, these associations between parenting styles and obesogenic behaviors and environments are based largely on observational evidence; a causal mechanism—if it exists—remains to be elucidated. Yet, there are various mechanisms that may explain this potential relationship, including the associations between parenting styles and healthy eating,⁴⁵⁻⁴⁷ physical activity,^{48, 49} and screen time.^{50, 51}

Previous work has demonstrated the negative association between authoritative parenting and obesogenic home environments.⁵² Authoritative parents are both responsive and demanding, which may elicit self-control behaviors in children that subsequently foster healthy eating behaviors, physical activity patterns, and weight status.¹⁵⁻¹⁷ In their study of first-grade children, Rhee and colleagues posited several explanations for this relationship.³⁷ With regard to diet, parents with responsive demandingness (i.e. authoritative parents) may foster a capacity in the child for regulating eating behavior by considering the child's developmental abilities. In juxtaposition, parents with high levels of unresponsive demandingness (i.e. authoritarian parents) may establish defined rules regarding eating—such as requiring the child to clean his or her plate—which may thwart a child's exercise of self-control over eating. With respect to physical activity patterns, parents with high levels of demandingness may create high expectations that their child exercises—resulting in the child losing the desire to exercise. However, parents with high levels of responsiveness understand their child's interests and are able to encourage physical activity naturally without strict rules.³⁷

Although the relationship between parenting style and weight outcomes appears strong in reviews that have focused on cross-sectional studies,^{14, 25} our focus on longitudinal studies shows findings are more inconsistent and mixed. Even with a prospective study design, studies included in this review may suffer from uncontrolled confounding. Only one included study considered a comprehensive list of potential confounders which included other parent's parenting style, maternal or paternal weight status, and family structure.⁴⁰ The omission of these potentially important confounders may explain some of the observed heterogeneity between study findings. Four of the six highest quality studies suggested a

protective role of authoritative parenting style against adverse weight outcomes,^{33, 35-37} and five of the eight studies that categorized parenting style into distinct groups provided evidence that authoritative parenting was negatively associated with adverse weight outcomes.³³⁻³⁷ However, all but one of these studies examined maternal parenting style exclusively.³⁴⁻³⁷ Among all eleven studies included in the review, four assessed both maternal and paternal parenting style, and three of these four studies found no association for maternal parenting style after adjusting for paternal parenting style.³⁸⁻⁴⁰ Therefore, failing to assess all parents' parenting styles may bias results, as evidenced by the finding that among the highest quality study that measured both maternal and paternal parenting styles, paternal parenting had a different relationship with child weight compared to maternal parenting.⁴⁰ No studies reported the relationship between maternal and paternal parenting styles, so the interplay of parenting by the mother and the father remains unclear. More work needs to be done that considers paternal styles both independently and in combination with maternal parenting style and considers confounding factors more carefully.

The evidence surrounding our second research question is inconclusive. There may be critical ages where parenting style has a more pronounced association with later weight outcomes,⁵³ but this was not discernable from the present studies. When we stratified findings by age categories, we found no apparent pattern for the risk or protective nature of specific parenting style categories within different age cohorts, but this may be because there were only a couple of studies in each age range. Moreover, many of the studies only assessed parenting style at baseline and outcome at the end of follow-up; for these analyses we might not see the differences in the relationship that occur at different ages during follow-up. More prospective cohort studies of greater durations and with more sophisticated methods that examine the time-varying or age-varying nature of the relationships are likely needed to ascertain such critical periods. However, of note is that for different age spans within the same cohort, different findings emerged regarding the relationship between parenting style and future weight outcomes. This suggests that obesity and weight gain are dynamic, and the relationship between parenting style experienced in childhood and later weight status may change over time.

There were a number of strengths and limitations to this review. Comparability across studies is limited by differences in the assessment methods and measures of parenting style across different studies, particularly in terms of the use of self-report *vs* direct observation and reporting by either the parent or the child. Further, different analytic methods and adjustment variables make comparisons of findings difficult. Inconsistencies across studies might be related to differences in study populations and characteristics or to limited power among smaller cohorts. Because of variation in the referent parenting style for comparisons, variable ways of measuring the weight outcome (i.e. categorical values of weight status *vs* change in BMI), and inconsistent statistical methods and reporting of results (i.e., 3 studies reported odds ratios, 3 beta coefficients, and the remainder reported only *p*-values), we were unable to conduct a meta-analysis. Based on the observational nature of the included studies, we are unable to make conclusions regarding the causal relationship between experienced parenting styles and weight-related outcomes. Yet, our focus on prospective studies provides insight into this relationship and an establishment of temporality that reviews of cross-

sectional studies lack. Moreover, our comprehensive study search, rigorous data extraction process, and overall adherence to PRISMA guidelines for systematic reviews provides credibility to our findings. Our review included 5 new studies not included in the previous review by Vollmer and Mobley¹⁴ and 7 new studies relative to the previous review by Sleddens and colleagues.²⁵ Further, to increase comparability and focus of included studies, we excluded longitudinal studies that did not assess weight outcomes yet were included in prior systematic reviews.

Similar to other reviews in the area of parenting style and weight outcomes, we found that parents from minority populations were underrepresented.⁴⁴ Moreover, analyses in the presently included articles did not attend to the nuances of family structure, such as one-parent households, non-biological caregivers, dual mother parenting, or dual father parenting. Additionally, all studies were conducted in the United States or Australia. Moving forward, the field would benefit from studying more diverse samples of parents and family structures. Authoritative parenting may be protective against later overweight and obesity, but to better define this relationship, future studies should consider paternal styles both independently and in combination with maternal parenting style, conduct studies of a longer duration to allow the assessment of the critical period to intervene, more carefully control for child-related and parent-related confounding factors, and account for the nuances in family make-up and structure.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Abbreviations

BMI	body mass index
SECCYD	Study of Early Child Care and Youth Development
LSAC	Longitudinal Study of Australian Children

	Low responsiveness <i>Parent is parent-centered</i>	High responsiveness <i>Parent is child-centered</i>
Low demandingness <i>Parent expects little of child</i>	Neglectful parenting <i>Parent is uninvolved with child</i>	Permissive parenting <i>Parent is indulgent toward child</i>
High demandingness <i>Parent expects much of child</i>	Authoritarian parenting <i>Parent is power-assertive over child</i>	Authoritative parenting <i>Relationship between parent and child is reciprocal</i>

Figure 1. Parenting style matrix

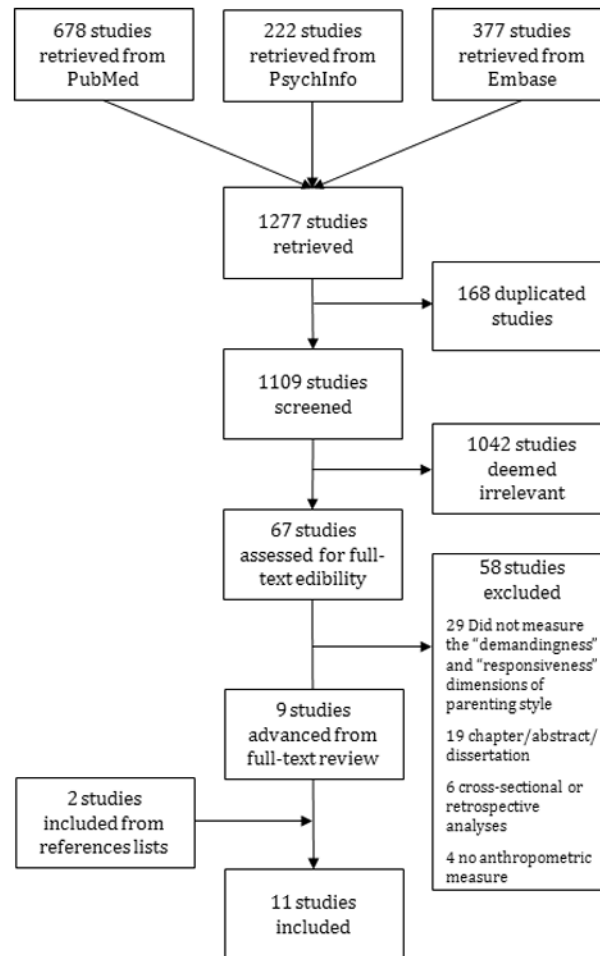


Figure 2. PRISMA tree of search for studies that evaluate the prospective relationship between parenting style experienced in youth and subsequent weight outcomes

Table 1
Characteristics of 11 prospective cohort studies included in the systematic review

Authors, year	Study Name	Country	Sample Size ^d	Girls % ^a	Age ^{a,b}	Follow -up, y	Parent measured/Reported by	Parenting Style Assessment
Taylor et al., 2011 ⁴⁰	LSAC	Australia	4,934	49.1	4 and 5	2	Both/Both	Dichotomized on: responsiveness (6 items adapted from the Warmth subscale of the Child Rearing Questionnaire) and demandingness (1 item adapted from the Control subscale of the parenting style questionnaire from the LSAC)
Bergmeier et al., 2015 ⁴²	(Not presented)	Australia	79	54.4	3.1 (0.8)	1	Mother/Mother	Individual scores on: responsiveness and demandingness subscales of the parenting style questionnaire from the LSAC
Bergmeier et al., 2014 ⁴¹	(Not presented)	Australia	201	57.7	2.9 (0.8)	1	Mother/Mother	Individual scores on: responsiveness and demandingness subscales of the parenting style questionnaire from the LSAC
McPhie et al., 2012 ⁴³	(Not presented)	Australia	117	53.9	2.8 (0.7)	1	Mother/Mother	Individual scores on: responsiveness and demandingness subscales of the parenting style questionnaire from the LSAC
Fuennmeler et al., 2012 ³⁵	Add Health	USA	12,550	49.0	15.7 (1.8)	7	Both/Adolescent	Factor analysis on: 6 items measuring familial and parental acceptance and 7 items measuring parental control or monitoring
Olvera and Power, 2010 ³⁴	Al Bienstar del Nino	USA	69	52.2	6.8 (1.4)	3	Mother/Mother	Dichotomized on: responsiveness and demandingness subscales of the Parenting Dimension Inventory
Connell and Francis, 2014 ³⁵	NICHD SECCYD	USA	778	52.0	4.5	11	Mother/Researcher and mother	Dichotomized on: maternal responsiveness (composite of 3 scales of supportive presence, respect for autonomy, and reversed reflected hostility) during behavioral interaction tasks, and maternal demandingness (11 items)
Lane et al., 2013 ³⁶	NICHD SECCYD	USA	1,238	48.9	2 ^c	9	Mother/Researcher and mother	Dichotomized on: maternal responsiveness (composite of 3 scales of supportive presence, respect for autonomy, and reversed reflected hostility) during behavioral interaction tasks, and maternal demandingness (11 items)
Rhee et al., 2006 ³⁷	NICHD SECCYD	USA	872	51.0	4.5	2	Mother/Researcher and mother	Dichotomized on: maternal responsiveness (composite of 3 scales of supportive presence, respect for autonomy, and reversed reflected hostility) during behavioral interaction tasks, and maternal demandingness (11 items)
Berge et al., 2010 ³⁹	Project EAT	USA	2,516	55.1	14.8 (0.8)	5	Both/Adolescent	Dichotomized on: responsiveness (2 items measuring caring and communication) and demandingness (1 item)
Agras et al., 2004 ³⁸	(Not presented)	USA	150	50.7	0	9.5	Both/Both	Individual scores on: permissive, authoritarian, and authoritative parenting

Authors, year	Study Name	Country	Sample Size ^a	Girls % ^a	Age ^{a,b}	Follow -up, y	Parent measured/Reported by	Parenting Style Assessment from the Parental Authority Questionnaire (30 items per parent)

EAT, Eating Among Teens; IOTF, International Obesity Task Force; LSAC, Longitudinal Study of Australian Children; NICHD, National Institute of Child Health and Human Development; SD, standard deviation; SECCYD, Study of Early Child Care and Youth Development

^aReported for baseline sample

^bAge at baseline for age-homogenous sample or Mean (SD) for age-heterogeneous sample.

^cParenting style was measured at age 4.5

Table 2

Results of eleven prospective cohort studies for the association between parenting style and weight-related outcome.

Authors, study name (if available)	Parenting Style Method	Outcome ^a	Statistical method: adjustment	Findings
Taylor et al, LSAC ⁴⁰	Responsiveness score (6-30 points);Demandingness score (5-25 points) Authoritative (high responsiveness/high demandingness); Authoritarian (low responsiveness/high demandingness); Permissive (high responsiveness/low demandingness); Disengaged (low responsiveness/low demandingness)	Weight status: under/normal weight, overweight, obese using IOTF age- and gender-specific cutoffs	Ordinal regression: gender, Socioeconomic Index for Areas, parental weight status, parental education, presence of two parents in the household, number of siblings, other parent's parenting style, baseline weight status, parent irritability, non-English spoken at home,	Paternal responsiveness was associated with increased risk of being in a higher weight category (OR = 1.54; 95% CI: 1.16–2.06). Paternal demandingness and maternal demandingness/ responsiveness was not associated with weight category ($p>0.05$) Paternal disengaged parenting style was associated with a decreased risk (OR = 0.51; 95% CI: 0.27-0.96) compared to authoritative parenting style, while paternal authoritarian or permissive parenting style or maternal parenting styles were not associated with the risk for overweight or obesity ($p>0.05$).
Bergmeier et al (2015) ⁴²	Responsiveness score (6-30 points);Demandingness score (5-25 points)	BMI Z score	Linear regression: baseline BMI Z score, maternal concern about child weight	Maternal responsiveness (warmth) and demandingness (control) were not associated with child BMI Z score ($p>0.05$).
Bergmeier et al (2014) ⁴¹	Responsiveness score (6-30 points);Demandingness score (5-25 points)	BMI Z score	Linear regression: family income, maternal education, maternal BMI, baseline child BMI Z score, child temperament, and mother-child dysfunctional interaction	Maternal responsiveness (warmth) and demandingness (control) were not associated with child BMI Z score ($p>0.05$).
McPhie et al ⁴³	Responsiveness score (6-30 points);Demandingness score (5-25 points)	BMI Z score	Path analyses: family income, maternal education, maternal BMI, baseline child BMI Z score, maternal child-feeding practices, mother-child dysfunctional interaction, child food habits, and change in child eating behaviors	Low maternal demandingness was associated with greater increase in BMI Z score ($\beta=-0.20$; $p<0.05$); responsiveness was not associated with change in child BMI Z score.
Fuemmeler et al, Add Health ³³	Authoritarian (high demandingness);Disengaged (low responsiveness);Permissive (low demandingness);Balanced (mean levels of demandingness and responsiveness)	BMI	Latent growth models: gender, race, parental education and family structure	Parental authoritarian ($\beta=-0.23$, $p<0.05$) and disengaged ($\beta =-0.33$, $p<0.05$) parenting styles were associated with a less steep average BMI increase (linear), but less leveling off (quadratic) of BMI compared to the balanced parenting style; permissive parenting style was not associated with BMI trajectories ($p>0.05$).

Authors, study name (if available)	Parenting Style Method	Outcome ^a	Statistical method: adjustment	Findings
Olvera and Power, Al Bienstar del Nino ³⁴	Authoritative (high responsiveness/high demandingness); Authoritarian (low responsiveness/high demandingness); Indulgent (high responsiveness/low demandingness); Uninvolved (low responsiveness/low demandingness);	Weight status: normal weight, overweight, obese	Analysis of covariance: gender and baseline weight status	Maternal indulgent parenting style was associated with increases in the prevalence of child overweight/obesity compared to authoritative ($p<0.05$) and authoritarian ($p<0.05$) parenting styles, but not compared to uninvolved parenting ($p>0.05$).
Connell and Francis, NICHD SECCYD ³⁵	Authoritative (high responsiveness/high demandingness); Authoritarian (low responsiveness/high demandingness); Permissive (high responsiveness/low demandingness); Neglectful (low responsiveness/low demandingness)	BMI	Mixed effects models, gender stratified: family income-to-needs ratio, mother's education, pubertal status, time (age), self-regulation, and interactions of parenting style, time, and self-regulation	For boys, maternal neglectful or authoritarian parenting styles were associated with higher gains in BMI compared to permissive or authoritative styles ($p<0.05$); for girls, maternal parenting style was not associated with the rate of growth in BMI ($p>0.05$).
Lane et al, NICHD SECCYD ³⁶	Authoritative (high responsiveness/high demandingness); Authoritarian (low responsiveness/high demandingness); Permissive (high responsiveness/low demandingness); Neglectful (low responsiveness/low demandingness)	BMI percentile	Growth mixture models: family income, maternal depression, positive parenting, and prenatal smoking	Maternal permissive parenting style was associated with higher likelihood of being in the elevated BMI percentile class than the stable class (OR = 2.85; 95% CI: 1.20, 6.78; $p = 0.009$) compared to authoritative style, while authoritarian and neglectful parenting styles were not.
Rhee et al, NICHD SECCYD ³⁷	Authoritative (high responsiveness/high demandingness); Authoritarian (low responsiveness/high demandingness); Permissive (high responsiveness/low demandingness); Neglectful (low responsiveness/low demandingness)	Weight status: non-obese, obese ^b	Logistic regression: race and income/needs ratio, and sensitivity analysis adjusted for baseline BMI	Authoritarian, permissive, and neglectful parenting styles were associated with greater risk of being obese (authoritarian OR: 4.88; 95% CI: 2.15–11.10; $p=0.001$; permissive OR: 2.84; 95% CI: 1.10–7.35; $p=0.03$; neglectful: OR: 2.67; 95% CI: 1.12–6.38; $p=0.03$) compared to authoritative parenting style.
Berge et al, Project EAT ³⁹	Authoritative (high responsiveness/high demandingness); Authoritarian (low responsiveness/high demandingness); Permissive (high responsiveness/low demandingness); Neglectful (low responsiveness/low demandingness)	BMI	Linear regression, gender stratified: age, ethnicity, socioeconomic status, baseline BMI and other parent's parenting style	Authoritarian, permissive, and neglectful parenting styles were not associated with a higher BMI compared to authoritative parenting ($p=0.361-0.626$).
Agras et al ³⁸	Authoritarian score (10-50); Authoritative score (10-50); Permissive score (10-50)	Weight status: under/normal weight, overweight/obesity	Logistic regression: (Not presented)	Parenting style was not associated with the risk of being overweight/obese.

^aBMI Z score, BMI percentile, weight status used CDC sex-specific BMI-for-age growth charts unless otherwise specified

^bPresent authors revised the designation of BMI 95th percentile for age and gender from “overweight” used by Rhee and colleagues to “obesity” to match current obesity criteria

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Table 3

Findings of 8 prospective cohort studies for the risk or protective nature of parenting style categories, by participant age timeframe.

Age timeframe	Authors, study name	Age span, in years	Authoritative	Permissive	Neglectful	Authoritarian
Early Childhood to Early/Mid-Childhood	Taylor et al, LSAC ⁴⁰	4.5-6.5	Risk	NS	Protective	NS
	Rhee et al, NICHD SECCYD ³⁷	4.5-6.5	Protective	Risk	Risk	Risk
Early Childhood to Adolescence	Olvera and Power, AI Bienstar del Nino ³⁴	6.8-9.8	Protective	Risk	NS	Protective
	Agras et al ³⁸	0-9.5	NS	NS	NS	NS
	Lane et al, NICHD SECCYD ³⁶	2.0-11.0	Protective	Risk	NS	NS
Adolescence to Young Adulthood	Connell and Francis, NICHD SECCYD ^{35a}	4.5-15.5	Protective/NS	Protective/NS	Risk/NS	NS/NS
	Fuemmeler et al., Add Health ³³	15.7-22.0	Protective	NS	Risk	Risk
	Berge et al, Project EAT ³⁹	14.8- 19.8	NS	NS	NS	NS

NS indicates no significant relationship between parenting style category and weight-related outcome.

^aResults presented for boys/girls

Table 4

Quality assessment

	Bergmeier et al., 2015 ⁴²	Bergmeier et al., 2014 ⁴¹	McPhie et al., 2012 ⁴³	Taylor et al., 2011 ⁴⁰	Olvera & Power., 2010 ³⁴	Berge et al., 2010 ³⁹	Connell & Francis, 2014 ³⁵	Fuemmeller et al., 2012 ³³	Lane et al., 2013 ³⁶	Rhee et al., 2006 ³⁷	Agras et al., 2004 ³⁸
SELECTION											
Were the analytic sample's characteristics clearly described?	X	X	X	X	X	X	X	X	X	X	
Was the analytic sample representative of the population from which it was recruited?				X			X	X	X	X	
Is the sample generalizable to the region from which it was obtained?				X			X	X	X	X	
COMPARABILITY											
Was there demonstration that the weight-related outcome was not present at the start of the study? OR Was baseline "weight-related outcome" controlled for?	X	X	X	X	X	X	X	X	X	X	
Were key important confounders (age, SES, sex, & race if US-based) controlled for or strategies for covariate selection presented?				X		X		X		X	
Were other important confounders (other parent's parenting style, parent weight status, & family structure) controlled for or strategies for covariates selection presented?				X							
EXPOSURE											
Was the parenting style assessment validated?											
Was parenting style assessed for more than one caregiver (e.g. mother and father) or measured by study staff observation?	X	X	X	X	X	X	X	X	X	X	X
OUTCOME											
Was weight/height measured by study staff?	X			X	X		X		X	X	
Was the number of participants at each stage/wave specified?	X		X	X	X	X	X		X	X	X
Was the number of participants lost to follow-up <30%?	X			X	X				X		

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	Bergmeier et al., 2015 ⁴²	Bergmeier et al., 2014 ⁴¹	McPhie et al., 2012 ⁴³	Taylor et al., 2011 ⁴⁰	Olvera & Power, 2010 ³⁴	Berge et al., 2010 ³⁹	Connell & Francis, 2014 ³⁵	Fuemmeller et al., 2012 ³³	Lane et al., 2013 ³⁶	Rhee et al., 2006 ³⁷	Agras et al., 2004 ³⁸
Were characteristics of lost participants independent of parenting styles/or the major reasons why they dropped out were not due to parenting styles?	X						X				
Was missingness accounted for?		X	X			X		X	X	X	
Were effect estimates reported?		X	X	X	X	X	X	X	X	X	X
Was the number in the analytical sample greater than 200?				X		X	X	X	X	X	
TOTAL	7	5	6	12	7	9	11	9	12	12	3