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REVIEW ARTICLE

General parenting, childhood overweight and obesity-inducing behaviors: a review

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Abstract

Despite emerging efforts to investigate the influence parents have on their children's weight status and related dietary and activity behaviors, reviews regarding the role of general parenting are lacking. We performed a systematic review regarding the relationship between general parenting and these weight-related outcomes to guide observational research. In total, 36 studies were included. Discrepancies across studies were found, which may be explained by differences in conceptualization of parenting constructs. Overall, however, results suggest that children raised in authoritative homes ate more healthily, were more physically active and had lower BMI levels, compared to children who were raised with other styles (authoritarian, permissive/indulgent, uninvolved/neglectful). Findings of some moderation studies indicate that general parenting has a differential impact on children's weight-related outcomes, depending on child and parental characteristics. These findings underline the importance of acknowledging interactions between general parenting and both child and parent characteristics, as well as behavior-specific parenting practices.

Key words: *Adolescent, body mass index, child, child preschool, diet, motor activity, parent-child relations, parenting, review, sedentary lifestyle*

Introduction

There has been a dramatic increase in prevalence of childhood overweight and obesity over the last few decades (1). So-called energy balance-related behaviors (2) contributing to excessive weight gain include the consumption of energy-dense foods, sugar-sweetened beverages (e.g., 3,4) as well as low levels of physical activity and sedentary behaviors (e.g., 5,6). An area of emerging research focuses on the role of parents in the development of obesity-inducing health behaviors of their children. Many of these studies address the influence of parental feeding styles and *specific* parenting practices regarding food and/or activity (e.g., 7–16). Specific parenting practices include, for example, house-rules regarding breakfast consumption, parental control of child snacking and television viewing time. Existing reviews mainly concentrate on these specific types of parental influences affecting children's weight-related health outcomes, (e.g., 17,18). Numerous efforts to unravel the influence of *general* parenting on children's weight-related behaviors suggest that the causal pathways are likely to be complex (19–23). For instance, the contextual influence of general parenting is assumed to moderate the association between parenting practices and children's health outcomes (24). The concept of general parenting has been defined as a constellation of attitudes and beliefs that create an emotional climate and determines behavioral expression between parent and child (24). *General* parenting in this paper is also referred to as parenting style or dimensions (of parental behavior). In addition to having a potential moderating influence, general parenting may also impact on children's weight status through its influence on various parenting practices with regard to diet and physical (in) activity. Figure 1 depicts the possible mediating and moderating pathways of the influence of parenting

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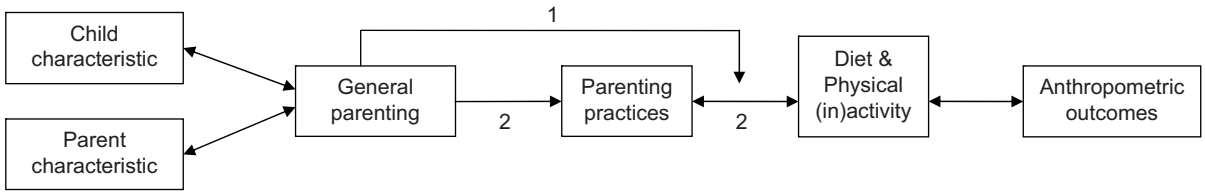

Figure 1. Conceptual model for the relationships between parenting and children's anthropometric-related outcomes.

Note: Pathway 1 (moderation): interaction between *general* parenting and more *specific* parenting practices in predicting child diet and physical (in)activity. Pathway 2 (mediation): influence of general parenting on child diet and physical (in)activity mediated by effects of *general* parenting on more *specific* parenting practices. Child and parent characteristics may have an influence on all variables in the model.

on child weight (general parenting - child weight relationship).

The main objective of this review was to synthesize evidence regarding the influence of general parenting on children's diet and activity behaviors, and weight status. To our knowledge, this is the first review to focus exclusively on the influence of general parenting.

Background of parenting typologies

The commonly used typological approach in parenting research is based on the work of Maccoby and Martin (25) in 1983, who described parenting style as a function of two dimensions of parental behavior: the extent to which parents are (1) responsive to their children's needs (responsiveness), and (2) controlling of their children's behaviors (demandingness). These two dimensions of parenting consistently emerge from factor analytic approaches. 'Responsiveness' has also been referred to as parental warmth (26–28), involvement (29), nurturance (30), child-centeredness (31), acceptance (26,32), and caring/empathy (33). 'Demandingness', on the other hand, is often related to aspects of control such as behavioral control (28) and firm control (34), restrictiveness (27), and democracy (35). By crossing the dimensions of responsiveness and demandingness, four prototypes of parenting are created (see Table I) (25): authoritative (parents who are both responsive and demanding), authoritarian (parents who are less responsive but highly demanding), indulgent or permissive (parents who provide a high level of responsiveness but are less demanding), and neglectful or uninvolved (parents who show relatively low levels of both dimensions).

Table I. Four-fold typology of parenting based on the two-dimensional classification of Maccoby and Martin (25).

	Responsiveness	
Demandingness	High	Low
High	Authoritative	Authoritarian
Low	Indulgent	Neglectful

Methods

Search strategy and eligibility criteria

Comprehensive literature searches were conducted between September 2009 and February 2010 utilizing a range of electronic databases (PubMed, PsycINFO, Scopus) together with lateral searching techniques (reference tracking and author searching). We included studies reporting general parenting and at least one of the following child outcomes: weight status, dietary intake (behaviors), physical (in)activity. To specify, literature searches were performed using at least one of the following parenting-related keywords: parenting (style), (child) rearing, authoritative, authoritarian, permissive, indulgent, or neglectful; weight-related keywords: physical (in) activity, sedentary behavior, sport(s), television, computer, eating, diet, fruit, vegetable, breakfast, snack(ing), (sugar-sweetened) beverages, (over) weight, obesity, or Body Mass Index (BMI); and age-related keywords: infant, preschool, child, or adolescent. Other inclusion criteria were as follows: all studies should be written in English and published in a scientific peer-reviewed journal or as a dissertation; and the study sample should consist of infants, preschoolers, children or adolescents (here defined as children with an age below 18 years at baseline). No selection criteria with regard to study methodology were formulated. Studies of children with eating disorders were excluded, as well as studies assessing the relationship between general parenting and child eating styles without dietary intake outcomes. We included every eligible study published until February 2010, including e-publications. Using the selected keywords, 2244 papers were identified in Pubmed, PsychInfo and Scopus. Thereafter, all papers were screened on title, leading to 546 eligible hits. Of these, 434 were eliminated based on abstract evaluation. Full-text manuscripts were retrieved for the remaining 112 papers. This resulted in 33 studies

which were considered eligible for inclusion, the other 79 papers did not describe on general parenting. Furthermore, we applied reference tracking leading to three additional references. In total, 36 studies were considered eligible for the current review. Manuscripts were mainly excluded because they did not assess general parenting. Furthermore, prevention and intervention studies with regard to childhood overweight were excluded.

Two authors (E.S. and S.G.) independently screened all titles and abstracts of the manuscripts identified by the literature search for inclusion in this review. Full text versions of all potential relevant studies were obtained for further evaluation to determine inclusion, with any disagreement being resolved by discussion. In case of doubt, a third author (S.K.) was consulted. All studies selected for inclusion were scanned for additional references. Following this procedure, 36 publications were included in the review (36–71). Figure 2 depicts the number of all studies published up until 2010 regarding the general parenting - child weight relationship. This figure shows that the number of studies examining this relationship has increased in recent years, from two studies before 2002 to about nine studies published in 2008 and 2009 together.

Data extraction

Data regarding sample characteristics (sample size, child age, gender, ethnicity, location and setting), measurements (overview of instruments assessing general parenting, child dietary and physical (in) activity behavior, child weight status), and study results were abstracted by the first author (E.S.) and checked by the second author (S.G.). Instruments measuring independent variables other than parenting styles, such as parenting practices, were only described when interaction was tested with general parenting in predicting children's weight-related outcomes. Studies assessing interaction could be valuable in understanding the complex mechanisms behind the general parenting - child weight relationship (see Figure 1). We report on results of studies with *a-priori* hypotheses about possible interaction and on results of post-hoc analyses (i.e., interaction patterns that were not specified at the beginning of the study). The results of the reviewed studies are presented in chronological order in Supplementary Table 1, available online. For all studies, both statistically significant results (depicted with closed spheres) and non-significant results (depicted with open spheres) are reported to give a complete overview of the associations between all study variables.

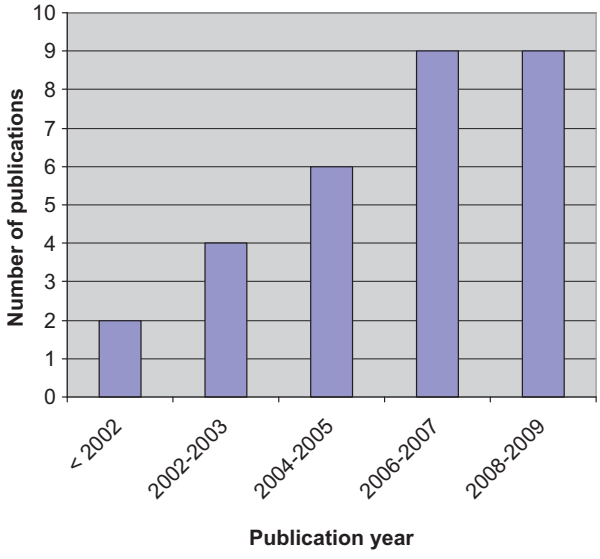

Figure 2. Number of publications examining the general parenting - child weight relationship by year (n = 30).

Note: All studies regarding the general parenting - child weight relationship published in a scientific journal issue (no e-publications) before 2010 are included in this Figure.

Results

Study characteristics of the included studies

The sample size of the included studies ranged from 45 to over 4000, representing the absolute number of caregivers and/or children who participated in the study. Different study characteristics in terms of sample size, age, gender, ethnicity and location/setting of the study are depicted in Table II. Most study populations consisted of North-Americans (n = 23), followed by Western Europeans (n = 9), Australians (n = 3), Asians (n = 3), Southern Europeans (n = 2) and Eastern Europeans (n = 1). Samples from the United States consisted of ethnically diverse populations, including participants with Hispanic, African and/or Asian backgrounds.

Parenting measures

In total, 21 different instruments were used to measure parenting dimensions or styles (see online supplement). All of these instruments have proven to be valid and reliable. The parenting tools which are used most often are the 'Child Rearing Practices Report' (30) applied in four studies (37,46–48), and the 'Parenting Style Instrument' (72–74) also used in four studies (39,56,63,65). The 'Parenting Practices Questionnaire' (75) or its short form, the 'Parenting Styles and Dimensions Questionnaire' (76) were administered to participants in three studies (43,59,66). Several parenting instruments were applied in two studies, i.e., the 'Authoritative

Table II. Sample characteristics from studies listed in chronological order.

Study	Sample size	Mean (SD) age in years	Gender (% male)	Ethnicity	Location and setting	Study type
Mendelson 1995 (36)	572	15.7 (1.0)	50	Ethnically diverse	3 Public high schools in Montreal, Quebec, Canada	C
Gable 2000 (37)	65	8.1 (1.4)	43	75% Caucasian, 3% African-American, 5% Asian, 3% Hispanic	Annual community health fair, USA	C
Schmitz 2002 (38)	3845	12.8 (.4)	51	67% Caucasian	16 Middle schools in Minneapolis/ Saint Paul, Minnesota, USA	C
Kremers 2003 (39)	643	16.5 (.1)	46	13% Immigrant	High schools in the Netherlands	C
Lytle 2003 (40)	3878	12.8 (.4)	51	67% White, 11% African-American, 3% Hispanic, 7% Asian, 2% Native American, 6% Mixed, 4% other	16 Middle schools in Minneapolis/ Saint Paul, Minnesota, USA	C
Mustillo 2003 (41)	991	Not reported, age range 9-13 at baseline	51	100% Non-Hispanic white (<10% African-American)	11 Counties in western North Carolina, Great Smoky Mountains, USA	L (8 years)[2]
Agras 2004 (42)	150	0.2 at baseline	49	Not reported	San Francisco Bay Area, USA	L (9.5 years)[2]
Brann 2005 (43)	49 (25 average BMI, 24 high BMI)	9.3	100	White	Small southern city, USA	CC
Chen 2004[a]/2005[b] (44,45)	163 (95 Taiwan, 68 USA)	9.0 (.8)	45	58% Chinese, 42% Chinese-American	1 Elementary school located in southern Taiwan, 2 Chinese language schools located in urban and suburban areas of northern California, USA	C
Chen 2005/2008 (46,47)	331	7-year-olds (N = 160), 8-year-olds (N = 171)	48	Chinese	2 Elementary schools: 1 rural and 1 urban in northern Taiwan	C
Ludrosky 2005 (48)	74	Not reported, age range grade 1-8[1]	61	Not reported	Small school in the Midwest, USA	C
Kim 2006/2008 (49,50)	233 (127 children, 106 adolescents)	Children 10.1 (.8), adolescents 14.1 (.8)	51	Children 76% white, adolescents 78% non-Hispanic white	Houston, Texas, USA	C
Musher-Eizenman 2006 (51)	68	5.0 (.7)	Not reported	96% of mothers and 97% of fathers Caucasian	Childcare setting, USA	C (laboratory visits)
Rhee 2006 (52)	872	4.5 at baseline	49	83% White	10 Sites across the USA	L (2.5 years)[2]
Gibson 2007 (53)	329 (23 treatment-seeking overweight and obese children, 306 non treatment-seeking children)	9.5 (1.8)	Not reported	Not reported	Pediatric hospital endocrinology department and 8 primary schools in Perth, Western Australia	C
Hejazi 2007 (54)	972	Not reported, age range 2–2.9 at baseline	50	100% Canadian	Households selected from Statistics Canada's Labor Force Survey, and National Population Health Survey, Canada	L (6 years)[2]

Moens 2007 (55)	56 (28 overweight, 28 normal-weight)	10.1 (1.6)	Overweight 32, normal-weight 54	European	Different rural and urban environments, Belgium	CC
Van der Horst 2007 (56)	383	13.5 (.6)	45	14% Immigrant	5 Secondary schools in the Netherlands	C
Wake 2007 (57)	4983	4.7	51	Not reported	Children in wave 1 of the nationally representative Longitudinal Study of Australian children, Australia	C
West 2007 (58)	124 (62 healthy weight, 62 obese)	8.1 (1.7)	40	92% White Australian/British ancestry	Brisbane, Australia	CC
Blissett 2008 (59)	48	3.5 (0.8)	40	Not reported	Preschool nurseries in the West Midlands and Cambridge, UK	C
Humenikova 2008 (60)	142 (45 USA, 97 Czech Republic)	USA 10.8 (0.2); Czech Republic 11.0 (.1)	33 USA, 43 Czech Republic	89% White USA, 100% white Czech Republic	4 Public schools (large Midwestern city) in the USA and 4 public schools (2 cities) in the Czech Republic	C
Reineke 2008 (61)	84	3.9 (0.6)	52	Parents 43% Hispanic, 18% African-American, 18% white, 21% other	2 Public preschools (urban district), USA	C
Zeller 2008 (62)	146 (77 obese, 69 non-overweight)	Obese 12.5 (1.9), non-overweight 12.7 (2.0)	43	Obese 51% white, 49% African- American; non-overweight 57% white, 43% African-American	90 Weight clinics to recruit obese youth (along with demographically similar non-overweight peers), USA	CC
De Bourdeaudhuij 2009 (63)	4555 (1180 Belgium, 883 the Netherlands, 1515 Portugal, 977 Spain)	11.0	49	Not reported	Primary schools in Belgium, the Netherlands, Portugal and Spain	C
Lohaus 2009 (64)	798 (432 second graders, 366 fourth graders)	2nd graders 7.9, 4th graders 10.1 at baseline	2nd graders 53, 4th graders 45	100% White	15 Elementary schools in Germany	L (3 years)[2]
Pearson 2010 (65)	328 (170 younger adolescents, 158 older adolescents)	Younger adolescents 13.3, older adolescents 15.6	57	97% White British	3 Secondary schools in East Midlands, UK	C
Topham 2010 (66)	176	6.9 (0.4)	52	78% European-American, 18% Native American, 2% Multi-ethnic, 1% other minority, 1%not stated	Rural public schools in a Midwestern state, USA	C
Vereecken 2009 (67)	1957	11.0	52	98% Belgian nationality	69 Elementary schools from 2 Flemish regions, Belgium	C
Berge 2010 (68)	4746 at baseline	14.9 (1.7)	50	49% White, 19% African-American, 19% Asian-American, 6% Hispanic, 4% Native American	31 Middle and high schools in Minneapolis/Saint Paul, Minnesota, USA	C
Berge 2010 (69)	2516 at follow-up	at baseline				L (5 years)[2]
Hennessy 2010 (70)	99	9.0 (1.5)	49	29% White, 49% African-American, 22% Hispanic	Elementary schools in rural areas of the Mississippi River Delta, Southeast, Appalachia, and Central Valley regions, USA	C
Olvera 2010 (71)	69	6.7 (1.3) at baseline	48	Mexican-American	Large metropolitan city in southwest USA	L (3 years)[2]

C = Cross-sectional study; L = Longitudinal study; CC = Case-Control study; [1]mean (SD) age not reported; [2]follow-up in years; Chen 2004[a] study sample consists of Tawainese (n = 95) and Chinese-American (n = 68) respondents; Chen 2005[b] study sample consists of Chinese-American (n = 68) respondents.

Parenting Index' (77) used by Schmitz *et al.* (38) and Lytle *et al.* (40); the 'Parental Authority Questionnaire' (78) used by Agras *et al.* (42) or its revised version (79) used by Musher-Eizenman and Holub (51); the 'Parenting Dimension Inventory' (80) used by Olvera and Power (71) and Hennessy *et al.* (70); the 'Attitudes Toward Child-Rearing Scales' (81) used by Chen and Kennedy (44,45); and the 'Parenting Scale' (82) used by Gibson *et al.* (53) and West (58). For an overview regarding reporting of general parenting and for a brief description of all parenting instruments used in the included studies, we refer to Table III and the online supplement, respectively.

Findings per outcome variable

The included studies were clustered by outcome variable: dietary behavior ($n = 14$), physical (in)activity ($n = 10$), and weight status ($n = 29$). Below, we give an overview of the key findings. Further study details are presented in Tables III and IV and the online supplement.

Dietary behavior

Eleven cross-sectional studies (39,40,45,48–51,56, 63,65,67) and three longitudinal studies (42,64,69) measured the relationship between parenting and children's weight-related dietary behaviors (see Table IVa).

Fruit and/or vegetable intake. In two large scale cross-sectional studies (63,67), one including multiple countries (63), no relationships were found with parenting styles. Other studies found favorable effects of authoritative parenting on fruit intake (39,40,65); in the study of Lytle *et al.* (40) this was only true for mothers, and this positive relationship was also present for vegetable intake. Berge *et al.* (69), the only study using a longitudinal design, found different results; daughters of permissive fathers having higher intakes of fruit and vegetables five years later than those of authoritarian fathers.

Breakfast consumption. For the relationship between general parenting and breakfast consumption inconsistent results are reported. Pearson *et al.* (65) indicated that authoritative parenting was related to more frequent breakfast consumption compared to neglectful and indulgent parenting. Contrary, other studies found no relationship of breakfast consumption with parenting styles (49,50,67) or the dimensions of parental behavior 'nurturance' and 'control' (48–50).

Snacking and soft drink intake. Snacking was uncorrelated to most parenting styles and dimensions (48–50). Only adolescents who reported a high degree of maternal control snacked less frequently (49,50). Neglectful parenting was related to frequent snacking compared to authoritative and authoritarian parenting (65). Vereecken *et al.* (67), who besides sweets consumption also assessed soft drink consumption, reported that no associations were present between these overweight inducing behaviors and parenting styles as defined using the four-fold typology.

Van der Horst *et al.* (56) executed moderation analyses, examining whether restrictive feeding practices have a different effect on adolescents' sugar-sweetened beverage consumption depending on the parenting style of their caregivers. Results indicated that the parenting dimensions of 'involvement' and 'strictness' modified the associations between restrictive feeding and sugar-sweetened beverage consumption, in a sense that controlling parenting practices had the strongest association with a decreased consumption of these drinks when parents were moderately controlling and highly involved.

Other nutrient intake. Kim and colleagues (49) found that children's carbohydrate intake was positively related with authoritative parenting by fathers and nurturance by mothers. Inconsistent findings were found for controlling parenting; this was related either to high (48) or low (49,50) intake of carbohydrates or fiber. For fat intake, there was a negative relationship with nurturing and authoritative parenting by mothers, whereas a positive relationship was found with fathers' controlling parenting (48–50). In a study of Chinese-American children, Chen *et al.* (45) indicated that a positive association was found between democratic parenting and sugar intake.

Caloric intake. In general, caloric intake was negatively correlated with maternal nurturance (47–49), but positively with parental restrictiveness (47). In the longitudinal study of Agras et al. (42) authoritative, authoritarian or permissive parenting during infancy was not significantly related to caloric intake of children at 9.5 years.

Musher-Eizenman and Holub (51) conducted moderation analyses to find out whether parenting style would moderate the effects of restrictive feeding practices on children's caloric intake through externally motivated eating. The authors hypothesized that authoritarian parenting is related to high levels of caloric intake among children, whereas authoritative parenting is expected to attenuate the negative effects of restrictive feeding. In this small sample

Table III. Overview of reported outcome measures per study from studies listed in chronological order.

						Diet			Physical (in)activity		Weight outcomes	
	Parenting											
Study	Mothers	Fathers	Together	PR	CR	Healthy dietary behavior	Unhealthy dietary behavior	Nutrient/ caloric intake	Physical activity	Physical inactivity	BMI (categorical variable)	BMI (other)
Mendelson (36)			X	X	X						X	X
Gable (37)	X			X					X	X	X	
Schmitz (38)	X	X			X				X	X		
Kremers (39)			X		X	X					X	
Lytle (40)	X	X			X	X						
Mustillo (41)	X			X							X	
Agras (42)	X	X		X				X	X	X		X
Brann (43)	X	X		X							X	
Chen (44)	X			X								X
Chen (45)	X			X			X		X	X		X
Chen (46)	X			X							X	
Chen (47)	X			X					X			
Ludrosky (48)	X	X		X		X	X	X	X	X		X
Kim (49,50)	X	X			X	X	X	X	X	X		X
Musher-Eizenman (51)	X	X		X				X			X	
Rhee (52)	X			X							X	
Gibson (53)	X			X								X
Hejazi (54)	X			X							X	
Moens (55)	X			X							X	
Van der Horst (56)			X		X		X					
Wake (57)	X	X		X							X	
West (58)	X			X							X	
Blissett (59)	X	X		X							X	X
Humenikova (60)			X	X								X
Reineke (61)	X			X								X
Zeller (62)	X			X							X	
De Bourdeaudhuij (63)	X			X		X						
Lohaus (64)	X	X			X	X	X		X	X		
Pearson (65)			X		X	X	X					
Topham (66)	X			X							X	
Vereecken (67)	X			X		X	X					X
Berge (68)	X	X			X							X
Berge (69)	X	X			X	X			X			X
Hennessy (70)	X			X								X
Olvera (71)	X			X							X	
Total	**32**	**13**	**5**	**26**	**11**	**10**	**8**	**5**	**10**	**8**	**16**	**15**

PR = parent-reported; CR = child-reported.

study, an external eating task was performed to assess eating in the absence of hunger and ultimately caloric intake. The results of this study showed that fathers with an authoritative parenting style who applied restrictive feeding practices had a protective effect on their child's caloric intake (i.e., associated with low caloric intake), whereas mothers with a authoritarian parenting style who applied these restrictive feeding practices had a counterproductive effect on caloric intake (i.e., associated with high caloric intake).

Positive and negative health behaviors. Results of a longitudinal study revealed that authoritative fathers and mothers had children with higher levels of positive health behavior trajectories (including high-grade nutrition such as fruit and vegetable consumption) and lower levels of negative health behavior trajectories (including low-grade nutrition) over a three-year period in contrast to children of parents with other styles (64). However, it should be noted that the positive health-related behavior measure used in this study also incorporated questions regarding physical activity, use of healthcare and personal hygiene. The negative health-related behavior measure also included statements regarding television viewing, nicotine and alcohol consumption, and risk behavior.

Table IV. (a) Descriptive summary of relationships between general parenting and children's dietary behaviors.

Results	Cross-sectional $n = 11$	Longitudinal $n = 3$
Fruit and/or vegetable intake (n = 6)		
o No differences were found in children's mean intake of fruit between different parenting style groups	(63,67)	
o No differences were found in children's mean intake of vegetables between different parenting style groups	(63,65,67)	
• Fruit intake among adolescents was highest when they were raised in authoritative homes (and lowest in neglectful homes)	(39,65)	
• Fruit and vegetable intake of young adolescents was positively related to authoritative parenting of mothers. A non-authoritative parenting style by a father was associated with greater intake of fruits and vegetables.	(40)	
• After five years, fruit and vegetable intake was higher among daughters with permissive fathers compared to daughters of authoritarian fathers		(69)
Breakfast consumption (n = 5)		
• Authoritativeness was related to more frequent breakfast consumption compared to neglectful and indulgent parenting	(65)	
o No relationship between breakfast consumption and parenting styles	(49,50,67)	
o No relationship between breakfast consumption and the dimensions of parental behavior 'nurturance' and 'control'	(48–50)	
Snacking intake (including eating restaurant foods) (n = 5)	(48–50,65,67)	
o Authoritative parenting and nurturance were not related to children's and adolescents snacking	(49,50)	
• Adolescents who reported a high degree of maternal control snacked less frequently	(49,50)	
o There was no association between children's snacking behavior and either parental nurturance or restrictiveness	(48)	
• Neglectful parenting was related to frequent snacking intake compared to authoritative and authoritarian parenting	(65)	
o No differences were found in children's mean sweets consumption between the different parenting style groups	(67)	
• Parental nurturance appeared to be positively associated with eating out	(48)	
Soft drink intake (n = 1)		
o No differences were present in adolescent's mean soft drink intake between the different parenting style groups	(67)	
Other nutrient intake (Carbohydrate, dietary fiber intake, fat, sugar) (n = 4)		
• Children's carbohydrate intake was positively related to authoritative parenting by fathers and nurturing by mothers	(49)	
o Nurturance and control by fathers and mothers was not associated with children's intake of carbohydrates eaten of the food packed from home	(48)	
• Control by fathers (not mothers) was related to high intake of carbohydrates eaten from school purchases	(48)	
• Paternal control was related to low intake of carbohydrates in adolescents, maternal control was related to low intake of dietary fiber in adolescents	(49,50)	
• Restrictiveness by fathers (not mothers) was positively correlated with extra fat eaten from school purchases	(48)	
o Parental nurturance was not correlated with extra fat eaten	(48)	
• Only maternal nurturance was negatively related to saturate fat intake among children	(49)	
• Only paternal control was positively related with child percentage calorie intake from (saturated) fat and sugar intake	(49)	
• Maternal authoritative parenting was negatively related to child intake from (saturated) fat	(49)	
o Authoritarian parenting was not related to children's fat and sugar intake	(45)	
• Democratic parenting was positively related to children's sugar intake	(45)	
Caloric intake (n = 5)		
• Maternal nurturance was negatively correlated with adolescents' total caloric intake	(49,50)	
• Maternal nurturance was negatively correlated with average amount of calories that were eaten of food that was packed from home among school children	(48)	
• Maternal authoritative parenting was related to higher intake of calories per body weight of children, but a negative relationship was found for maternal control	(49,50)	
• Paternal restrictiveness was positively correlated with extra calories eaten from school purchases	(48)	
o Authoritative, authoritarian, permissive parenting during infancy was not a predictor of caloric intake at age 9		(42)
o There were no mean differences between authoritative and authoritarian groups on calories eaten during the externally motivated eating task	(51)	
Miscellaneous (n = 1)		
• Children of authoritative fathers and mothers had higher levels of positive health behavior trajectories (including high-grade nutrition) and lower levels of negative health behavior trajectories (including low-grade nutrition) in contrast to children of parents with other styles		(64)

Findings of the moderation analyses in the studies of Van der Horst *et al.* (56) and Musher-Eizenman and Holub (51) are reported in the text (*Results* section); significant results depicted with closed spheres, non-significant results depicted with open spheres.

Physical (in)activity

Seven cross-sectional studies (37,38,45,47–50) and three longitudinal studies (42,64,69) examined associations between general parenting and children's physical (in)activity levels (see Table IVb). The cross-sectional studies reported inconsistent results regarding the parenting - physical activity relationship. In the studies assessing parental control no associations were revealed with children's and/or adolescent's physical (in)activity levels (48–50). In some studies no associations were found between authoritarian parenting (37,45), non-authoritative parenting (49–50) authoritative parenting (37), democratic parenting (45) and child physical (in)activity. The more positive parenting variables (e.g., nurturance and authoritative parenting) were more often positively associated with activity levels (48–50).

Two cross-sectional studies found that the relationship between general parenting and child activity was influenced by gender (38,47). However, mixed results were found. Chen *et al.* (47) who conducted a study in Taiwan found that physical activity was positively associated with authoritative parenting in 7- and 8-year-old boys, but with authoritarian parenting in girls of the same age. Schmitz and colleagues (38) found different results among a large group of young adolescents. Only for female adolescents, maternal authoritativeness was a significant positive predictor of physical activity and a negative predictor of sedentary leisure habits.

Findings of the longitudinal studies indicated that authoritative parenting was a positive predictor of physical activity (64,69), a negative predictor of sedentary leisure-time activities (leisure-time behaviors which require very little energy, including television viewing) (64) or a non-significant predictor (42) of physical (in)activity (including television viewing and assessment of physical activity via accelerometry) at follow-up. Berge *et al.* (69) showed that only for sons, authoritative parenting by fathers predicted frequent physical activity at five-year follow-up in comparison with sons of neglectful fathers.

Weight status

In total, 29 studies were identified which examined relationships between general parenting and a weight-related outcome variable (see Table IVc). The majority of these studies used cross-sectional (n = 19) (36,37,39,44–46,48–51,53,57,59–61,66–68,70) or case-control (n = 4) (43,55,58,62) rather than a longitudinal design (n = 6) (41,42,52,54,69,71).

Six cross-sectional studies found no significant effects of child weight status group (36,37,43,46, 55,59) on general parenting variables. Some other cross-sectional studies found no mean differences in child BMI between various parenting style groups (39,51). However, two studies comparing parenting styles of mothers with obese and normal-weight children did report significant results (58,62), indicating mothers of obese children scoring higher on 'laxness' and 'overreactivity' (58) and lower on 'behavioral control' (62).

Many cross-sectional studies reported some non-significant findings regarding associations between particular parenting dimensions or styles and children's BMI (44,45,48–50,53,57,59–61,67,68,70). Across studies which found significant relationships, inconsistent findings were reported. Some studies found that authoritative parenting was associated with lower BMI values (48,49,56,62). In contrast, Humenikova and Gates (60) found that less authoritative parenting was related with lower BMI z-scores in Czech children. Permissive parenting in US children (60) and democratic parenting in both Taiwanese and Chinese-American children (44,45) were positively related to children's BMI z-scores. Other studies found that parenting control of mothers (49,50) and fathers (48) (e.g., including forms of authoritarian and psychological control) was positively related to BMI z-score. However, Wake *et al.* (57) reported an inverse relationship between paternal control (some aspects of behavioral control) and child BMI.

It seems that relationships which were found depended on characteristics of the outcome variable. In general, no association between general parenting and weight status was found when a categorical variable was used; more often, significant relationships were found when BMI was used as a continuous outcome variable.

Six longitudinal studies were identified assessing whether general parenting predicts weight status at follow-up or weight status development among children (41,42,52,54,69,71). Three of these studies found positive effects of authoritative parenting on children's weight status (i.e., authoritative parenting was related with lower weight at follow-up) (52,69,71). One study relating parenting styles to child weight status, failed to detect significant effects (42). In two studies, children's weight and height were repeatedly measured to define various developmental BMI trajectories (41,54). The aim of these studies was to examine whether there were any differences in parenting dimensions between these defined groups. Only one study reported significant differences (54).

A minority of existing (cross-sectional) studies focused on assessing interaction between variables (i.e., parenting styles, parent or child characteristics) in predicting children's weight status (62,66,68). Zeller *et al.* (62) tested whether parenting interacted with child temperament in predicting child weight

Table IV. (b) Descriptive summary of relationships between general parenting and children's physical (in)activity levels.

Results	Cross-sectional $n = 7$	Longitudinal $n = 3$
Physical activity for boys and girls together (n = 7)		
○ No associations were found between maternal reports of parenting styles and activity levels of their child	(37,45)	
○ Associations between parental restrictiveness and physical activity were non-significant	(48)	
○ No correlations were found between physical activity and either parental non-authoritativeness or control	(49,50)	
• Mothers and fathers with high scores on nurturance reported higher levels of physical activity for their children	(48)	
• Children and adolescents who reported to have a nurturing and/or authoritative father had high activity levels	(49,50)	
○ Authoritative, authoritarian, permissive parenting during infancy was not a predictor of physical activity at age 9		(42)
• Positive relationship between children's reports of authoritative parents and their physical activity levels three years later		(64)
Physical inactivity for boys and girls together (n = 7)		
○ No associations were found between maternal reports of parenting styles and sedentary behaviors of their child	(37,45)	
○ Associations between parental restrictiveness and physical inactivity were non-significant	(48–50)	
○ Associations between parental nurturance and physical inactivity were non-significant	(48–50)	
○ Associations between parental (non)-authoritative parenting and physical inactivity were non-significant	(49,50)	
○ Authoritative, authoritarian, permissive parenting during infancy was not a predictor of physical inactivity at age 9		(42)
• Negative relationship between children's reports of authoritative parents and sedentary activities three years later		(64)
Physical (in)activity (boys vs. girls) (n = 3)		
• In boys, authoritative parenting was positively associated with aerobic capacity, whereas in girls the parenting style of authoritarianism was positively related to aerobic capacity	(47)	
• Only in boys, less authoritarian parenting was related to more moderate and vigorous activity	(47)	
○ There was no relationship between parenting and both muscular endurance and flexibility in boys and girls	(47)	
• Only in girls, maternal authoritativeness was a positive predictor of activity and negative predictor of sedentary habits	(38)	
• For boys, maternal non-authoritativeness was predictive of physical activity. With increasing levels of non-authoritativeness, activity levels raised. Scores at the upper end of non-authoritativeness were related to lower levels.	(38)	
○ The non-authoritative parenting style was not a significant predictor of sedentary leisure habits in boys and girls	(38)	
• Only for adolescent sons, authoritative parenting by fathers (not mothers) predicted frequent physical activity at five-year follow-up in comparison with sons of neglectful fathers		(69)

Significant results depicted with closed spheres, non-significant results depicted with open spheres.

Table IV. (c) Descriptive summary of relationships between general parenting and children's weight status.

Results	Cross-sectional $n = 19$	Case-control $n = 4$	Longitudinal $n = 6$
Weight status for boys and girls together (e.g., underweight/normal-weight/overweight/obesity) (n = 14)			
○ The distribution of children over the parenting styles did not differ for weight status or BMI	(36,37,39,46,51,59)	(43,55)	
• Mothers of obese children score high on laxness and overrreactivity compared to mothers of lean children		(58)	
• Mothers of obese children score low on behavioral control compared to mothers of lean children		(62)	
• Higher control scores of fathers were associated with lower odds of the child being in a higher BMI category	(57)		
• Children of fathers with permissive or disengaged parenting styles had higher odds of being in a heavier BMI category compared to children of authoritative fathers	(57)		
• Mothers with authoritative styles were less likely to have children who were overweight two and a half years later at age seven compared with mothers using authoritarian, permissive, or neglectful styles			(52)
• Indulgent mothers were significantly more likely than authoritative or authoritarian mothers to have children who became overweight three years later at age nine, controlling for weight status scores at baseline			(71)
○ There were no differences among different BMI trajectories groups in parenting dimensions			(41)
Weight status for boys and girls together (BMI as a continue outcome variable) (n = 12)			
• There was a negative relationship between maternal authoritative parenting and BMI in adolescents	(49,50)		
• Less authoritative parenting was related with lower child BMI z-scores	(60)		
• Permissive parenting was positively related to children's BMI	(60)		
• Authoritarian parenting was not related to BMI in children	(44,45,60)		
• Democratic parenting was positively related to children's BMI	(44,45)		
○ Parenting styles were not related to children's weight status	(61,67,70)		
• Parenting control of mothers was positively related to BMI	(49,50)		
• Parenting control of fathers was positively related to BMI	(48)		
○ Parental nurturance was not related to children's and/or adolescents BMI	(48–50)		
○ The parenting dimensions of laxness, overreactivity and verbosity were not related to child BMI z-scores	(53)		
○ Parenting styles (authoritative/authoritarian/permissive) were not significant predictors of child BMI z-scores	(59)		
○ Authoritative, authoritarian, permissive parenting during infancy was not a predictor of weight status at age 9	(42)		(42)
Weight status (boys vs. girls) (n = 3)			
• Maternal authoritarian parenting was associated with higher BMI for adolescent sons (not daughters) in comparison to mothers with authoritative and neglectful parenting styles	(68)		
• Adolescent boys of authoritarian mothers and girls of neglectful mothers had a higher BMI after five years of follow-up compared to sons and daughters of authoritative mothers			(69)
• Girls classified in the 'accelerating rise to obesity' group (measured throughout a six-year span) had parents scoring lower in the parenting dimension 'consistency in discipline' and higher on 'positive interaction', compared to children in the stable-normal BMI group			(54)
• For boys in the 'j-curve obesity' group (high BMI at 24-35 months, normal BMI at follow-up, but by age 78 and 100 months were overweight and obese respectively), parents had lower consistency scores compared to parents of boys classified in the 'stable-normal' and 'transient high' (normal BMI at baseline and last follow-up measurement, but high BMI in between) BMI group			(54)

Findings of the moderation analyses in the studies of Zeller *et al.* (62), Berge *et al.* (63) and Topham *et al.* (68) are reported in the text (*Results* section); significant results depicted with closed spheres, non-significant results depicted with open spheres.

status. Findings showed that interaction was present between low maternal warmth and difficult child temperament, indicating that 69% of obese youth were classified as being high on difficult temperament and low on maternal warmth as compared to 31% of non-overweight youth (62). Topham and colleagues (66) assessed the role of other potential moderating factors (i.e., Socio-Economic Status (SES) and maternal depression) on the relationship between general parenting style (authoritative, authoritarian, permissive) and child obesity. They hypothesized that maternal depression and high SES would aggravate the impact of authoritarian parenting as well as permissive parenting on child obesity. Findings indicated that only for permissive parenting there was an interaction with maternal depression and SES. Both depressed mothers and high SES mothers had children who are more likely to be obese when they had permissive parenting styles. Finally, Berge *et al*. (68) found in a large ethnically diverse group of US teens, who reported about the parenting styles of their parents, that the combination of maternal authoritarian parenting and paternal neglectful parenting was related with a high BMI in sons, but not in daughters.

Discussion

The objective of the present review was to evaluate the existing literature examining the relationship between general parenting and children's weight-related outcomes. Some results were inconsistent. Generally, in many studies where a significant association with general parenting was found, children raised in authoritative homes were found to eat more healthily, to be more physically active, and to have lower BMI scores compared to children who were raised with a different style. An authoritative style is characterized by a family context of expressing warmth and emotional support, together with using clear, bidirectional communication (25). These results are strengthened by prospective findings which inform us about the direction of causality. Five of the seven longitudinal studies show that general parenting at an early age has an impact on weight-related outcomes at a later date (52,54,64,69,71). These studies specifically supported a role for authoritative parenting in promoting healthy weight-related behaviors. Furthermore, the findings of some moderation studies indicate that general parenting can have differential impact on children's weight status and related health behaviors, depending on characteristics of the child and the parents.

Discrepancies in study results

The parenting dimension 'nurturance' was typically positively related to overweight preventing behaviors of the child (e.g., high levels of physical activity) and negatively related to the child's obesity inducing behaviors (e.g., fat and caloric intake). For the dimension 'control' inconsistent findings were reported. Probably this is caused by different conceptualizations of controlling parenting. This dimension has been referred to as psychological control versus psychological autonomy, but also as lax control versus behavioral/firm control. Psychological control (opposite of psychological autonomy) was assessed in few of the included studies (49,50,62,64). It is defined as 'parental behaviors (such as guilt-induction, love withdrawal or contingent love, instilling anxiety, and invalidation of the child's perspective) that are intrusive and manipulative of children's thoughts, feelings, and attachments to parents' (83). This construct was related to negative behavioral outcomes (e.g., high intake of calories and fat) (49,50). Although this type of control by mothers was related to BMI z-scores of the children in the study by Kim (49,50), there was no difference between obese and non-overweight youth in reported psychological control in the study of Zeller and others (62). Using another operationalization, Lohaus *et al*. (64) created the four prototypes of parenting based on three dimensions of parental behavior; besides 'warmth' and 'behavioral control' incorporating 'psychological pressure' in the classification of parenting typologies. Authoritative parenting was characterized by high levels of behavioral control and low levels of psychological pressure and related to the most positive health outcomes (66). Very closely related to the construct of psychological control is the restrictiveness dimension assessed in the Child Rearing Practices Report (30). Ludrosky (48) found that paternal restrictiveness was positively related to children's BMI and caloric intake. Lax control, defined as inconsistent discipline (chaos) has been assessed in some studies (41,53,54,58,62), usually indicating higher scores on inconsistent discipline of parents in the obese group compared to parents of non-overweight children (58,62) and for parents of children with rapid excessive weight gain (54).

Besides the repeated findings for the negative influence of psychological and lax control on children's health behaviors, positive effects were reported for behavioral control e.g., (57,62,64). However, controversies exist regarding the optimal level of control. For instance, Van der Horst *et al*. (56) found evidence that general parenting modified the relationship between restrictive feeding practices and adolescents' sugar-sweetened beverage consumption: restrictive feeding was associated with lower intake of sugar-sweetened beverages when parents were highly involved, but moderately controlling (56). Such results could indicate that both low control and

very strict, overcontrolling types of parenting are counterproductive, indicating a U-shaped relationship between parental control and child weight. Despite the availability of a large number of parenting instruments, measurement tools assessing the apparent broad range of controlling dimensions are currently lacking. Therefore, one should be very cautious in comparing and interpreting the study results of the included studies.

Differences in conceptualization of parenting constructs may also explain other inconsistent findings regarding the relationship between general parenting and children's weight-related outcomes. In some studies instruments were used that can assess parenting style without crossing scores on separate parenting dimensions (36–38,40,42–47,51, 59–61,66). In other studies parenting styles were constructed based on the scores on separate parenting dimensions (39,49,50,52,57,63–65,67–71). Typically, parenting styles were categorized into four prototypes (authoritative, authoritarian, indulgent/permissive, and neglectful/uninvolved) based on splits of two parenting dimensions (e.g., nurturance/warmth and amount of control, involvement and strictness, sensitive to child's need and expectations for self-control, responsiveness and demandingness). In six of these studies (52,63,65,67,70–71) this categorization was based on median splits of both dimensions, a method which has to be applied carefully. For instance, if all parents of a study sample score very low on authoritarian control, using median splits, it is possible that parents scoring in the higher end on this dimension are classified as being authoritarian, whereas these parents would not be classified as being authoritarian in a different sample. Furthermore, when using median splits to define parenting styles, it is not possible to compare the study results with other studies, since scores on various parenting dimensions may differ across samples.

Only in one study the categorization into prototypes of parenting was based on three dimensions (warmth, control, psychological pressure) (64). Of 13 studies that assessed separate parenting dimensions, 10 studies only reported on relationships between parenting styles and children's weight-related outcomes (39,52,63–65,67–71), rather than also assessing relationships with separate parenting dimensions. In doing so, important information could be lost. For instance, parents scoring moderately on both dimensions could be falsely categorized into a parenting style. Additionally, some studies (e.g., 53,58,62) assessed parenting constructs as being bipolar (i.e., parents scoring high on a parenting construct are expected to score low on its opposite). Recently, however, Skinner *et al.* (84) provided empirical support for the multidimensionality of parenting constructs rather than treating those constructs as being bipolar; parents scoring high on one parenting dimension (e.g., acceptance) do not necessarily score low on its conceptual opposite (i.e., rejection). Future researchers should take into account this multidimensionality.

Study results could differ according to the person completing the parenting instruments. The current review revealed that this could be done by both parents separately, one of the parents, or the child. Especially parental self-reporting could be a limitation of some of the studies, which may be biased because of social desirability. This may also decrease comparability with other studies which measure general parenting constructs via children or adolescents, although these constructs are also measured via questionnaires and thus subjective measures. Differences in the relationship between general parenting and children's weight-related outcomes were found for mothers and fathers (e.g., 38,40,48–50,64). It also seems that differences among the samples (e.g., sample size, child gender, age and ethnicity) may explain some of the inconsistencies. Study findings should be interpreted with caution as the variables (i.e., general parenting and children's weight-related outcomes) are all measured in different ways. However, most outcome variables were measured with validated instruments. It was not possible to calculate power and effect sizes of each study because of the heterogeneity of measurements across the studies and lacking information (e.g., regarding distribution of independent and outcome variables) in many studies.

Furthermore, several variables (e.g., socioeconomic status, maternal depression, child temperament) have been found to interact with certain parenting styles or dimensions in predicting children's weight status. Two studies examined the role of general parenting as a contextual factor that can influence the effectiveness of food-related parenting practices in predicting children's dietary intake behaviors (51,56). In line with this, we came across studies assessing parent-child interactions in relation to children's weight status in a broader context, e.g., quality of a child's environment (85–89), parental stress (90), attachment (90,91). Since we were specifically interested in parenting style (dimensions), these studies were not included in the present review.

Recommendations for future research

Additional research is needed to further study the influence of mediating and moderating factors influencing the general parenting - child weight

relationship, preferably employing a longitudinal design with more extended follow-up periods to establish causation. The proposed conceptual model (see Figure 1) could be used in order to guide determinant research, thereby enabling better understanding of the general parenting - child weight relationship. There is a need to conduct determinant studies using diverse ethnic samples and age groups. Moreover, larger samples of fathers should be included to allow for comparisons between mothers and fathers.

Increasingly, intervention studies address general parenting in the prevention and treatment of childhood overweight and obesity (92). We recommend intervention developers to increase their attention to the family context as it is an important factor influencing outcomes of overweight and obesity interventions for children. The primary goal of this type of interventions should be to create authoritative environments characterized by parental encouragement of instrumental competence in children by helping them in balancing other-oriented, rule-following tendencies with individualistic, autonomous active thinking (93–95).

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Supplementary material available online

Supplementary Table 1.