



Weight and Health-related Quality of Life in Children and Adolescents: A Systematic Review

Demetria Pizano

Cedars-Sinai Medical Center, Los Angeles, California, USA

Rebecca Hedrick

Cedars-Sinai Medical Center, Los Angeles, California, USA

Steven Clevenger

Cedars-Sinai Medical Center, Los Angeles, California, USA

Samantha Cohen

Cedars-Sinai Medical Center, Los Angeles, California, USA

Waguih William IsHak (Corresponding Author)

Cedars-Sinai Medical Center, Los Angeles, California, USA

Email: Waguih.IsHak@cshs.org

Article History

Received: 24 March, 2021

Revised: 19 May, 2021

Accepted: 21 June, 2021

Published: 27 June, 2021

Copyright © 2021 ARPG & Author

This work is licensed under the Creative Commons Attribution International

Attribution International



BY: Creative Commons Attribution License 4.0

Abstract

Objective: This systematic review aims to examine the spectrum of research studies including cross-cultural and international studies that have focused on weight and health-related quality of life in children and adolescents. **Methods:** Following the PRISMA guidelines, studies published in the past 25 years from 1995 until 2020 that pertain to weight and health-related quality of life (HRQoL) in children and adolescents were identified through the use of Pubmed, ScienceDirect, Google Scholar, and PsycInfo databases. Two authors independently conducted a focused analysis and reached a final consensus on which studies to include using specific selection criteria followed by a quality check of the studies, resulting in the final selection of 25 studies. **Results:** The selected studies particularized the level of impaired quality of life among normal-weight, overweight and obese children and adolescents, and distinctly found that higher participant weight was correlated with a lower HRQoL score. **Conclusion:** Studies showed a significant negative correlation between weight and HRQoL. Multiple types of prevention and treatment programs are critically needed to provide resources to improve quality of life in overweight and obese children and adolescents.

Keywords: Weight; Health-related quality of life; Obesity; Children and adolescents.

1. Introduction

Obesity is a highly prevalent and chronic disease affecting health, caused by abnormal or excessive body fat accumulation due to genetic, metabolic, social, cultural and behavioral factors [1]. As one of the most common physical health problems and the leading cause of preventable deaths, obesity continues to be a point of concern for health professionals [2]. Whether one categorizes excessive weight and obesity as a chronic disease or lifestyle, this health concern persists not only in the United States but throughout the world. As the country with the highest rates of pediatric obesity, the United States had 4.4 million children and adolescents diagnosed with severe obesity, with an estimated prevalence of 20.5% in 2011 [3, 4]. An alarming rise in the prevalence rate by 47.1%, from 1980 to 2013, is reaching global pandemic proportions [5, 6]. There is an overall impacted population rate of 23.8% of boys and 22.6% of girls in developed countries, and 12.9% of boys and 13.4% of females in developing countries.

As a critical factor impacting personal health, Health-Related Quality of Life, or HRQoL, is a subjective evaluation of multiple quality of life dimensions relating to health [7]. Specifically, HRQoL focuses on the impact of one's physical, mental and social wellbeing resulting from a disease or health state [8, 9]. Many researchers have found that overweight/obese adolescents have lower physical, psychosocial and overall HRQoL scores [10]. Studies have demonstrated that obese children or adolescents are 5.5 times more likely to have greater impairment of HRQoL compared with their healthy-weight counterparts [11].

This systematic review aims to examine the spectrum of research studies, including cross-cultural and international studies, that have focused on weight and health-related quality of life in children and adolescents by addressing the following questions:

- (1) What are the measures used to assess health-related quality of life?
- (2) What is the relationship between weight and health-related quality of life?
- (3) What is the impact of intervention upon reducing weight and improving health-related quality of life?

2. Methods

2.1. Search Strategy

Following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [12], studies published in the past 25 years from January 1, 1995 until January 1, 2020 that pertain to weight and health-related quality of life were identified through the use of the Pubmed, ScienceDirect, Google Scholar, and PsycInfo databases, using the following keywords: “quality of life” AND “weight.” The search was further focused by adding the following keywords: “obesity” OR “overweight” AND “children and adolescents”. We also conducted a manual search of reference lists from identified papers and previous reviews of quality of life, weight, obesity, overweight, and children and adolescents.

2.2. Study Selection Criteria

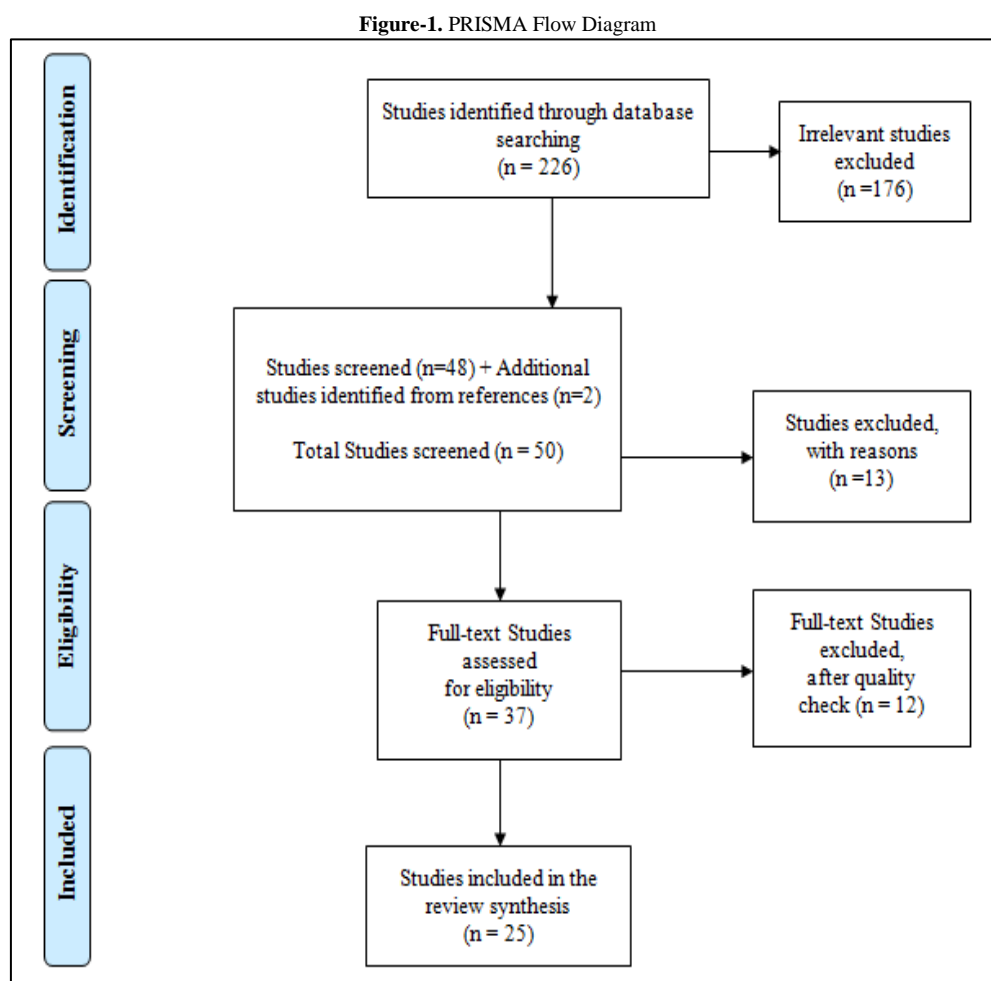
The following criteria were used for selection: A) articles published via a peer-reviewed journal, B) articles published in English or those published with an English translation, C) studies of any design in humans that focused upon obesity and overweight populations, D) studies that focused upon children and adolescents, E) studies that measured quality of life, F) articles which included cross-cultural and international studies. In the review process, within the set parameters, an analysis was conducted on the full-text articles that were compiled. Exclusion criteria included editorials, opinion pieces, case reports, and other systematic reviews.

2.3. Study Selection Methodology

Two authors independently conducted a focused analysis and reached a final consensus regarding which studies to include, by using the above specified selection criteria, followed by a quality check of these studies using the criteria adapted from Lohr and Carey by the Agency for Healthcare Research and Quality [13, 14].

2.4. Search Results

The above selection process and methodology resulted in the final selection of 25 studies as shown in the PRISMA flow diagram depicted in Figure 1.



2.5. Data Extraction

Key findings were extracted from full-text research publications and corresponding tables. Study design and accumulated findings are explained in table 1 of this review. See Table 1.

3. Results

Table 1 shows results compiled from 25 studies.

Table-1.

Study	Population and Setting	Design	Region	Exclusion Criteria	Instrument	Outcome
Al-Akour, <i>et al.</i> [15]	1433 adolescents 13-18 y.o.	Cross-sectional	Jordan	N/A	BMI PedsQL	Compared to overweight boys, obese boys had sig lower overall scores in social, physical, and school functioning. Overweight and obese subjects are impaired in all HRQoL domains
Aldaqa and Sehlo [11]	64 subjects 13-17 y.o.	Case-control	Saudi Arabia	Eligible: Psychological evaluation, biatric surgery Ineligible: Past/family history of psychiatric disorders	BMI PedsQL RSE	Higher BMI is associated to lower QoL. Decrease in BMI is associated with higher QoL and self-esteem one year after biatric surgery
Bianchini, <i>et al.</i> [16]	92 children and adolescents 10-18 y.o.	Pre - Post	Brazil	Use of psychotropics interfering w/ weight control, long-term alcohol consumption	BMI Tanner Stages (pubertal devel.) Body composition PedQL	Following intervention w/ sig. improvements in physical, psychosocial, social and total HRQoL. Parents perception has sig. improvement in all domains except school. Parents perceived HRQoL lower than their children at baseline and after intervention parent's perception score was only lower in physical and total HRQoL domain
Boyle, <i>et al.</i> [17]	1771 children 11 - 15 y.o.	Cross-sectional	England	N/A	BMI CAPANS PedsQL EQ-5D Block food intake screener	Correlations were found between QoL and PA. Difference in all domains of PedsQL between normal and overweight and obese subjects.
Cui, <i>et al.</i> [18]	6000 adolescents 12-17 y.o.	Cross-sectional	USA	Pregnancy	BMI CDC's HRQoL measure	Obese and overweight reported worse health than normal weight; QoL domains of physically unhealthy and mentally unhealthy days were not significant across BMI categories
De Beer, <i>et al.</i> [19]	93 adolescents 12-18 y.o.	Case-control	Amsterdam	Genetic syndromes or diseases associated w/ obesity	BMI PedsQL CHQ	Obese adolescents experience lower HRQoL compared to normal weight controls. BMI inversely assoc. w/ lower HRQoL. Tension w/ family found due to health cond.
Fazah, <i>et al.</i> [20]	1000 adolescents 14- 18 y.o.	Case-control	Lebanon	Chronic physical disabilities	BMI PedsQL PA Questionnaire	Obese children had lower physical and social functioning. Boys had higher HRQoL than girls in both overweight and

						normal weight subjects. Overweight girls reported lower physical functioning and average HRQoL scores compared to normal-weight. Obese girls reported lower social functioning score than normal weight
Finne, et al. [21]	74 children and adolescents 8 - 16 y.o.	Randomized control	Germany	Eligible: overweight (BMI \geq 90th percentile), healthy and not taking medications Ineligible: obese	BMI SES measure KINDL-R	Only sig. impairment for self-report was social functioning (i.e. friends). Twelve months after end of treatment, scores reached population means. Parents rated self-esteem increase at end of treatment and 12-month follow-up. Self-report had sig. overall HRQoL scores at 12-months follow-up.
Finne, et al. [21]	9076 children and adolescents 8-16 y.o.	Randomized control	Germany	Eligible: overweight (BMI \geq 90th percentile), healthy and not taking medications Ineligible: obese	BMI SES measure KINDL-R	Treatment sample had parents' with higher BMIs. Lower physical and emotional well-being scores than normal weight. Inpatient parent evals had different perceptions/scoring than inpatient subject. Male pt. reported sig. lower physical well-being scores than control After controlling for age/BMI HRQoL did not differ between samples .
Guardabassi, et al. [22]	600 children 8-11 y.o.	Cross-sectional	Italy	N/A	BMI POTS PedsQL	Stigma experiences act as mediator in relationship between children's body weight and HRQoL. Children's weight is indirectly related to QoL (perhaps QoL is from teasing and not weight)
Hamzaid, et al. [23]	90 children 8-11 y.o.	Case-control	Kuala Lumpur, Malaysia	BMI \geq 95th percentile	BMI PedsQL	QoL child's self-report were higher than parent-proxy for physical and psychosocial domain. Parent engagement influence treatment outcomes. Sig. obesity-related impairment of QoL. Obese children were on the lower end of range of score compared to those with chronic and disabling conditions (studies in western society)
Helseth, et al. [24]	1238 children 8-18 y.o.	Cross-sectional	Norway	N/A	BMI KIDSCREE N-52	HRQoL decreased significantly with age in both girls and boys. BMI was negatively and weakly correlated with HRQoL (physical well-being and self-perception). Neg

						correlation btw age and several QoL subscales. Parent report rated child's QoL lower than child's rating in Social support and peers, Parent relations, and Psychological well-being subscales
Jalali-Farahani, <i>et al.</i> [25]	465 adolescents 14-17 y.o.	Case-control	Tehran Iran	N/A	BMI EAT-26 PedsQL	Disordered eating has higher prev. in overweight adolescent but only sig. in adolscent girls. Girls w/ disordered eating had lower emotional and social functioning of HRQoL than non-disorder eaters. Both genders show disordered eating is associated with poor HRQoL. Higher dissatisfaction with body weight and shape in girls. Disordered eating is assoc. overweight and obese adolscent girls
Lin, <i>et al.</i> [5]	236 children (elementary students)	Case-control	Southern Taiwan	N/A	BMI Sizing Them up and Sizing Me Up KINDL PedsQL	Lowest scores in obese group in Emotion, Physical and Teasing domain. Scores for total, Emotion, Teasing/Marginalization, and School domains were sig. lower in overweight group.
Loh, <i>et al.</i> [26]	624 adolescents 13 year old	Cross-sectional	Malaysia	Chronically ill, long-term med use, restricted diets/weight supplements	BMI PedsQL	Malay female adolescents had sig. lower emotional functioning than chinese counterparts. Adolescents w/ educated mothers reported sig. lower emotional functioning. Overweight/obese adolscents had impaired overall HRQoL scores compared to normal weight. Negative impact of excess weight includes physical impediments, low self-esteem, social stigmatization and peer victimization
Mollerup, <i>et al.</i> [27]	477 children and adolescents 3-18 y.o.	Pre - Post	Denmark	Eligible: BMI \geq 85	BMI PedsQL Pubertal Devel. Stage SES	The Children's Obesity Treatment: At post-tx. QoL scores had improved. QoL was associated with BMI reductions and higher SES. Total QoL scores improved regardless of age of at pre-tx.
Nicholls, <i>et al.</i> [28]	3040 adolescents 13-18 y.o.	Cross-sectional	Australia	N/A	BMI PedsQL ABAKQ	It's Your Move, obesity prevention program: Normal weight and overweight QoL scores were similar, but those with obesity had sig. lower scores. High levels of

						parental encouragement are related to physical functioning and wellbeing in overweight and obese adolescents. Positive relationship between parent encouragement and healthy HRQoL scores
Ottova, <i>et al.</i> [29]	13041 children 8-18 y.o.	Case-control	Germany, Spain, France, Netherlands, Austria, UK, Switzerland, Hungary, Czech Republic, Poland	N/A	BMI KIDSCREE N-52 SES	Impairment in overweight group occurs strongest in physical and self-perception, however, sig. in moods and emotions, social support and peers, school environment, and social acceptance. Seen throughout all countries is impairment for obese and overweight subjects, highest in self perception, physical well-being and social functioning. KIDSCREEN strength is cross-cultural validity
Pinhas-Hamiel, <i>et al.</i> [30]	182 children and adolescents	Case-control	Israel	N/A	BMI PedsQL	Lower scores in physical, social, and school domains in obese subjects. School and BMIz had strongest negative correlation. Parents of obese children reported lower scores QoL scores compared to children's scores
Sato, <i>et al.</i> [31]	422 children and adolescents (primary and junior high grade)	Cross-sectional	Japan	N/A	WHO-QOL BMI	Overall QOL scores did not differ among under-, normal-, or overweight. Psychosocial elements of HRQoL may differentiate based on gender and developmental status
Southerland, <i>et al.</i> [10]	1509 adolescents (Grade 9-12)	Cluster-randomized	USA	N/A	BMI Weight Misperception on PedsQL	Trail for Team Up for Healthy Living Project, 32% misperceived their weight. Females overestimate their weight status. Males who overestimated lower social functioning. Underestimated subjects had higher total HRQoL
Sysko, <i>et al.</i> [32]	101 adolescents 14-17 y.o.	Pre - Post	USA	Eligibility: BMI > 40 kg/m ² ; history of obesity; appropriate contraception; absence of medical contraindications for surgery; no purging	BDI EDE-Q Family Environment scale PedsQL Youth self-report Clinical interview w/ adol and parent	Improvement in total PedsQL score and PedsQL- Emo function were sig; Gradual deceleration of increase in scores over time; Improving levels of depression decelerates over course of followup; PedsQL was sig related to change in BMI; PedsQL subscale scores was not predictive of BMI change
Wynne, <i>et al.</i> [7]	255 subjects 7-12 y.o.	Cohort	Dublin	N/A	BMI KIDSCREE N-27	Those who wanted to change their weight had higher levels of body fat

					HRBQ Children's Depression Inventory	and depressive symptoms and sig. lower levels if total HRQoL than those happy with their weight. Depressive symptoms were sig. correlated to lower HRQoL
Yacobovitch-Gavan, <i>et al.</i> [33]	71 adolescents 12-18 y.o.	Cohort	Isreal	Eligible: BMI > 95th percentile Ineligible: Chronic disease, current tx. w/ weight- loss inducing meds, participant in other weight- loss study in last 2 mnt.	BMI PedsQL	Intervention caused sig improvements in physical, emotional, school and psychosocial functioning. Intervention led to scores seen in healthy youth. Youth with better psychosocial functioning (emotional field) at baseline are more likely to have better improvement in BMI.

RSE: Rosenberg Self-esteem Scale

EQ-5D: EuroQoL

PA- Physical Activity

PedsQL - Pediatric Quality of Life Inventory

CAPANS- Western Australians Child and Adolescent Physical Activity and Nutrition Survey

CHQ: Child Health Questionnaire

KINDL-R is generic measure for QoL

POTS: Perception of Teasing Scale

KIDSCREEN questionnaire is a generic HRQoL instrument

EAT: Eating Attitude Test

Sizing Them Up and Sizing Me Up questionnaire to capture children's weight-related QoL

ABAKQ: Adolescent Behavior, Attitude, and Knowledge Questionnaire

HRBQ- Health Related Behavior Questionnaire

EDE-Q: Eating Disorder Examination – Questionnaire

3.1. What are the Measures used to Assess Health-Related Quality of Life?

Health-related quality of life (HRQoL) was assessed using several measures utilized in the selected studies. Along with the widely used PedsQL inventory, KIDSCREEN is one of the most relevant measures found in the various studies discussed. Measures include Centers for Disease Control and Prevention's QoL, World Health Organization's QoL, KINDL-R, and Duke Health Profile for adolescents.

The most widely used measure, the 23-item Pediatric Quality of Life Inventory 4.0 (PedsQL), is for children and adolescents 2 to 18 years old (parent-proxy report) and 5 to 18 years old (self-report), using a recall period of the prior 7 days [10, 17]. This quality of life inventory includes the following four dimensions: 1) physical, 2) emotional, 3) social, and 4) school functioning. The Psychosocial Health Summary Score includes 5 items, each dedicated to emotional, social and school functioning. Each item rates the reactions of children and adolescents to statements such as, "I feel sad," "I have trouble getting along with other teenagers," and "It is hard to pay attention in class." The remaining eight items comprise the Physical Health Summary Score with prompts such as, "It is difficult for me to run." Each item is rated on a 5-point Likert scale from 0 (never) to 4 (almost always), and subsequently transformed linearly to a scale from 0 to 100. Thus, the total score reflects the subject's perceived quality of life, with higher scores correlating with greater QoL.

Although not as widely used, KIDSCREEN is a valid measure used on an international basis. KIDSCREEN is a measure with variations of either 52, 27, or 10 items [24, 29]. The KIDSCREEN questionnaire focuses on physical, social, and mental dimensions of well-being. There are up to 10 dimensions that are examined, including: physical well-being, psychological well-being, moods and emotions, self-perception, autonomy, parent relations and home life, financial resources, peers and social support, school environment, and social acceptance/bullying. Although the number of items associated with specific dimensions may differ, the 52-item breakdown consists of seven items for moods and emotions, and six items each exploring constructs relating to psychological well-being, parent relations and home life, social support and peers, and school environment. Five items are each used to examine physical well-being, self-perception and autonomy, while three items are each used to examine both financial items and social acceptance/bullying. This questionnaire is utilized for ages 8 to 18 years, similar to the PedsQL that also measures HRQoL from both the child's and parent's proxy perspectives, using a one week recall period. KIDSCREEN uses a 5-point Likert scale to assess either the frequency of certain behaviors/feelings (never to always), or the intensity of an attitude (not at all to extremely). Rasch scores are computed for each dimension then transformed into T-values with a mean of 50 and a standard deviation of 10, with a higher score representing a higher quality of life.

Additionally, there are several questionnaires that were involved in completing the review's findings. These surveys are similar to KIDSCREEN and PedsQL, utilizing standard scoring and domain features. For example, the CDC's measure examines several components including health, physically unhealthy days, mentally unhealthy days, and activity limitation days [18]. Using a Likert scale with a 1 to 5-point range, 1 being Excellent and 5 being Poor, the measure asks for reflection upon the previous 30 days [34]. The WHO-QoL inventory includes physical,

psychological, social and environmental factors based on life situations in children and adolescents [31]. This measure is comprised of 47 items, utilizing a five-point Likert scale. KINDL-R, a HRQoL measure composed of 6 dimensions, with each dimension containing 4 items, is based upon the previous week's thoughts [21]. This measure examines physical health, emotional health, overall well-being, self-esteem, family, friends, and school. The Duke Health Profile for adolescents is a 17-item questionnaire with 10 domains. With a 0-100 total score, similar to the former measures, a higher score with this profile corresponds with a greater perceived HRQoL [35].

3.2. What is the Relationship between Weight and Health-Related Quality of Life?

Pinhas-Hamiel, *et al.* [30] found, like many others, that high BMI was closely related to quality of life and that obese children and adolescents reported lower HRQoL scores in physical, social and school domains compared with those of normal weight [11, 18, 32]. Other constructs proven to have significant results - including strength, diligence, and self-esteem - were lower in overweight populations [31]. A study by Lin, *et al.* [5] found that emotional and physical factors, as well as teasing, were domains with lower scores in obese children. Fazah, *et al.* [20] noted that obese adolescents tend to have lower physical and social functioning.

There are some differences found between obese and overweight study populations. For example, Pinhas-Hamiel, *et al.* [30] found that school performance was less affected in overweight students compared with their obese counterparts. Congruent with school performance, overweight individuals scored lower on self-esteem and friends scales [21] compared to those of average weight. These reduced scores may be attributed to overweight children are more likely to be victims of bullying [11].

Additional studies found that boys had higher HRQoL than girls in both overweight and normal weight subjects [20]. When compared with girls of normal weight, overweight girls reported lower physical functioning and average HRQoL scores, while obese girls reported lower social functioning scores [18, 20]. Overweight female adolescents reported lower emotional and social functioning [25, 26]. This may be attributable to girls internalizing the thin ideal, a phenomenon generally not seen among the male participants [15, 35]. Boys, on the other hand, were more likely to desire average to larger-sized bodies and to feel that a variety of body-shapes was more socially acceptable, as shown by Jalali-Farahani, *et al.* [25].

3.3. What is the Impact of Intervention upon Reducing Weight and Improving Health-Related Quality of Life?

Treatment-seeking obese patients have a higher HRQoL than the general obese population, with those seeking treatment having a more fulfilling weight-loss experience [8]. Specifically, Finne, *et al.* [36] noted that self-esteem was higher in treatment-seeking participants. As the overweight and obese populations continue to grow, it is imperative that countries begin to create prevention and treatment programs. A study by Nicholls, *et al.* [28] is one of multiple studies that introduced a weight-loss program to study the negative correlation of BMI and HRQoL. Programs like "It's Your Move" is a community-based program in Australia created to promote healthy eating and physical activity. The Children's Obesity Treatment (TCOCT) was a BMI reduction treatment program utilized in a healthcare center [27]. Programs such as these focus on meal/food intake, physical activity, sedentary behavior, sleep time, and screen time.

Studies focusing on post-intervention scores found significant improvements in physical, emotional, school and psychosocial functioning [16]. Intervention led to scores comparable to those seen in healthy youth [33]. Youth with better psychosocial functioning at baseline are more likely to have better improvement in BMI. Studies found that weight loss was a significant predictor of improvement in self-esteem and all HRQoL measures [11]. Edwards, *et al.* [9] used a treatment emphasizing perceived body shape/composition and improved quality of life caused by weight loss rather than focusing upon reduction of BMI as a treatment outcome [27].

Many studies suggest, as research progresses, that there is a need to identify treatment programs that are specifically dedicated to improving HRQoL in both children and parents [30]. In addition, it has been observed that lower overall quality of life scores were closely correlated with lower education and unemployed parents, thus solidifying the need to create interventions that include more education [15].

4. Discussion

This review provides a perspective on the important role that weight has regarding quality of life in children and their transition into adolescence. Overall, the selected studies evaluated quality of life measures among normal-weight, overweight and obese children and adolescents, and distinctly found that higher weights were correlated with lower HRQoL scores. Eight studies specifically identified the significant negative correlation between weight and HRQoL. The primary quality of life subscales that were identified with decreased scores were: overall HRQoL total, social support and peers, physical well-being and school environment [5, 29]. Although the names of the domains may differ among the different instruments, the studies generally provided similar conclusions regarding quality of life measures. Most importantly, these findings appear valid and reliable as they were quite consistent across different studies using different questionnaires. Of those programs that had intervention components, four studies found a significant improvement of quality of life scores over time, with one study in particular demonstrating that there was a deceleration of the treatment benefit as time continued. With eight studies focusing on prevention programs or intervention techniques, such as It's Your Move [28] or the Children's Obesity Treatment [27], this review found multiple facets that can be utilized to improve levels of quality of life. Additionally, these studies found that other variables improve with intervention, such as depression and self-esteem [11, 22, 32].

Other elements that may impact perceived levels of quality of life in overweight and obese children are gender and age. Three studies noted that both overweight and obese boys had significantly higher HRQoL scores than their female counterparts. This may be explained by Southerland and colleagues' study (2016) the found girls are more likely to overestimate their weight status [20]. In addition to the finding that females are more likely to have lower quality of life scores, adolescents tend to have lower quality of life levels than their younger-aged obese and overweight counterparts [31]; this finding is supported by two studies, both of which noted this vulnerability of adolescents of both genders.

Other factors impacting perceived quality of life include interaction with parents and socioeconomic status. Several studies have found that higher socioeconomic status and increased parental interaction or encouragement are correlated with increased levels of quality of life in their children [23, 27, 28]. Additionally, four studies have noted that parent-proxy measurements tend to be lower than children's self-reporting HRQoL scores [16, 24, 30].

This review of the selected studies provides a wide array of information and identifies various facets of research regarding the relationship between weight and quality of life in children and adolescents. The criteria HRQoL measures and study protocol used in the selected studies had a common theme and facilitated a validated and comprehensive perspective regarding the relationship between weight and quality of life. Although many researchers found that weight and QoL were negatively correlated, only a select few measured this relationship over time. Of the latter researchers, their research found that the effectiveness of intervention, although initially quite beneficial, decreased over time. Thus, researchers should seek out opportunities to examine the long-term effects of weight on quality of life. In particular, our review underlines the importance of conducting clinical trials that seek to identify the potential lasting effects of prevention and intervention. Additionally, it is important to acknowledge that while many of the subscales of quality of life proved to be statistically significant, there are several variables that were not as widely tested due to use of measures such as PedsQL or KINDL-R. Other factors that were examined included age, gender, and levels of depression or self-esteem. The studies that included these variables provided findings that may further shed light on how to better aid the overweight and obese pediatric community.

Helseth, *et al.* [24] showed that overweight adolescents report lower quality of life scores compared with overweight children, and that females tend to report lower scores than males [35]. Weight loss was not significantly associated with improved physical and mental HRQoL scores, as some studies have found that weight loss may not be able to reverse the negative impact of overweight/obesity had on HRQoL [8]. This may be explained on the basis of the findings of Guardabassi, *et al.* [22], who noted that experiencing the stigma of being overweight may have an enduring effect upon quality of life.

Researchers have found an association in overweight patients with overall lowered HRQoL scores, suggesting that body dissatisfaction, cognitive perception and emotions are integral to one's self-perception of weight and shape [7]. Specifically, obese adolescents are at a higher risk of psychological impairment and poor development [33]. Nicholls, *et al.* [28], found that obese patients tend to report poorer psychosocial functioning and wellbeing; however, these results do not reach statistical significance in the overweight population. Adolescents with excess weight are more likely to experience body dissatisfaction, depression, anxiety, and poor self-esteem [7, 21, 22, 36]. Researchers have found that pediatric obesity is commonly correlated with negative psychosocial behaviors, decreased self-worth, and teasing by peers and family members [2]. Along with teasing, Gandhi, *et al.* [3] noted that overweight children and adolescents encounter discrimination, leading to increased loneliness, sadness and further social isolation.

Many studies have found that Body Mass Index (BMI) is associated with lower HRQoL [30, 37]. Outliers, such as Helseth, *et al.* [24], conclude that BMI is not strongly associated with HRQoL scores. This study examined parent modeling and its impact upon HRQoL, as participants seek treatment to attain a healthier BMI. Parental modeling is associated with healthy eating and weight loss in children [2, 28]. Parents can play a pivotal role by providing better eating and activity habits, promoting the family's physical and mental health, thereby facilitating weight loss over a period of time [23]. Uniquely, a study by Helseth, *et al.* [24] used parent-proxy reporting, along with child self-reporting, and found that parents rated their children's quality of life quite differently than the children themselves. For example, studies have found that parents assigned lower scores to their children's emotional wellbeing, self-esteem, friends, physical and psychosocial functioning in comparison with their children's self-reported scores [23, 36]. Hamzaid, *et al.* [23] found that parent-perceived impairment served as a significant impetus to seek treatment for obese children.

Adolescents of low income and minority-identifying families have a higher prevalence of overweight and obesity status [3, 24, 27]. However, a study by Edwards, *et al.* [9], found that race and ethnicity were not a predictor of weight-specific quality of life [38]. This finding may be explained by the fact that ethnic and racial groups such as Hispanics, Asians, and African-Americans reported lower overall health, self-esteem, and depression.

The criteria for selecting research studies for this systematic review are similar to those utilized in other reviews, such as the review by Griffiths, *et al.* [39]. Additionally, the results of this review are similar to the results found in other reviews, such as the review by Ul-Haq, *et al.* [40]. Although the studies identified for this review differ from those used in other reviews or have little overlap, our results identify findings that are similar to those of other reviews, with respect to quality of life scores, specific subscale scores, and confounding variables.

This review examined various aspects of the relationship between weight and quality of life. Selection criteria for this review included studies with various designs, differing measures, and different forms of intervention in order to gain a greater depth of understanding surrounding this issue. This review included a broad spectrum of studies that encompass the widest possible array of overweight and obese children. The review by Muhlig, *et al.* [41] focused only upon controlled clinical trials, thereby limiting the scope of overweight and obese individuals that may have

been included in other study designs. Moreover, certain reviews confined their attention to individuals undergoing specific interventions, such as bariatric surgery [42], thereby limiting their analysis to a specific subpopulation of overweight or obese children. Unlike the study by Sanders, *et al.* [43], which focused upon a single country, this review incorporated studies with participants from various cultural backgrounds from four different continents.

4.1. Strengths and Limitations

As the problem of overweight and obesity continues to manifest with increased prevalence throughout the globe, a strength of this study includes its review of this topic throughout the world. Given the considerable impact that weight has upon children and adolescents on a global scale, this review utilized studies throughout Europe, Asia, North America, South America and Australia, as seen in Table 1. These studies provided a global perspective on the universal factors associated with quality of life and weight. Another potential strength of this review is the inclusion of various types of analytical and control-study designs. The majority of designs used were cross-sectional and case-control, which allowed for larger pools of data to be collected. With nine of twenty-five studies using the cross-sectional design, information could be gathered from thousands of children and adolescents throughout the world. The smallest participant pool was 422 children, while the largest subject pool was approximately 9000 children and adolescents.

Although the inclusion in this review of a wide variety of studies allows for a broader insight, it is acknowledged that certain limitations result. The included studies did not uniformly evaluate the long-term effects of overweight/obesity, did not select uniform weight categories in their respective study populations, and did not consistently measure the effect of potential interventions. Another limitation of this review may relate to the small number of studies with clinical trials. In an effort to include studies addressing different aspects of prevention and treatment, a number of studies focusing upon a particular treatment were excluded in order to avoid redundancy. Therefore, the amount of information derived from clinical trials in this review was limited.

5. Conclusion and Future Directions

The goal of this review was to include a variety of culturally diverse participants, examine relevant treatment and prevention programs, and utilize multiple types of study designs to gain a better understanding of the impact weight has upon the quality of life of children and adolescents. Studies showed a significant negative correlation between weight and HRQoL. Future research should focus upon more clinical trials that address prevention and treatment options for children and adolescents who are overweight or obese. Prevention and treatment programs are critically needed to provide resources that will improve the quality of life in overweight/obese children and adolescents.

References

- [1] Yamashita, J. M., Garcia de Moura-Grec, P., Rodrigues de Freitas, A., Sales-Peres, A., Groppo, F. C., Ceneviva, R., and Sales-Peres, S. H., 2015. "Assessment of oral conditions and quality of life in a morbid obese and normal weight individuals: A cross-sectional study." *PLoS One*, vol. 10, p. e0129687.
- [2] Jelalian, E. and Evans, W., 2016. "Behavioral intervention in the treatment of obesity in children and adolescents: Implications for Mexico." *Nutrition Review*, vol. 75, pp. 79-84.
- [3] Gandhi, P. K., Revicki, D. A., and Huang, I. C., 2015. "Adolescent body weight and health-related quality of life rated by adolescents and parents: The issue of measurement bias." *BMC Public Health*, vol. 15, p. 1192.
- [4] Inge, T. H., Courcoulas, A. P., Jenkins, T. M., Michalsky, M. P., Helmrath, M. A., Brandt, M. L., Harmon, C. M., Zeller, M. H., Chen, M. K., *et al.*, 2016. "Weight Loss and Health Status 3 Years after Bariatric Surgery in Adolescents." *The New England Journal of Medicine*, vol. 374, pp. 113–123. Available: <https://doi.org/10.1056/NEJMoa1506699>
- [5] Lin, Y. C., Strong, C., Tsai, M. C., Lin, C. Y., and Fung, X. C. C., 2018. "Validating sizing them up: A parent-proxy weight-related quality-of-life measure, with community-based children." *International Journal of Clinical and Health Psychology*, vol. 18, pp. 81-89.
- [6] Ottova, V., Erhart, M., Rajmil, L., Dettenborn-Betz, L., and Ravens-Sieberer, U., 2012. "Overweight and its impact on the health-related quality of life in children and adolescents: results from the European KIDSCREEN survey. Quality of life research." *International Journal of Quality of Life Aspects of Treatment, Care and Rehabilitation*, vol. 21, pp. 59–69. Available: <https://doi.org/10.1007/s11136-011-9922-7>
- [7] Wynne, C., Comiskey, C., and McGilloway, S., 2016. "The role of body mass index, weight change desires and depressive symptoms in the health-related quality of life of children living in urban disadvantage: Testing mediation models." *Psychology and Health*, vol. 31, pp. 147-165.
- [8] Hayes, M., Baxter, H., Muller-Nordhorn, J., Hohls, J. K., and Muckelbauer, R., 2017. "The longitudinal association between weight change and health-related quality of life in adults and children: A system review." *Obesity Reviews*, vol. 18, pp. 1398-1411.
- [9] Edwards, T. C., Patrick, D. I., Skalicky, A. M., Huang, Y., and Hubby, A. D., 2011. "Perceived body shape, standardized body-mass index, and weight-specific quality of life of African-American, Caucasian, and Mexican-American adolescents." *Quality of Life Research*, vol. 21, pp. 1101-1107.

- [10] Southerland, J. L., Wang, L., and Slawson, D. L., 2017. "Weight misperception and health-related quality of life in appalachian adolescents in the united states." *Maternal and Child Health Journal*, vol. 21, pp. 168–176. Available: <https://doi.org/10.1007/s10995-016-2106-x>
- [11] Aldaqal, S. M. and Sehlo, M. G., 2013. "Self-esteem and quality of life in adolescents with extreme obesity in Saudi Arabia: The effect of weight loss after laparoscopic sleeve gastrectomy." *General Hospital Psychiatry*, vol. 35, pp. 259-264.
- [12] Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., *et al.*, 2021. "The PRISMA 2020 statement: An updated guideline for reporting systematic reviews." *Journal of Clinical Epidemiology*, vol. 134, pp. 178–189. Available: <https://doi.org/10.1016/j.jclinepi>
- [13] Lohr, K. and Carey, T., 1999. "Assessing "best evidence": issues in grading the quality of studies for systematic reviews." *The Joint Commission Journal on Quality Improvement*, vol. 25, pp. 470-9.
- [14] West, S., King, V., and Carey, T., 2002. "Systems to rate the strength of scientific evidence. Agency for healthcare research and quality report no 02-e016." Available: <https://www.ncbi.nlm.nih.gov/books/NBK11930/>
- [15] Al-Akour, N. A., Khader, Y. S., Khassaneth, M. Y., and Bawadi, H., 2011. "Health-related quality of life of adolescents with overweight or obese in the north of Jordan." *Child: Care, Health and Development*, vol. 38, pp. 237-243.
- [16] Bianchini, J. A. A., Fernandes da Silva, D., Dad, R. P., Lopera, C. A., McNeil, J., and N., J. N., 2017. "Improvements in self-reported and parent-proxy perceptions of adolescents' health-related quality of life following a multidisciplinary obesity treatment program." *Sport Sciences for Health*, vol. 13, pp. 131-137.
- [17] Boyle, S. E., Jones, G. I., and Walters, S. J., 2010. "Physical activity, quality of life, weight status and diet in adolescents." *Quality of Life Research*, vol. 19, pp. 943-954.
- [18] Cui, W., Zack, M. M., and Wethington, H., 2014. "Health-related quality of life and body mass index among US adolescents." *Quality of Life Research*, vol. 23, pp. 2139-2150.
- [19] De Beer, M., Hofsteenge, G. H., Koot, H. M., Hirasing, R. A., De Waal, H. A. D., and Gemke, R. J. B. J., 2006. "Health-related-quality-of-life in obese adolescents is decreases and inversely related to BMI." *Acta Paediatrica*, vol. 69, pp. 710-714.
- [20] Fazah, A., Jacob, C., Moussa, E., El-Hage, R., Youssef, H., and Delamarche, P., 2010. "Activity, inactivity and quality of life among Lebanese adolescents." *Pediatrics International*, vol. 52, pp. 573-578.
- [21] Finne, E., Reinehr, T., Schaefer, A., Winkel, K., and Kolip, P., 2013a. "Health-related quality of life in overweight German children and adolescents: Do treatment-seeking youth have lower quality of life levels? Comparison of a clinical sample with the general population using a multilevel model approach." *BMC Public Health*, vol. 13, p. 561.
- [22] Guardabassi, V., Mirisola, A., and Tomasetto, C., 2017. "How is weight stigma related to children's health-related quality of life? A model comparison approach." *Quality of Life Research*, vol. 27, pp. 173-183.
- [23] Hamzaid, H., Talib, R. A., Azizi, N. H., Maamor, N., Reilly, J. J., and Wafa, S. W., 2011. "Quality of life of obese children in Malaysia." *International Journal of Pediatric Obesity*, vol. 6, pp. 450-454.
- [24] Helseth, S., Harakdstad, K., and Christophersen, K. A., 2015. "A cross-sectional study of health related quality of life and body mass index in a Norwegian school sample (8-18 years): A comparison of child and parent perspectives." *Health and Quality of Life Outcomes*, vol. 13, p. 47.
- [25] Jalali-Farahani, S., Chin, Y. S., Nasir, M. T. M., and Amiri, P., 2015. "Disordered eating and its association with overweight and health-related quality of life among adolescents in selected high schools of Tehran." *Child Psychiatry and Human Development*, vol. 46, pp. 485-492.
- [26] Loh, D. A., Moy, E. M., Zaharan, N. L., and Mohamed, Z., 2015. "Disparities in health-related quality of life among healthy adolescents in a developing country - the impact of gender, ethnicity, socio-economic status and weight status." *Child: Care, Health and Development*, vol. 41, pp. 1216-1226.
- [27] Mollerup, P. M., Nielsen, T. R. H., Bosoe, C., Kloppenhorg, J. T., Baker, J. T., and Holm, J. C., 2017. "Quality of life improves in children and adolescents during a community-based overweight and obese treatment." *Quality of Life Research*, vol. 26, pp. 1597-1608.
- [28] Nicholls, L., Lewis, A. J., Petersen, S., Swinburn, B., Moodie, M., and Millar, L., 2014. "Parental encouragement of healthy behaviors: Adolescent weight status and health-related quality of life." *BMC Public Health*, vol. 14, p. 369.
- [29] Ottova, V., Erhart, M., Rajmil, L., Dettenborn-Bertz, L., and Ravens-Sieberer, U., 2012. "Overweight and its impact on the health-related quality of life in children and adolescents: Results from the European KIDSCREEN survey." *Quality of Life Research*, vol. 21, pp. 59-69.
- [30] Pinhas-Hamiel, O., Singer, S., Pilpel, N., Fradkin, A., Modan, D., and Reichman, B., 2006. "Health-related quality of life among children and adolescents: Associations with obesity." *International Journal of Obesity*, vol. 30, pp. 267-272.
- [31] Sato, H., Nakamura, N., and Sasaki, N., 2008. "Effects of bodyweight on health-related quality of life in school-aged children and adolescents." *Pediatrics International*, vol. 50, pp. 552-556.
- [32] Sysko, R., Devlin, M. J., Hildebrandy, T. B., Brewer, S. K., Zitsman, J. L., and Walsh, B. T., 2012. "Psychological outcomes and predictors of initial weight loss outcomes among severely obese adolescents receiving laparoscopic adjustable gastric banding." *J. Clin. Psychiatry*, vol. 73, pp. 1351-1357.

- [33] Yackobovitch-Gavan, M., Nagelberg, N., Demol, S., Phillip, M., and Shalitin, S., 2008. "Influence of weight-loss diets with different macronutrient compositions on health-related quality of life in obese youth." *Appetite*, vol. 51, pp. 697-703.
- [34] Zullig, K. J., 2010. "Creating and using the CDC HRQOL healthy days index with fixed option survey responses." *Quality of Life Research*, vol. 19, pp. 413-424.
- [35] Bonsergent, E., Benie-Br, J., Baumann, C., Agrinier, N., Tessier, S., Thilly, N., and Briancon, S., 2012. "Effect of gender on the association between weight status and health-related quality of life in adolescents." *BMC Public Health*, vol. 12, p. 997.
- [36] Finne, E., Reinehr, T., Schaefer, A., Winkel, K., and Kolip, P., 2013b. "Changes in self-reported and parent-reported health-related quality of life in overweight children and adolescents participating in an outpatient training: Findings from a 12-month follow-up study." *Health and Quality of Life Outcomes*, vol. 11, p. 1.
- [37] de Beer, M., Hofsteenge, G. H., Koot, H. M., Hirasing, R. A., Delemarre-van de Waal, H. A., and Gemke, R. J., 2007. "Health-related-quality-of-life in obese adolescents is decreased and inversely related to BMI. Acta paediatrica (Oslo, Norway : 1992)." vol. 96, pp. 710-714. Available: <https://doi.org/10.1111/j.1651-2227.2007.00243.x>
- [38] Swallen, K. C., Reither, E. N., Haas, S. A., and Meier, A. M., 2005. "Overweight, obesity, and health-related quality of life among adolescents: The national longitudinal study of adolescent health." *Pediatrics*, vol. 115, pp. 340-347.
- [39] Griffiths, L. J., Parsons, T. J., and Hill, A. J., 2010. "Self-esteem and quality of life in obese children and adolescents: A systematic review." *International Journal of Pediatric Obesity*, vol. 5, pp. 282-304.
- [40] Ul-Haq, Z., Mackay, D. F., Fenwick, E., and Pell, J. P., 2013. "Meta-analysis of the association between body mass index and health-related quality of life among children and adolescents, assessed using the pediatric quality of life inventory index." *The Journal of Pediatrics*, vol. 162, pp. 280-286.
- [41] Muhlig, Y., Wabitsch, M., Moss, A., and Hebebrand, J., 2014. "Weight loss in children and adolescents." *Deutsches Arzteblatt International*, vol. 111, pp. 818-824.
- [42] Black, J. A., White, B., Viner, R. M., and Simmons, R. K., 2013. "Bariatric surgery for obese children and adolescents: A systematic review and meta-analysis." *Obesity Reviews*, vol. 14, pp. 634-644.
- [43] Sanders, R. H., Han, A., Baker, J. S., and Cobley, S., 2015. "Childhood obesity and its physical and psychological co-morbidities: A systematic review of Australian children and adolescents." *European Journal of Pediatrics*, vol. 174, pp. 715-746.