

# Childhood obesity: Facts and parental perceptions

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**Abstract.** The present study aimed to depict the parental perception of children's weight status and associated health risks. The present study was a cross-sectional study collecting anthropometric measures among children and data using a parental survey in 2020-2021 in private elementary schools. A total of 191 subjects were eligible for analysis. The body mass index of the children and parents was calculated. The perceived child weight status was compared to the actual weight status. Parental knowledge of obesity-related health risks and sources of concerns was assessed using a scoring system. Quantitative variables were reported as average, standard deviation, first and third quartiles. Qualitative variables were reported as frequencies and percentages. Statistical tests were used to assess significance levels, set at  $P < 0.05$ . More than half of the children were overweight (30%) or obese (25%). However, the parents underestimated their child's weight status (61%) and were unconcerned about them becoming overweight (52%), despite solid knowledge about the related health risks. The maternal weight status was associated with the underestimation of child weight ( $P = 0.0068$ ). Being overweight did not rank high on sources of parental concerns. It is thus suggested that parents need to be made aware of their child's weight status. Efforts are needed to spread awareness about childhood obesity health risks.

## Introduction

An escalating global epidemic of overweight and obesity, colloquially known as 'globesity', is evident in numerous parts of the world. Obesity is a multifactorial chronic disease that can be influenced by several biological, behavioral and environmental factors (1,2) with childhood obesity being a strong predictor of adult obesity (3).

As per the World Health Organization (WHO) 2014 estimate, overweight and obesity affect 41 million children <5 years of age, mostly in low- and middle-income countries (3). The global prevalence of childhood overweight and obesity more than doubled in the span of 20 years. It has escalated from 4.2% in 1990 to 6.7% in 2010, and was expected to increase to 9.1% in 2020 (4,5). In 2016, overweight or obesity was reported among 340 million children and adolescents aged 5-19 years (more than quadrupling in rates since 1975) and in 2020, among 39 million children <5 years of age (6). There is a high prevalence of obesity among children and adolescents in Middle Eastern countries (7). In Lebanon, a 2003 cross-sectional survey revealed that among children aged from 3 to 19 years, the overweight rates were 22.5 vs. 16.1% for boys and girls, and the obesity rates were 7.5 vs. 3.2% respectively (8). Moreover, a 2014 study demonstrated that for the age group 6-11 years, 40.2% of Lebanese boys and girls were overweight, and 17.1% were obese (9). These studies demonstrate that over the past 20 years, the prevalence of overweight and obesity among children in Lebanon has rapidly increased.

Obesity, and in particular childhood obesity, is associated with a number of diseases such as type-2 diabetes, cardiovascular disease, depression, hypertension, sleep apnea, physical illnesses, social exclusion, psychological isolation, development of eating disorders and a low-self-esteem (1,4,8-14).

Parents play a crucial role in safeguarding the health of their children (7,9) as they can influence their eating habits and instate an active lifestyle (7,15). It has been shown that the parental support of health-promoting behaviors has a positive impact on children who are overweight or obese (12,16). Weight perception is considered a key element in defining the association between weight status and its management (17). Parents who fail to recognize the weight status of their overweight children are found to be less likely to provide them with the assistance and support needed to achieve a healthy weight (18). On the other hand, parents who perceive their children as overweight are more likely to make efforts and lifestyle changes to help their children lose weight (15,19). A previous study conducted on 11,530 overweight children demonstrated that over half of the parents failed to perceive that their child was overweight and 62.4% of them incorrectly perceived their child's weight as healthy (20). Effective public health strategies are necessary to prevent childhood obesity and increase parents' of their children's weight status (19). Healthcare professionals need to be aware of the frequent

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parental misperception of their children's overweight status and instate appropriate treatments when necessary (20). The present study aimed to evaluate the perception of parents towards their child's weight, and assess its association with knowledge of the health risks.

## Subjects and methods

*Study design, participants and recruitment.* The present cross-sectional study surveyed the parents of children at private schools (grade 1 to 5) in the Tripoli and Koura districts in Northern Lebanon, between 2019 and 2021. The study registered the participation of parents from 18 schools, which represent 29.5% of private schools in the aforementioned districts. Self-administered questionnaires were sent out in a printed format (2019) or via email (2020-2021) due to the restrictions faced through the COVID-19 pandemic. A total of 340 subjects (the parents of the children; either both or one parent completed the forms) voluntarily participated in the study (235 in person and 105 online). Those who accepted to take part in the study had to sign a consent form or to provide consent via the online platform. The median age of the participating children ( $n=191$ ) was 8 years, ranging from 5 to 11 years.

Ethical approval was obtained from the Ethics Committee at the University of Balamand (Approval no. 006-2019). All parents had provided informed consent before any study-related activity. Oral assent was taken from all children involved in the study. The researchers had ensured that the internationally recognized ethical principles, guidelines and regulations for research involving human subjects were respected throughout the study.

*Instruments and variables.* The parental survey included questions about sociodemographic characteristics and behavioral characteristics. These variables included the child's age, sex, nationality, family structure, as well as the parent's level of education, weight status, self-reported weight status and household monthly income. In a further set of analyses, the parents' knowledge related to potential health risks associated with obesity was assessed. The questions of the survey were adapted from questionnaires previously used in the literature (21-25). To achieve the validity and reliability of the survey, a pilot test was conducted on 20 parents. Participants were asked to provide their feedback about the content of the survey and to indicate any unclear wording of a question.

An index for parental concerns about the children's health was created by adding up 7 items reported on a 4-point Likert scale as follows: i) not concerned; ii) a little concerned; iii) quite concerned; iv) extremely concerned. This index could range between 7 and 28; the higher the index the higher the parents' level of concern.

Similarly, an index for parents' beliefs was computed by adding up 13 items reported on a 4-point Likert scale as follows: i) strongly disagree; ii) disagree; iii) agree; and iv) strongly agree. This index could range between 13 and 52; the higher the index the more positive the parents' beliefs.

During the first year of the study (prior to the COVID-19 pandemic), the weight and height of the children were provided by school nurses. Children were weighed using a standardized

clinical balance in light indoor clothing and with bare feet. The height was measured without shoes using a portable stadiometer. A portable stadiometer was used on a level, stable surface. Additionally, all participants were provided with the same instructions; to look straight ahead while being measured. The same stadiometer was used for all height measurements, which allowed the elimination of operator bias and error. In the second year of the study, the weight and height of children were reported by the parents, due to COVID-19-imposed lockdowns. The weight and height were used for the calculation of the body mass index (BMI;  $\text{kg}/\text{m}^2$ ).

The WHO defines adult weight status categories as follows: BMI  $<18.5 \text{ kg}/\text{m}^2$  as underweight, between 18.5 and  $24.9 \text{ kg}/\text{m}^2$  as healthy weight, between 25 and  $29.9 \text{ kg}/\text{m}^2$  as overweight and  $>30 \text{ kg}/\text{m}^2$  as obesity (26). In children, overweight and obesity were assessed using the WHO age and sex specific cut-offs for BMI: +1 and +2 BMI z-scores, respectively (27).

*Statistical analysis.* Data management and analysis were performed using JMP<sup>®</sup>, version 15.0 SAS Institute Inc. The perception of children's weight by the parents was classified in three categories as follows: Weight underestimation, accurate weight estimation and weight overestimation.

The main outcome of the study was to compare the child's actual weight status (child BMI category) to the parental assessment of his/her weight status. Therefore, children were classified into three categories, according to parental perception: Weight underestimation, accurate weight estimation and weight overestimation. Since the study focused on child weight underestimation, the 5 children for whom weight was overestimated by their parents were excluded from the analysis.

Categorical data are reported as counts (frequencies) and percentages and quantitative data are reported as mean  $\pm$  standard deviation, median, minimum and maximum, as well as first and third quartiles (Q1 and Q3). The Chi-squared and Fisher's exact tests were used for categorical independent variables. Bivariate analysis was used to identify factors associated with parental underestimation of children's weight status.

## Results

*Characteristics of the study participants.* The present study included 191 children; after excluding those for whom weight was overestimated by their parents ( $n=5$ ) and those for whom either child weight and/or parent's perception of the child's weight were not recorded ( $n=39$ ). Approximately half of the children were boys [98 (51.3%)]. The mean age of the children was  $8.2 \pm 1.6$  years, ranging from 5 to 11 years, with a median of 8.0 years. The majority (92.2%) lived in homes with both parents. Of note, one third of families' income was below USD 2,000 (calculated at the 2022 official rate of LBP 1,500 for every USD 1). The characteristics of children are presented in Table I. Of special interest to the present study, 73 (38.2%) children had a BMI within the healthy range, while 118 (61.8%) fell in the overweight or obese category. Additionally, the weight of the majority of the parents fell either in the overweight or obesity categories, as detailed in Table I. There was no statistically significant association between the parents' weight status and the child's weight status (fathers: Chi-squared test,  $P=0.67$ ; mothers: Fisher exact test,  $P=0.50$ ).

Table I. Characteristics of the study participants (n=191).

Characteristic	Total participants		
Male sex, n (%)	98 (51.3%)		
Age (years)			
Mean ± SD	8.2±1.6		
Median	8.0		
Min-max	5.0-11.0		
Q1;Q3	7.0;10.0		
Children's anthropometric data	Height (cm)	Weight (kg)	BMI (kg/m <sup>2</sup> )
Mean ± SD	129.3±10.8	33.0±9.9	19.4±3.5
Median	129.0	30.0	18.5
Min-max	104.0-154.0	17.6-69.2	14.0-31.7
Q1;Q3	121.0;138.0	25.4;38.2	17.0;21.0
Child BMI categories, n (%)			
Healthy weight	73 (38.2%)		
Overweight	62 (32.5%)		
Obesity	56 (29.3%)		
Parent BMI categories, n (%)	Father	Mother	
Underweight	0 (0.0%)	4 (2.2%)	
Healthy weight	23 (13.7%)	100 (56.2%)	
Overweight	97 (57.7%)	63 (35.4%)	
Obesity	48 (28.6%)	15 (8.4%)	
Missing data	23	9	
Socio-economic status, n (%)			
Two-parent family	176 (92.2%)		
Household income (USD)			
<500	2 (1.1%)		
(500-1,000)	15 (7.9%)		
(1000-1,500)	26 (13.6%)		
(1500-2,000)	17 (8.9%)		
(2000-3,000)	45 (23.6%)		
>3,000	35 (18.3%)		
Other	49 (25.7%)		
Parental education	Father	Mother	
Elementary	6 (3.1%)	1 (0.5%)	
Intermediate	17 (8.0%)	16 (8.4%)	
Secondary	44 (23.0%)	22 (11.5%)	
University degree	53 (27.8%)	71 (37.2%)	
Postgraduate degree	66 (34.6%)	80 (41.9%)	
Other <sup>a</sup>	5 (2.6%)	1 (0.5%)	

Max, maximum; min, minimum; SD, standard deviation; Q, quartile; USD, United States dollars. <sup>a</sup>Other includes 'not applicable and refusal to answer'.

**Weight perception.** Among the study participants, 62 (32.5%) and 56 (29.3%) children were overweight and obese, respectively, with no sex predilection ( $P=0.10$ ) (data not shown). The distribution of the children's actual weight status in the different computed BMI categories is presented in Fig. 1A. In parallel, as illustrated in Fig. 1B, while 14.1% of parents perceived their children as underweight, the BMI calculation indicated that none of the children

in the study was in the underweight category. Conversely, while no parent classified their child's weight status in the 'obesity' category, 29.3% of the participating children had a BMI within the obesity range. The majority of parents [223 (63.7%)] perceived their weight as healthy, while in fact, 97 (57.7%) and 48 (28.6%) of fathers and 63 (35.4%) and 15 (8.4%) of mothers were overweight and obese, respectively (Table I).

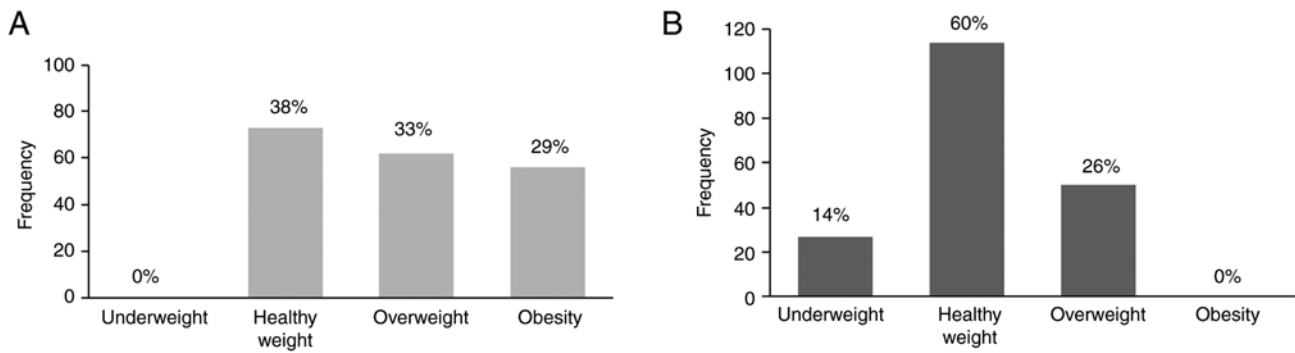


Figure 1. Weight status of the parents and children. The BMI of 191 children was calculated, and children were classified in the following weight categories: Underweight, healthy weight, overweight or obesity. Parents were also asked to rate their children's perceived weight status. (A) Distribution of children's actual weight status in the different computed BMI categories. (B) Distribution of children's perceived weight status across BMI categories according to the paternal weight perception. BMI, body mass index.

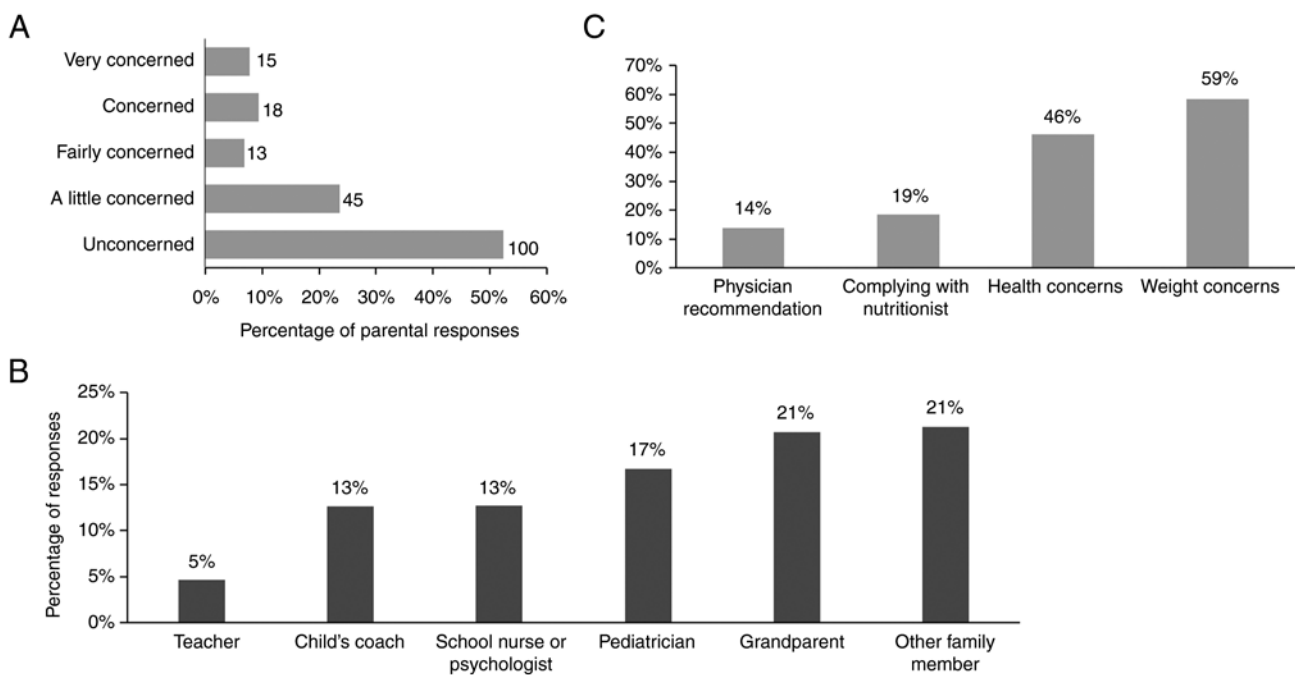


Figure 2. Weight concerns. Parents were asked about their concern for their child's weight status. (A) Description of parental concern. In total, 100 parents (52.4%) were unconcerned about their child's weight status. (B) Other parties concerned with children's weight status. Grandparents and other family members had voiced concern over the children's weight status. (C) Reasons behind weight control measures. Weight and health concerns were the main drivers behind the parents' efforts to curb their children's weight.

*Weight concerns and control.* The parents were asked about their concern of their children's perceived weight status. The answers to these questions are presented in Fig. 2A. Of note, >50% of the parents were unconcerned about their child's weight status [100 (52.4%)] and only 15 parents (7.9%) were very concerned. A closer analysis revealed that 18 parents of children perceived as overweight expressed concern over their child's weight status and 1 parent was unconcerned. Conversely, 42 parents of children perceived to be at a healthy weight still expressed some level of concern (data not shown). Notably, the proportions of concerned parents were compared according to the parental obesity status, and the distribution of the answers differed significantly between the two subgroups (Chi-squared test,  $P=0.006$ ). Apart from the parents, other

individuals in the child's entourage expressed concern about the child's weight status. Fig. 2B demonstrates the frequency of concern expressed by grandparents (20.7%), other family members (21.3%) and other individuals interacting with the children. In the present sample, 65 (34.8%) parents tried to control their child's weight; mostly due to health (46.2%) and weight (58.5%) concerns, as shown in Fig. 2C.

*The bases for parental concern.* In an attempt to understand why parents voiced concern about their child's weight status, they were asked to rate their concern about their child's ability to play and exercise, the potential development of chronic diseases in adulthood (heart disease and diabetes mainly), as well as psychological troubles (self-worth, self-image

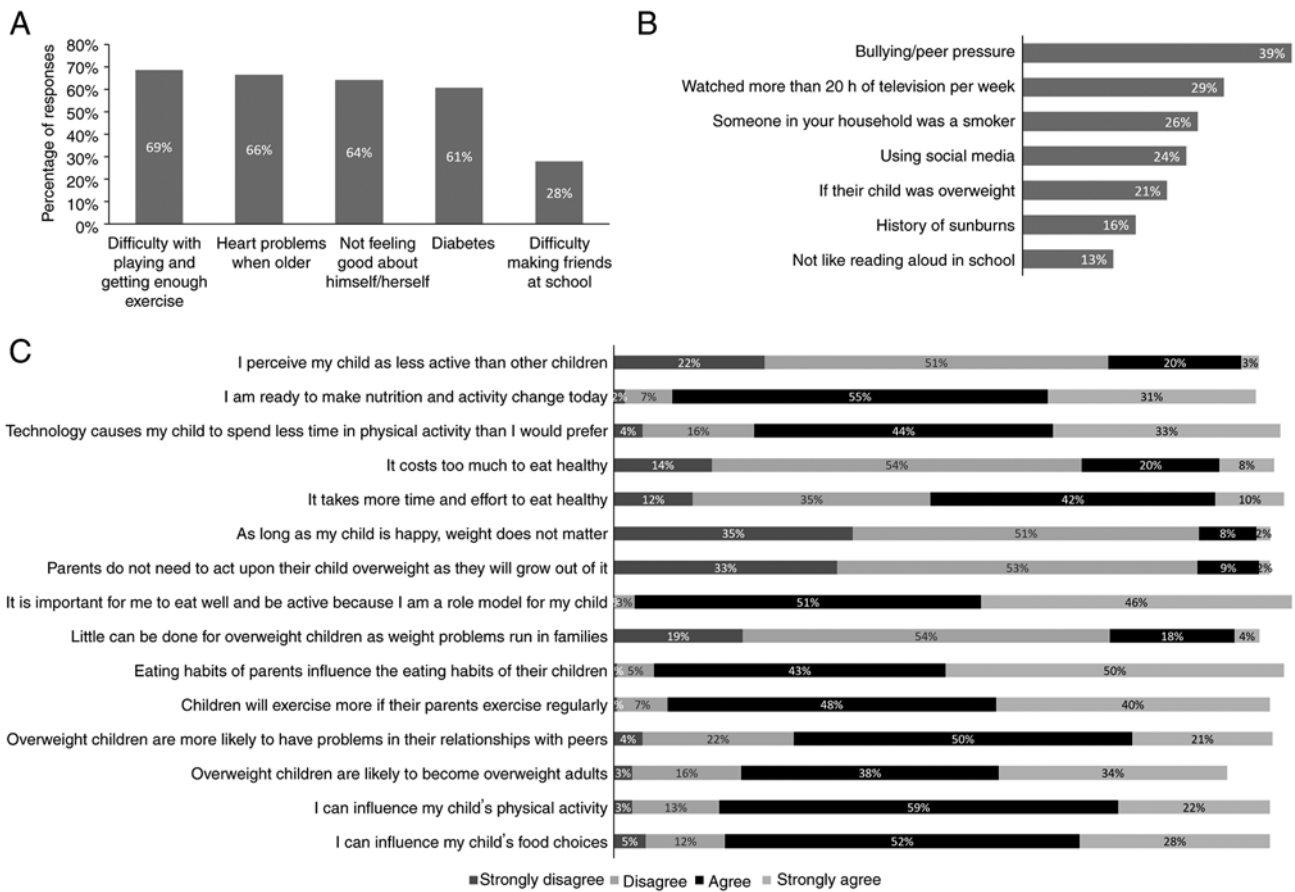


Figure 3. Breakdown of parental concerns. Parents were asked to rate their concern about potential implication of overweight/obesity on their children and to rank other potential sources of concern. (A) Problems resulting from overweight or obesity; >60% of parents were concerned about their child's physical activity, feeling good about themselves or developing heart disease and diabetes later in life. (B) Parental reasons for extreme concern about their children. Bullying and peer pressure ranked high on the list of concerns, while 21.1% of parents felt extremely worried about their child's overweight. (C) Parental perceptions about their children's weight-related health issues

and popularity). The findings obtained are presented in Fig. 3A. The parental fears of potential implications that overweight or obesity might entail on their children included the following: Not making friends at school [53 (27.8%)], diabetes [116 (60.8%)], not feeling good about himself/herself [124 (64.2%)], heart problems when older [127 (66.5%)], and difficulty playing and getting enough exercise [131 (68.8%)]. Additionally, and to unveil other sources of concern for the child, parents rated their concern about other aspects of their children's life, as shown in Fig. 3B. Bullying and peer pressure were at the top of the list of parental concerns [75 (39.2%)] and overweight felt like an extreme concern among 40 (21.1%) parents. The overall index of concerns about children ranged between 7.0 and 28.0, with a mean of 16.9±6.6. Moreover, parents were asked to rate their belief on how they can influence their children's food choices and physical activity, on how they can set the right example for them, on how childhood obesity can dictate adulthood weight status and health, on how technology dictates physical activity, as well as their willingness to cook healthier meals. The index of parents' beliefs ranged between 25.0 and 49.0 with a mean of 40.4±4.2. This was paralleled with a high level of knowledge (92%) on the risks of increased weight on health. A breakdown of the health belief answers provided by the parents is provided in Fig. 3C.

The results also revealed that >80% of parents agree or strongly agree on the statements that they can influence their child's food choices, that they can influence their child's amount of physical activity, that children will exercise more if their parents exercise regularly, and that they are ready to make nutrition and activity change today. The majority of the parents agree or strongly agree on the statements that the eating habits of parents influence the eating habits of their children (92.5%), and that it is important for them to eat well and be active to serve as role models for their children (96.3%). Additionally, over half of the parents agree or strongly agree on the statements that overweight children are likely to become overweight adults (71.3%), that overweight children are more likely to have problems in their social relationships with other children than children who are not overweight (70.3%), that it takes more time and effort to eat healthy (51.9%), and that technology causes the child to spend less time in physical activity than they would prefer (77.2%).

Additionally, a minority of parents agree or strongly agree on the statements that they perceive their child as less active than other children (22.1%), that little can be done for overweight children because weight problems run in families (22.0%), that parents do not need to do anything about child overweight as they will grow out of it (10.6%), and that weight is unimportant as long as the child is happy (10.5%) (Fig. 3C).

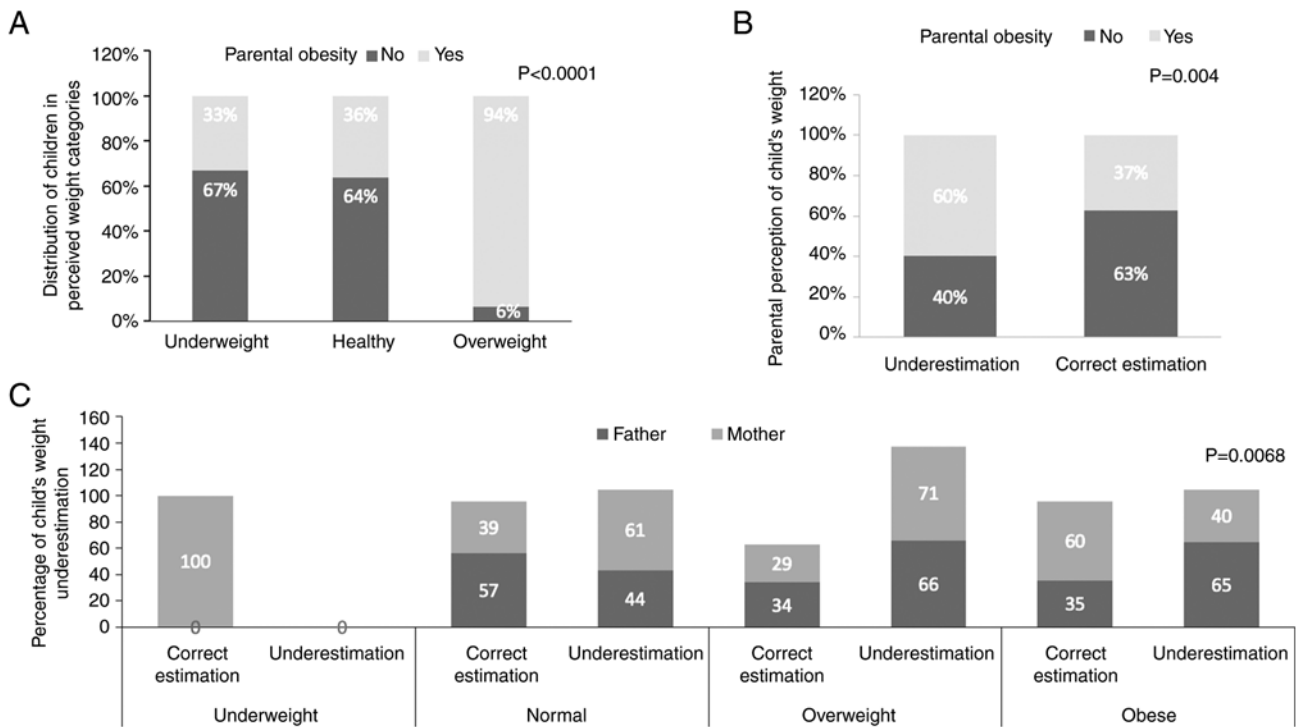


Figure 4. Parental perception of child weight status. (A) Impact of parental obesity on children's weight category perception. (B) Impact of parental obesity on children's weight perception. (C) Percentage of child's weight underestimation based on parental weight status.

*Parental weight status and associated perceptions.* The study examined the potential factors associated with the underestimation of a child's weight status by their parents. The proportion of maternal underestimation of child weight was higher for boys (67.4%) compared to girls (54.8%), and the difference was trending towards statistical significance ( $P=0.08$ ) (data not shown).

Parental obesity appeared to influence the parents' perception of their child's weight status (Chi-squared test,  $P<0.0001$ , Fig. 4A). Herein, 112 parents [45 (40.2%) obesity-free and 67 (59.8%) with obesity] underestimated their children's weight status and 62 parents [39 (62.9%) obesity-free and 23 (37.1%) with obesity] correctly perceived their children's weight status (Chi-squared test,  $P=0.004$ ) (Fig. 4B).

The weight status of the mother was found to be significantly associated with the maternal underestimation of the child's weight ( $P=0.0068$ ), with the proportion of underestimation being at 61.0% for mothers with a normal weight, 71.4% for overweight mothers and 40.0% for obese mothers (Fig. 4C).

In addition, the parents' concern about the child becoming overweight in the future was found to be associated with the parental underestimation of the child's weight ( $P=0.02$ ). Family income, the parents' education, index of concerns about child's health and of parents' beliefs were not significantly associated with parental underestimation of the child's weight status (Chi-squared test and t-test, not significant; data not shown).

However, weight status assessment, underestimation of child's weight, concerns about overweight, perception of the child's physical activity, as well as the perception of parental role model, and healthy eating were significantly associated with parental obesity (Table II).

## Discussion

The results revealed the expected underestimation of children's overweight status by parents. In fact, 55% of children in the current sample were classified in the overweight or obesity category, but only 26.2% of parents perceived their child as overweight. In the present study sample, more than half of the parents (61%) underestimated their child's weight, and only 39% assessed their child's weight correctly. This finding is in agreement with the findings of a previous study which demonstrated that more than half of the parents failed to perceive that their children were overweight (20). Similarly, a study conducted in Portugal revealed that ~33% of parents misperceived their child's weight, and 93% underestimated it (28). Previous studies have shown that weight perception is a key element in defining the association between weight status and weight management (17). Parents who fail to recognize their children's excess weight are less likely to provide them with assistance and support needed to achieve a healthy weight (18). Thus, it is critical to have a correct estimation between perceived and actual weight.

Additionally, studies have demonstrated that children who have parents with overweight or obesity are at a higher risk of developing the disease themselves, given the parents' influence and role in preventing childhood obesity (1,29). The present study demonstrated that >85% of fathers and 40% of mothers in Northern Lebanon were either overweight or obese; thus, Lebanese children are at a high risk of developing obesity themselves. Alarmingly, the findings from the present study demonstrated that parents not only underestimated their children's weight status, but also their own: 66% had perceived their weight as healthy and only

Table II. Association of parental obesity with the parents' perception of their child's weight status.

	Among parents with obesity (%)	P-value <sup>a</sup>
Weight status assessment, n=174		
Underweight	8 (33.3)	P<0.0001
Healthy weight	37 (36.3)	
Overweight	45 (93.8)	
Perception of child's weight status, n=174		
Underestimated	67 (59.8)	P=0.004
Accurately estimated	23 (37.1)	
Extent of concern about the child's overweight, n=174		
Unconcerned	34 (38.2)	P=0.006
A little concerned	26 (61.9)	
Fairly concerned	8 (61.5)	
Concerned	11 (73.3)	
Very concerned	11 (73.3)	
Parental influence on child's physical activity, n=165		
Strongly disagree	3 (75.0)	P=0.0005
Disagree	18 (85.7)	
Agree	52 (51.5)	
Strongly agree	13 (33.3)	
Parents as role models for healthy behaviors, n=173		
Disagree	6 (100)	P=0.01
Agree	49 (55.1)	
Strongly agree	34 (43.6)	
Healthy eating is time-consuming, n=169		
Strongly disagree	9 (47.4)	P=0.02
Disagree	22 (37.3)	
Agree	49 (64.5)	
Strongly agree	9 (60.0)	
Healthy eating is expensive, n=168		
Strongly disagree	11 (42.3)	P=0.02
Disagree	44 (45.8)	
Agree	24 (70.6)	
Strongly agree	9 (75.0)	

<sup>a</sup>Responses/attitudes of parents with obesity towards the different topics were compared with those of parents with a healthy weight using the Chi-squared test.

status has been underscored (22), and also detected in the sample of mothers in the present study.

Nevertheless, of note, the present study found that more than half of the parents (52%) appeared to be unconcerned about their child developing overweight, in spite of parental education (64% of fathers and 79% of mothers held a university degree) and satisfactory knowledge about the health risks of excess weight. The absence of parental concern about their children's weight gain translated into a limited percentage of parents (35%) trying to manage their child's weight. Conversely, the present study found that more parents were extremely concerned about their children facing bullying/peer pressure (39%), having a long screen time (29%) and using social media (24%), rather than being overweight (21%). In other words, children being overweight did not appear to be a key concern for parents in Northern Lebanon. As indicated by the literature, excess weight only triggers parental concern if it hinders physical functioning or if it provokes bullying (a widespread concern voiced by parents in the current study) (31,32).

Apart from parents, the present study demonstrated that concern for the child's weight was expressed by grandparents (21%) and other family members (21%). In fact, grandparents play a crucial role in controlling and influencing the daily caloric intake of children under their care (33,34) and their involvement in their grandchildren's life was found to be protective against excess weight (34-36).

In an attempt to unveil the bases of the parents' attitudes towards their child's weight status, knowledge about the health risks of obesity was assessed among parents. The majority of parents (92%) displayed satisfactory knowledge, stating that the most common health issues related to being overweight or obese include physical, social and mental health. Contrary to a 2003 study (37), the majority of parents in Northern Lebanon realize that overweight children are likely to have problems in their social relationships with other children (70%) and to become overweight adults (71%). This finding agrees with previous research that suggests that parents, in general, do appreciate the health risks of childhood obesity and have a basic understanding of healthy eating habits (37). Conversely, the findings of a recent study indicated that most parents whose children suffer from overweight or obesity lacked basic awareness of related risks (7).

Parental support of health-promoting behaviors has a positive impact on overweight and obesity among their children (29). In fact, literature stresses that the family environment has an important influence on the development of the child's habits (29,38,39). The findings of the present study are in agreement with what was previously outlined in the literature, about active parents having active children (40). In fact, the majority of participants in the present study realize that children would exercise more if their parents exercised regularly (88%) and that parents are a role model for their child in terms of eating habits (96%), irrespective of the parents' obesity status. This finding is parallel with findings in the literature, whereby parents do affect their children's eating habits in several ways, such as by modeling dietary choices and patterns and making healthy nutritious food choices for the family (22,29,34,38,41).

However, in the present study, the majority of parents (72%) disagreed on the fact that little can be done to help overweight children as weight problems run in families; yet, of note, twice

28% as overweight. Studies have found that the majority of parents of children who are overweight or obese underestimate their child's BMI status (11,30). Specifically, the high rate of maternal misperception of the child's overweight

as many parents with obesity than parents without obesity believe that indeed, obesity runs in families and is therefore a non-modifiable condition. This underscores gaps and misconceptions about risk (and genetic) factors underlying obesity and the ability to control weight gain by a healthy lifestyle.

Nevertheless, the majority of parents in the present study believe that they do need to act in case their child has excess weight, suggesting that parents are ready to act and change their behavior in order to positively influence their child's weight. Actually, parents are ready to make nutrition and activity change immediately (85%); although over >50% believe healthy eating requires time and effort. Moreover, instigating more physical activity will require less technology-based leisure time; a challenging undertaking, as 77% of parents believe that technology is impeding their child's physical activity. It is however vital to instigate healthy habits and behaviors in children as it becomes difficult to make health behavioral changes in adulthood (42).

The results of the present study need to be interpreted in light of the following limitations. First, due to COVID-19-imposed lockdowns, schools were closed and some questionnaires were not collected. Additionally, there the available data were not sufficient to compare the living conditions and diet of children before and after COVID-19. Second, while the present study demonstrated that the parents of overweight children systematically underestimate their children's weight status, the reasons for misperception were not identified. Third, more comprehensive data about the parents (including health conditions, lifestyle and activity habits) would have provided further insight on the cultural and personal perception of weight in the Northern Lebanese population. Lastly, children with metabolic disorders and/or under long-term medication were not accounted for herein. Further research is thus warranted to evaluate its potential influence of parent's perception of children weight status. Notwithstanding the aforementioned limitations, the present study provides invaluable information about the perception of Lebanese parents towards their child's weight status and assesses its association with knowledge of the related health risks.

In conclusion, despite the relatively small sample size, the present study reflects the perceived vs. the actual weight status of children attending private schools in Lebanon. A larger study covering the remainder of the Lebanese governorates is required however, in order to allow for result generalizability, gaps and unmet needs in terms of parental education and awareness, as well as in terms of childhood obesity management programs have been identified, which should motivate policy and action by all involved stakeholders.

The present study provides the following implications for research and practice: The growing prevalence of overweight and/or obesity among children is a key public health concern globally, regionally and in Lebanon. Parental perceptions and knowledge about obesity-related health risks should be factored in when designing awareness programs for parents and weight loss interventions for children. Parents and other stakeholders (schools, ministries, healthcare providers, etc.) should be involved in obesity prevention programs. Efforts are still needed to spread awareness about the importance of parents' perception on childhood obesity in communities such as the Northern Lebanese population, and the health risks associated with obesity and its deleterious effect on shaping a healthy population. More

robust and nationwide studies are warranted to fully depict the Lebanese situation on childhood obesity prevalence, as well as parental perception, knowledge and readiness for change.

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### **Availability of data and materials**

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

### **Authors' contributions**

NA designed the study and wrote the proposal, collected, managed the data, and participated in the writing of the manuscript. HR participated in writing the proposal, performing data collection and in the writing of the manuscript. JS participated in data analysis, and in writing and revising the manuscript. REB performed the data analysis, and participated in the writing of the manuscript. REB and NA confirm the authenticity of all the raw data. All authors have read and approved the final manuscript.

### **Ethics approval and consent to participate**

Ethical approval was obtained from the Ethics Committee at the University of Balamand (Approval no. 006-2019). All parents had provided informed consent before any study-related activity. Oral assent was taken from all children involved in the study. The researchers had ensured that the internationally recognized ethical principles, guidelines and regulations for research involving human subjects were respected throughout the study.

### **Patient consent for publication**

Not applicable.

### **Competing interests**

The authors declare that they have no competing interests.

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