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Examination of parental knowledge of child weight status and associated potential health risks

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Abstract:

BACKGROUND: The identification of parental health knowledge related to obesity and overweight status in children is an important area. Its importance relates to understanding gaps in knowledge that can be used to create targeted intervention and prevention strategies to improve the management of child's weight.

AIM: There is a growing awareness of the potential health risks associated with increased childhood weight. It is currently unclear how well the public understands these risks and if understanding is linked to improvement in obesity or overweight levels in children. This review focused on determining if the current research is available to describe parental knowledge and whether it is connected to improved outcomes in the child's weight status.

METHODS: The search for original research articles published between 2003 and 2018 involved six databases, including CINAHL, EBSCOhost, PubMed, PsycINFO, Psychology, and Behavioral Sciences Collection, and OneSearch. The OneSearch database is a comprehensive search engine that allows simultaneous searching of the entire library category and results that are ranked by relevance to the search terms. The terms used included for the keyword search in each database included: "knowledge" or "awareness," "health risk" or "consequence," "obesity" or "overweight," and "weight" or "body mass index," "child," and "parent" or "parental." A content analysis of included articles was performed to synthesize available literature into a review.

RESULTS: This review included nine articles dealing specifically with parents of children and their knowledge levels. As there was limited information about if child's weight status connected to parental knowledge, an additional seven articles addressing how knowledge affects weight at any age was examined. The findings for parental knowledge and its effect have mixed results and varying methods of measurement.

CONCLUSIONS: While some studies have indicated the importance of knowledge, it is difficult to establish a reliable connection due to the limited examination of this subject. This is, therefore, an underexplored area that needs further study.

Keywords:

Child obesity, health risks, parental knowledge, parenting

Introduction

The health and social consequences linked to childhood obesity are unnecessary and can cause lasting problems.^[1] Preventing associated consequences requires that both children and their families be taught about the needed habits to maintain healthy

lifestyles and reduce the risks associated with increased weight.^[2]

Obesity is a pervasive, worldwide epidemic that affected more than 2 billion people who are classified as overweight and 671 million who were classified as obese in 2013.^[3] The epidemic is even affecting children as seen by the numbers of children under the age of 5 years that are classified as obese. The

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rate increased from 32 million in 2000 to 41 million in 2014.^[4] Projections indicate that by 2025 the United States will have 16.7 million overweight children and will rank third in the world for this problem.^[5] Illnesses such as cardiovascular disease, arthritis, cancer, and type 2 diabetes mellitus are now affecting children and are linked to weight problems.^[6]

Genetics, behavior, and environmental factors have all been linked to obesity development.^[7] The preschool age has been targeted as an ideal time to implement intervention and prevention strategies because children are still developing habits and are relatively adaptable, but the modifiable behaviors for this age group require the inclusion of both children and their parents.^[8,9] Parents are major influencers on lifestyle and child development, including those potentially modifiable, weight-related behaviors that are learned in the home.^[10] A child's weight status can be influenced by the allowance of high TV time, permissive parenting styles, food intake, and activity.^[11] Health-related socialization can occur as parents model and plan eating or physical and as they show specific attitudes toward choices.^[8,9] Connection to identifiable risk and understanding the severity of potential outcomes if the behavior is not changed is an important component of behavior change models such as the Health Belief Model, which has been used to affect change in health-related situations.^[12]

The significant consequences related to excess weight and the need to minimize associated health risks accentuates the need to teach parents and children habits for healthy.^[2] Health teaching is considered a positive approach to increase recognition of influential behaviors and when necessary to replace them with new and more appropriate behaviors.^[13] A prerequisite to effective health teaching requires that the needs of parents of preschoolers and the barriers that either limit the effectiveness of an intervention or that contribute to childhood obesity be understood. How obesity is treated and understood is affected by the complexities related to psychosocial and physiological components. Parental caregiving behaviors can be affected by their perception of items such as obesity risk factors, related complications, and even the support for intervention.^[14] Therefore, the degree to which a parent understands obesity risk and weight problems could impact their motivation and willingness to intervene.^[15] This could mean that awareness and recognition of an optimal weight necessitates the need to focus, in part, on education.^[15]

Education needs to involve understanding associated risks because obese individuals have increased the likelihood of having a reduced quality of life and of developing physical health problems including type 2 diabetes mellitus, cardiovascular disease,

and musculoskeletal disorders.^[3] Even children are experiences with heart-related problems such as high blood pressure and elevated triglycerides, which are illnesses previously isolated to adulthood.^[16,17] Childhood weight problems are also linked to hypertension, dyslipidemia, and insulin resistance. Evidence shows that if a child is obese their likelihood of having hypertension is three times higher than their normal-weight peers.^[2] The early diagnosis of these conditions in overweight and obese children means they will suffer 20–30 years longer than healthy-weight individuals.^[16]

Children who are overweight or obese are more likely to remain so as they age. Weight issues in birth to 5-year-old age are linked to a five times greater chance that the child will be overweight at the age of 12 years.^[9] There is also evidence that the body mass index (BMI) of a child tracks into adulthood with an average of 40% to as high as 80% chance for the overweight children to become obese adults.^[2] Obesity is both morbidity and a risk factor tied to the development of comorbidities.

While there is a growing medical awareness of health risks associated to weight in research findings and medical communities, it is unclear how well the public understands this and if understanding impacts obesity or overweight status in children. This review focused on these questions:

1. Are parents aware of the health risks associated with overweight and obesity in childhood?
2. How is knowledge or awareness of risks measured?
3. What relationship does knowledge have on weight in preschool children?

Methods

Six electronic databases were searched between April and June 2018: CINAHL, EBSCOhost, PubMed, PsycINFO, Psychology, Behavioral Sciences Collection, and OneSearch. OneSearch is an engine that allows simultaneous searching of the entire library category and results are ranked by the relevance to search terms. Reference lists of included articles were also examined to find qualifying papers.

Search strategy

The search was limited to articles published between 2003 and 2018. Search terms included word variations related to “knowledge” or “awareness,” “health risk” or “consequence,” “obesity” or “overweight,” and “weight” or “BMI,” “child,” and “parent” or “parental.”

Inclusion and exclusion criteria

Four key components were required for inclusion. First, research articles needed to be published in English and examine knowledge of health risks, knowledge of

obesity consequences, and/or knowledge of nutrition. Second, the target sample needed to be parents. Third, examination of the relationship of any of those three types of knowledge to child’s weight was required. Fourth, they needed to be published in the timeframe identified from 2003 to 2018. Articles were excluded if they were not available in English or if the full text was not available, if they were systematic reviews or not original studies, if they were published outside the timeframe, or if they did not explore one of the three parental knowledge aspects identified and include a focus on child’s weight issues.

The initial database searches yielded 9,387 articles. This was reduced by including only full-text options ($n = 1861$), peer-reviewed articles ($n = 1819$), and those published between 2003 and 2018 ($n = 748$). The number of included articles was reduced by excluding duplicates, reviews, and poster abstracts as well as by articles not being available in English ($n = 487$). There were also 28 additional articles identified with a reference search. The titles and abstracts of these articles were reviewed to determine their relevance to the overall focus of this review. The articles excluded at this stage included ones providing only study protocols, those that were not primary research, and those that did not discuss child’s

weight ($n = 258$). Nine articles ultimately fit the four inclusion criteria. A more detailed representation of this process is shown in Figure 1.

Results

Knowledge about children’s weight status and health risks has been examined in various contexts. Table 1 details important information about the studies, including the purpose, country, and findings. A primary objective of six of the studies was to examine the accuracy of how parents perceived their child’s weight. Six of the nine studies^[19,21,24,26] included a measure to gauge the accuracy of parental perception of the child’s weight while 5 of the 9 discussed knowledge of specific diseases and weight.^[19,21,24,25] Findings related to knowledge of health risk are presented in a later section.

Regarding the perception of child’s weight, the studies consistently demonstrated a lack of parental ability to correctly assess child’s weight status. In one study,^[21] 38.2% ($n = 78$) had inaccurate perception (kappa between actual weight and measure weight = 0.347). The highest noted rate was 52% ($n = 43$).^[20] Each of the studies noted that in the class of overweight and obese children, there was an even higher rate of misperception. This

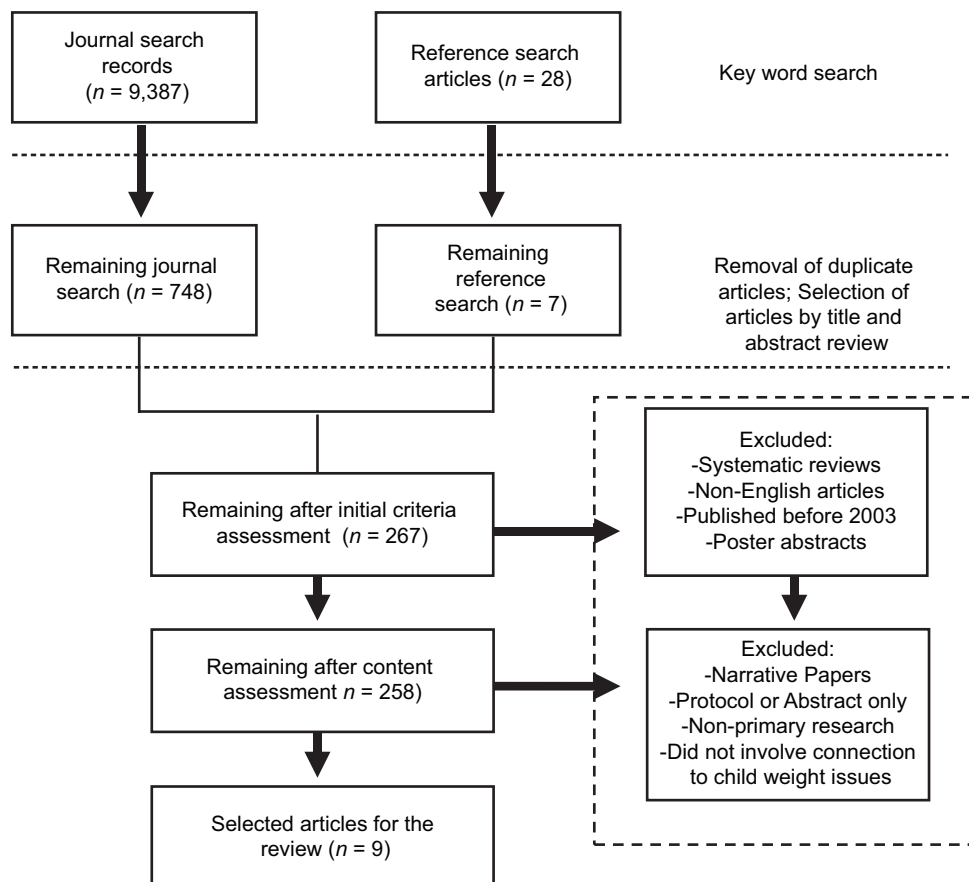


Figure 1: Search procedure for studies relating to parental knowledge of health risks, obesity consequences, and/or nutrition

Table 1: Descriptive information and important findings of knowledge-related studies by year

Author, country	Purpose	Sample	Overweight or obese, percentage of the sample	Inaccurate child's weight perception by parents, (%)	Findings
Etelson <i>et al.</i> , 2003 The United States	Assess understanding of excess weight, health risk, knowledge of healthy eating, and recognition of obesity in children	83 parents of 4-12-year-old children	Children: 23	52	Parents knew to avoid excessive sugar and fat Parents felt the health risk of a child being overweight compared to health risks as serious as those of excessive sunburn and more serious than casual contact with a person with AIDS
Muhammad <i>et al.</i> , 2008 Malaysia	Evaluate parental perception of child's weight and its relationship to nutrition and obesity knowledge	204 parents of 9-12-year-old children	Children: 19.6	38.2	Mean knowledge of nutrition and obesity 78.5 Inadequate nutrition knowledge of the food pyramid and low-fat food preparation >90% recognized weight association with diabetes, heart disease, and hypertension
Nsiah-Kumi <i>et al.</i> , 2009 The United States	Examine what affects the parental perception of health risk and parent self-efficacy	386 parents of 2-17-year-old children	Children: 35	33	Associated overweight in a child with a higher likelihood of developing diabetes
Dawson <i>et al.</i> , (2013) New Zealand	Determine if the intervention could improve parental recall and understanding of health information related to weight	1093 parents of 4-8-year-old children	N/A	N/A	39% of sample recalled information with a mean of 6.3 of 16 94% of parents could recall child's weight status, though <10 could describe what it meant
Tsai <i>et al.</i> , 2014 The United States	Evaluate changes in obesity awareness after a statewide campaign	1101 adults with a target of mothers with small children	N/A	N/A	Change of the view that obesity is a problem went from 83% precampaign to 86% postcampaign 53% of those who saw campaign reported surprise at what overweight and obese people looked like (body size)
Rune <i>et al.</i> , 2015 Australia	Employ a brief educational intervention to increase parental knowledge of risk factors for childhood obesity	80 parents of 4-12-year-old children	Children: 26.6 Parents: 35	35	Weight perception accuracy had no difference between the control or experimental group Parents of overweight children reported significantly higher knowledge on the posttest than the control group
Wright <i>et al.</i> , 2016 The United States	Evaluate parental understanding of long-term risk for obesity-related conditions	502 parents of 5-12-year-old children	Children: 35 Parents: 67	81.2*	17%-20% of parents estimated child would have zero risks of developing four health conditions as adults When family history of disease present, reported risk estimates for the four conditions were 5.1%-8.6% higher than those without a family history

Contd...

Table 1: Contd...

Study, country	Purpose	Sample	Overweight or obese, percentage of the sample	Inaccurate child's weight perception by parents, (%)	Findings
Hatta <i>et al.</i> , 2017 Malaysia	Evaluate the knowledge, attitude, and practices of mothers regarding childhood obesity	100 mothers	Children: 27.7	N/A	Moderate knowledge, attitude, and practice scores ADD scores Knowledge increased with education and income Good attitude was related to higher knowledge
Vittrup <i>et al.</i> , 2018 The United States	Examine exercise and eating habits, knowledge of obesity and health risks, and attitudes toward intervention and prevention in families with young children	205 parents of 3-12-year-old children	Children: 40 Parents: 69	100** 75*	Only 6% of children diagnosed as overweight or obese 71% of parents linked weight to diabetes <20% of parents linked weight to respiratory, cholesterol, or mental health problems

**Overweight child; *Obese. N/A=Not available

rate was as high as 81.2% of parents with overweight or obese children misperceiving their child's weight as underweight (5.5%) or about the right weight (75.7%).

This review also found three studies that described knowledge interventions^[18,19,23] focused on knowledge intervention. The first^[23] focused on examining changes in obesity awareness, identification, and health self-assessment following a statement public education campaign in Colorado. Their findings highlighted an unawareness of what size constitutes being overweight or obese with 53% ($n = 203$) of those who saw the campaign noting surprise at what such a person looked like. The campaign improved the accuracy with identifying correct weight status among participants who were categorized as underweight, normal weight, overweight, and obese ($P < 0.01$).

While this first intervention study focused on a large campaign, the other two were focused on a smaller population and more tailored intervention. These two intervention-type studies^[18,19] had positive results that supported the idea that intervention can improve parental knowledge and their overall understanding of risk and weight issues. While these two studies had similar findings, their methodology was different.

An experimental design using a pamphlet about obesity as an educational intervention versus a control group with a pamphlet focusing on stress reduction was the premise of the first study.^[19] Researchers examined whether parental knowledge related to risk, cause, and consequences of obesity changed with intervention. Parents who received the obesity pamphlet did show significantly greater knowledge

or risk factors and causes of obesity than those in the control group ($P = 0.001$). However, parents were not asked questions that assessed their actual knowledge, but rather parents provided a self-assessment on a Likert scale indicating a lack of lot of knowledge in the examined areas.

Meanwhile, the other studies^[18] focused directly on assessing knowledge. Parents of overweight children were given direct feedback about their child's weight and what it meant during either a motivational interviewing session or regular feedback session. Of the 271 parents of overweight children included in the study, parental recall of the information was 39% overall, though almost all (97%) remembered their child had an elevated BMI. Even with the recognition of elevated BMI, <10 parents could explain what the BMI measurement meant while 15% of parents had no knowledge of what the implications of BMI were and another 38% could recall one of the four consequences discussed. Impacts of the BMI were more likely to be remembered by parents in the motivational interviewing group ($P < 0.01$). Results also revealed that university education (maternal) and finding the information useful were independent predictors of the total recall score with a confidence interval (CI) of 0.81 (0.25–1.37) and 0.19 (0.04–0.35), respectively ($P < 0.05$).

While the latter measured knowledge by specific questions that were right or wrong,^[18] the former did not objectively test knowledge. Parents instead self-rated their knowledge on a Likert scale ranging from no knowledge to a lot of knowledge. The self-rating of knowledge does not provide an accurate appraisal of the parent's knowledge; thus, it is not could impact the

results and does not provide clear evidence of improved knowledge.

How child’s weight affects understanding was only assessed in one of these two studies.^[19] Results showed parents who had an overweight child reported significantly higher knowledge of the causes of obesity ($P = 0.051$), mental health consequences ($P = 0.019$), and physical consequences ($P = 0.005$) in the intervention versus control group.

How is knowledge measured?

This review showcases there is inconsistency in how knowledge is measured. None of the studies used a standardized assessment tool. The above-noted studies discussed knowledge by parental self-report of knowledge^[19] and by assessing recall of weight-related information shared following a weight screening.^[18] Another study^[24] used a questionnaire, which was validated with a pilot study, to ask multiple choice questions and statements that had participants to select their answer on a 3–5-point Likert scale. This tool assessed knowledge, attitude, and practices related to childhood obesity. However, the most common method of gauging knowledge was to see if parents recognized that childhood obesity could cause actual diseases such as heart failure and diabetes in children and predispose children to higher risks of these conditions in adulthood. Hypertension, heart disease, and depression were the illnesses most commonly used to assess parental awareness of how weight relates to disease.^[21,22,24,26] The connection of diabetes to weight was examined in all five of the reviewed studies that used disease awareness as an indication of knowledge.^[21,22,24-26] As this was the most common method, it will be discussed in further detail in the next section.

Parental recognition of health risks associated with increased child’s weight

Five studies examined parental understanding of health risks relating to obesity as shown in Table 2. The earliest study was conducted in 2008 and the latest in 2018. There is variability in what diseases are used to examine the relationship between obesity and overweight status in childhood to health risks. As described above, diabetes was the most common disease analyzed, followed by hypertension, heart disease, and depression. However, other consequences of childhood obesity were also examined, including early puberty,^[25] hypercholesterolemia,^[25,26] asthma/respiratory issues,^[25,26] sleep problems,^[25] issues in social relationships,^[22] and being overweight as an adult.^[22]

As part of the findings, the percentage of each sample who identified the health risk being associated with weight status was reported by researchers.^[21,22,24-26] The reported percent and the sample sizes are listed in Table 2 as reported in each study. The percentage of parents who relate obesity in children to health risks varied widely in these studies. The first identified study in 2008 reported high levels of recognition by parents that weight causes diseases with 95.1%, 93.1%, and 94.1%, respectively, for hypertension, heart disease, and diabetes. However, these rates did not hold across the studies that are included in this review. The lowest levels of recognition were found in 2016 with 15.4%, 11.2%, and 12.1%, respectively, for the same diseases while a study in 2018 also reported low recognition with 29%, 29%, and 71%, respectively. Researchers reported the percentage as a way to classify how aware parents were of the link between weights as a risk factor for disease development.

Physical health issues like those mentioned above were most often used as health risks for obesity and

Table 2: Percent of parental awareness of weight relationship to disease

	Study					Average across studies
	Muhammad <i>et al.</i> (2008) ²¹	Nsiah-Kumi <i>et al.</i> (2009) ²²	Wright <i>et al.</i> (2016) ²⁴	Hatta <i>et al.</i> (2017) ²⁵	Vittrup & McClure (2018) ²⁶	
Total Sample Size	204	386	502	271	205	1,568
Specific disease examined						
Hypertension	95.1	-	15.4	68	29	51.88
Heart disease	93.1	-	11.2	75	29	52.08
Depression	-	-	12.5	-	12	12.25
Diabetes	94.1	76	12.1	86	71	67.84
Early puberty	-	-	-	23	-	23
Hypercholesterolemia	-	-	-	84	15	49.5
Asthma/respiratory issues	-	-	-	72	17	44.5
Sleep problems	-	-	-	61	-	61
Non-disease measure						
Issue in social relationship	-	74	-	-	-	74
Overweight as adult	-	67	-	-	-	67
Incorrect perception of child weight	38.2	62	81.2*	-	59	60.1

*Actual child BMI as overweight and obese and percent of parents choosing either underweight or about the right weight

overweight status. However, mental health and social disorders have also been linked to weight studies.^[24,26] Despite a known connection between weight and mental health issues, the risk for depression related to weight status was only examined in two studies. Both studies showed low-parental recognition of this risk with 12.5% and 12%. Another study examined the related topic of how weight can cause issues in social relationships and found that 74% of parents recognized this as a risk. The same study found that parents recognized that being overweight in youth puts the child at risk for obesity in adulthood.

This review consistently identified that the percentage of parental recognition regarding health risk was reported, though how this related to child's weight was not always clear. The awareness of health risks was done secondary to the main purposes of each study. Therefore, the reporting of parental awareness of health risk was conceptualized, and its use varied significantly depending on the overall purposes and subsequent analyses of each study. For example, two studies sought to characterize how parental knowledge and attitudes related to barriers of childhood obesity,^[13,19] another examined child's weight issues and its relationship to knowledge, attitudes, and beliefs and its relationship to child's weight issues,^[25] one examined how child's weight affects parental risk perception,^[24] and another looked at family history and beliefs relating to consequences of childhood obesity.

An examination of parental knowledge and attitudes to examine barriers to childhood obesity was the purpose of one studies.^[26] Results showed that children's BMI did not correlate to parental knowledge, attitude, or practices.^[25] However, a positive correlation was noted between knowledge and parent's age and income ($r = 0.222$, $P = 0.026$; $r = 0.337$, $P = 0.013$) and between parental income and attitude toward obesity ($r = 0.326$, $P = 0.016$).^[25] The second study considered health risk with multiple other factors including perception of child's weight, who is responsible for addressing obesity problems, and major barriers to prevention.^[26] Their findings showed highly variable knowledge about healthy eating practices, limited recognition of appropriate portion sizes, the inability of parents to perceive correct weight status of their children, and variable recognition of diseases as health risks with most parents able to identify two of the six factors asked about ($M = 2.12$, standard deviation [SD] = 1.45). This study did not compare child's weight status to the knowledge of health risks. Instead, it looked at items like how child's weight status affects parental perceptions of responsibility and barriers. The finding showed that parent weight status affected their perception significantly ($P = 0.01$), though the child's weight status did not ($P = 0.26$).

Parents who have an obese child are more likely than parents of healthy-weight children to be a part of the 8% of those sampled who predicted their child would be overweight or obese in adulthood (odds ratio [OR] = 2.4 with CI 1.3, 4.7).^[24] Findings also showed that parents of overweight and obese children also estimated the risk of future diagnosis of hypertension higher by +3.99% points (CI = -0.19, +8.19) and + 4.18 higher for heart disease (CI = +0.61, +7.76) than parents of healthy-weight children. In parents of obese children, these items were also higher (+5.01 [-0.62, +10.63]; +5.38 [+0.10, +10.66], respectively) and a noted difference between depression ratings was also noted (+6.04, CI = +0.31, +11.78). Meanwhile, parents of children who had a family history of the disease had higher risk estimates for all four studied conditions (hypertension, heart disease, depression, and diabetes) that were 5.1%–8.6% higher than those with no family history ($P < 0.05$). This study confirmed an inability of parents to recognize the correct weight class of their child, though parents with an obese child did recognize the increased risk for children to develop obesity-related diseases in adulthood with an increased percentage 5–6 points higher than parents of healthy-weight children.

Effect of obesity knowledge on weight

Three of the nine reviewed articles specifically mentioned how parental knowledge relates to child's weight status or perception of child's weight. The first study had a broader focus than the other two by including an examination of multiple factors including knowledge, attitude, and practices.^[24] There was no significant finding relating children's BMI to parental knowledge, attitude, or practices ($P = 0.522$, $P = 0.758$, $P = 0.953$). However, they did find attitude and knowledge ($r = 0.414$, $P < 0.001$) and practices ($r = 0.261$, $P = 0.009$) were correlated.^[24] Their findings showed that as education and income increased, the attitude and knowledge also increased.

The other two studies looked at knowledge and its relationship to how a parent perceives their child (i.e. whether underweight, healthy weight, or overweight/obese). While one study looked at the population of Australia,^[19] the other focused on the Malaysian population.^[21] The Malaysian study examined a parent's knowledge of nutrition and obesity and compared it to their ability to perceive their child's weight correctly. Both parents who correctly perceived weight ($n = 126$) and incorrectly perceived weight ($n = 78$) had similar knowledge scores of 79.8 (SD = 13.9) and 76.5 (SD = 15), respectively. The parents' education level ($P = 0.59$) and knowledge of obesity and nutrition ($P = 0.11$) were not significantly associated with how the parent perceived the child's weight status. Meanwhile, the Australian study utilized an intervention approach to see how an obesity pamphlet (experimental) and a stress

pamphlet (control) affected the parental perception of child's weight.^[27] Results showed no difference in accuracy of child's weight perception between their control and experimental groups ($P = 0.353$), though they did find a trend toward significance when examining the interaction effect between intervention and child's weight categories $P = 0.0$.

While all three of these studies included child's weight as a variable in the study, only one tracked how knowledge relates to child's weight.

Discussion

The contributing factors to continued weight problems and associated diseases are being investigated to develop appropriate intervention and prevention strategies. Knowledge alone cannot be linked as the cause of child's weight issues. However, it is being examined and identified as one of many modifiable factors that can potentially influence the parental perception of child's weight and their willingness to intervene. This idea has been supported by research that shows that parental knowledge and practice has a positive, significant relationship with weight ($r = +0.261$, $P = 0.009$).^[25] This study involving Malaysian mothers confirmed awareness of obesity effects. The researchers concluded that attitude and knowledge were factors that should be considered jointly to inspire parental behavioral changes, such as preparing healthier foods for a meal, that could ultimately reduce obesity problems.^[25]

The reviewed studies also showed that parents were inaccurate at perceiving child's weight. This inability to correctly perceive weight is linked to a lower chance of implementing positive lifestyle changes in the family.^[14] At the same time, education has been shown to improve recognition of weight deviances and increase understanding of weight and its complications.^[23] A statewide public education campaign demonstrated this with its results of improved accuracy of weight recognition and identification of weight as a health issue.^[23] Despite positive findings in some studies, no significant connections between child's weight status and knowledge were identified in three of the other nine studies examined.^[19,21,25] It is important to note that all three studies with this finding had small sample sizes, and one of these three used self-reported knowledge instead of a measure judging actual knowledge by asking specific questions and scoring the results.

This lack of consistency in findings is mirrored by research relating to the general adult population. For example, BMI is negatively correlated to knowledge, though nonsignificant ($P = 0.552$),^[20] and another study found no relationship between losing 10 or more pounds

and having knowledge of obesity risks (OR = 1.075, 95% CL 1.005, 1.027).^[27,28] Similar to the studies in this review, though, there have been positive connections made between knowledge and obesity in three other studies. Findings include confirmation of a significant relationship between obesity health risk knowledge and the age of the students,^[29-30] of weight loss being associated to greater awareness of the social/aesthetic and health costs of obesity,^[30] and that even people who are deemed high risk, they have low knowledge of obesity health risks.^[30] An intervention-based study involving knowledge found adults significantly increased knowledge ($P = 0.001$) as weight loss ($P = 0.001$) as well as BMI and waist circumference ($P < 0.001$) significantly decreased.^[31]

Given the limited studies examining knowledge and the inconsistency in findings, this topic appears to need further study. Based on the identified studies, though, there needs to be more consistency in measurement tools as they have been highly variable. In this review, some studies included official measured validated with procedures such as Cronbach's alpha,^[35] but many did not do this.^[32] Some of the studies provided few details about the types of questions used to gauge knowledge, or they used a qualitative approach that did not allow quantitative comparison to weight.^[33,34] The employment of different tools to measure knowledge makes it difficult to compare findings from multiple studies. Reports of the validity and reliability of the studies or tools are also suspect due to unvalidated measurement tools.

Previously verified scales do exist and thus could be utilized in research studies. For example, this review found a scale for obesity health risk knowledge that was published in 2006.^[33] Later, in 2016, this scale was modified for use with adolescent populations.^[34] If research relied on a standardized tool, it could improve what is known about relationships between knowledge and weight at any age. Health knowledge has already been connected to other factors. This has been shown in a study that showed nutritional knowledge was significantly related to self-reported BMI and feeding practices.^[35] The primary caregiver's BMI was positively associated with feeding practices used for a child's weight control ($r = 0.29$, $P < 0.05$) and teaching children about nutrition ($r = 0.24$, $P < 0.05$).^[35]

If parents recognize child's weight issues and understand what consequences are associated with being overweight or obese, their motivation to initiate lifestyle changes and develop healthy habits could lead to healthier weights in children.^[4] Younger children rely on their parents and have the most significant potential to prevent weight issues. The use of nonstigmatizing messages related to weight has been shown to help people re-calibrate their perception of healthy weight and become more

aware of the health risks associated with unhealthy weights.^[24] Those results lead to conclusions that if health providers and educators focused on providing nonstigmatizing messages related to weight, it could help people re-calibrate their perception of healthy weight and be more aware of health concerns that relate to increased risks.

This re-calibration seems needed as studies show misperception of child's weight is consistently found to be a problem, especially among parents with overweight and obese children. Even with obesity and overweight levels ranging from 19.6%^[21] to 40%,^[27] parents are not engaging in efforts to improve the child's weight. In the one study, examining parental inclination to intervene,^[26] only 18% of parents said they would attempt to correct extreme weight deviations.

This review shows that more studies have been done on general adult knowledge than on parental knowledge of obesity health risks. With parents being a key component in child's weight and development, a better understanding of their knowledge and how it affects their choices is needed. In addition to this lack of research identified, the review showed that there is considerable variability in how knowledge is measured, and it is unclear if parents associate child's weight issues to chronic diseases, mental health problems, and social issues.

Limitations

There is a limited amount of research addressing this topic and an inconsistency of how it is evaluated, which makes it difficult to synthesize results. For example, the variable characterization of knowledge in the studies impacts the meaning of the results and the ability to compare across studies. The knowledge tools used were mostly investigator created without external validation. With the variable use of knowledge constructs and overall limited content, this implies that the state of science regarding this topic has gaps that need further explored. Further, this review highlights that current available research does not have a uniform consensus regarding findings. Another limitation is that some of the articles relied on self-reports of knowledge levels, which can lead to potential recall bias, and thus not represent changes in knowledge or actual knowledge of the participants.

Conclusions

Parental knowledge and its relationship to recognition of healthy weight and behaviors, desire or intent to make changes, and identification of health risk require more study and a more consistent approach. Knowledge of health risks and obesity have been measured in many

ways from asking parents to self-report their estimation of knowledge^[19] to examining awareness of how weight is connected to diseases.^[20,22-24,26,34,36] This review also highlights inaccuracy of perception of child's weight and inconsistency in the parental ability to connect weight to weight-related diseases, such as hypertension and heart disease. The only disease that parents were able to connect to weight consistently was diabetes. As recognition of abnormal weight and link to risk are precursors to behavior change, it is essential to find ways to improve these aspects in parents. Parents must be able to recognize how they influence their child's weight, identify when their child's weight is an issue, and understand the health risks of weight in their child to improve motivation for intervention and prevention to be successful.

While the research is limited and there are inconsistent findings, studies have shown that education could be an essential part of helping parents and children improve weight status, nutritional habits, and physical activity in youth. If gaps in parental knowledge are adequately identified, future educational efforts could focus on these areas to improve knowledge and success of intervention and prevention of childhood obesity.

Compliance with Ethical Standards

As this was a review of previously published research, IRB approval was not necessary. Likewise, informed consent was not needed as this was an analysis of existing research and did not involve participants or newly collected data.

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Conflicts of interest

There are no conflicts of interest.

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