

Prevalence of childhood obesity, its associated risk factors and parental misperception of their child's actual weight among Saudi children in Yanbu city, Saudi Arabia 2021: A cross-sectional study

Worood Abdulaziz Alodainy

Correspondence:

Worood Abdulaziz Alodainy, MBBS
Yanbu Family Medicine Residency Program,
Asharqiah PHC

Email: dr.roses_1411@hotmail.com

Received: December 2021; Accepted: January 2022; Published: February 1, 2022.

Citation: Worood Abdulaziz Alodainy. Prevalence of childhood obesity, its associated risk factors and parental misperception of their child's actual weight among Saudi children in Yanbu city, Saudi Arabia 2021: A cross-sectional study. *World Family Medicine*. 2022; 20(2): 60-83 DOI: 10.5742/MEWFM.2022.95248

Abstract

Aim of Study: To determine prevalence of childhood obesity among attendants of primary health care centers, its associated risk factors, and to identify parental misperceptions regarding their children's actual weight.

Methods: Following a cross-sectional study design, at primary health care centers (PHCC) in Yanbu Albahr City, Saudi Arabia, the study sample included 80 parents of Saudi healthy -school children aged 6 to 12 years. The study questionnaire included sociodemographic data of children and their parents, anthropometric data of children, the 1st section of the Arabic version of Comprehensive Feeding Practices Questionnaire (CFPQ), the child's lifestyle behavior assessment and parent's perception regarding their child's weight.

Results: Prevalence of overweight among children was 5%, while 13.8% were obese. Fast foods, sweets and soft drinks were commonly consumed by children, while 36.3% did not practice any sports. Children's BMI grades did not differ significantly according to their or their parents' sociodemographic factors, or their dietary habits, but differed according to their parents' educational level ($p=0.038$), with highest prevalence of obesity among less educated parents. Only 7.5% of parents perceived their children as overweight, while 1.3% perceived their children as obese. Parents' perception regarding their children's weight did not differ according to how they judge their weight, the way they weigh their weight or their source of information about their children's weight. Most parents (56.3%) incorrectly perceived their children's weight.

Conclusions: Prevalence of obesity among primary school children in Yanbu Albahr City is high. Unhealthy dietary habits, and physical inactivity are common among Saudi children. Most parents misperceive their children's actual body weight. Children's BMI grades differ significantly according to their parents' educational level, with highest prevalence of obesity among less educated parents.

Key Words: Childhood obesity, risk factors, dietary habits, physical activity, parents' perception about children's weight, Saudi Arabia.

Introduction

Obesity is the abnormal or excessive fat accumulation that may impair health(1). Body mass index (BMI) is a measure used to determine overweight and obesity. For children and teens, BMI is age- and sex-specific. Hence, it is often referred to as BMI-for-age, and the child's weight status is determined using an age- and sex-specific percentile for BMI. Overweight is defined as a BMI > 85th percentile and < 95th percentile for children of the same age and sex, while obesity is defined as a BMI >95th percentile for children of the same age and sex (2).

Over 340 million children and adolescents aged 5-19 were overweight or obese in 2016 (1). Moreover, levels of obesity are growing across the globe and have raised concerns for healthcare professionals and policymakers (3). The World Health Organization recognized childhood obesity as the significant challenge of the 21st century, as the number of overweight children under the age of 5 years is projected to be more than 42 million (4). In Saudi Arabia, overweight and obesity among children are considered serious public health problems. Their prevalence is on the rise, and the need for interventions is becoming urgent(5).

Obesity decreases the quality of life and life expectancy considerably and accounts for billions of dollars in the provision of healthcare (4). Childhood obesity is associated with a higher chance of obesity, premature death and disability in adulthood. In addition to increased future risks, obese children experience breathing difficulties, increased risk of fractures, hypertension, early markers of cardiovascular disease, insulin resistance and psychological effects (1).

The fundamental cause of obesity and overweight is energy imbalance between calories consumed and calories expended. Therefore, it is necessary to study the association between different dietary habits, lifestyle behavior and childhood obesity so that we can under the light of our results, predicate solutions and preventative measures. (1)

It is to be noted that, when parents recognize their child's actual weight status as being unhealthy, they can provide the needed support in achieving a healthy weight. However, a meta-analysis found that 50.7% of parents underestimated their overweight/obese child's weight status (4). This misperception of children's actual weight status is of great significance since parents have the potential to play a vital role in influencing positive behavior and thus curtail weight gain in their children (6). However, only a few studies have explored the underlying factors that influence parental misperception of their children's actual weight status (7-9).

Study rationale:

The researcher has observed that parents frequently misperceive their obese or overweight children as normal. Therefore, the researcher is highly interested in proving

that poor health literacy is a factor that affects parents' misperceptions regarding their children's obesity, and in exploring risk factors associated with childhood obesity to be able to recommend effective management measures. Moreover, since data regarding Saudi parents' perception of their children's actual weight in Yanbu city, Saudi Arabia, is lacking, it is important to assess parents' misperception regarding their children's weight.

Aim of Study

To determine prevalence of childhood obesity among attendants of primary health care centers, its associated risk factors, and to identify parental misperceptions regarding their children's actual weight, in Yanbu city, Saudi Arabia, 2021.

Objectives:

1. To determine prevalence of obesity among Saudi children attending primary health care centers in Yanbu city, Saudi Arabia.
2. To assess common dietary habits of children.
3. To explore the association between childhood obesity and socio-demographic characteristics of children and their parents, in addition to children's dietary habits and lifestyle behaviors.
4. To investigate the level of parent's misperception regarding their children's actual body weight.
5. To find out the association of childhood obesity with parents' misperception.
6. To determine the association of parent's misperception about their children's weight with children's and parents' demographic characteristics as well as parents' health literacy.

Methodology

Following a cross-sectional study design, at primary health care centers (PHCC) in Yanbu City (Yanbu Albahr), Saudi Arabia, the study sample included 80 parents of Saudi healthy preschool children aged 6 to 12 years. Non-Saudi parents of children with psychiatric problems or chronic diseases (e.g., diabetes, hypertension, asthma), or those receiving corticosteroids, or immunocompromised children were excluded.

The sample size was determined to be 80 according to Dahiru et al. (10) with:

- 95% confidence interval, with $Z_{\alpha}=1.96$
- A 30% anticipated population proportion of obesity among the study group (11)
- An absolute precision of 0.1

All PHCCs in Yanbu Albahr City were chosen (N=7) as the study setting. At each PHCC, we interviewed 10-12 parents of children fulfilling the inclusion criteria. In case we had more than one child who met inclusion criterion, the data of the younger child was included.

After obtaining the ethical approval (No. 115-2021, on 16/6/2021, Al-Madina Al- Monowwarah Region), a paper-based, self-administered, screening questionnaire (in simple Arabic language) was designed by the researcher.

The study questionnaire consisted of the following parts:

A) Sociodemographic data: Child's age, gender, and his/her last scholastic achievement, in addition to parent's age, weight, height, marital status, education level, employment status, family size, average monthly income, and parents' consanguinity.

B) The anthropometric data of children were measured for children attending the Well-Baby Clinic, by the triage nurse. The reliability of measurements was assessed by repeated measurements on the same child with an intraclass correlation coefficient of >0.95 . The anthropometric data of children including height, weight and waist circumference were assessed as follows:

- Body weight was measured to the nearest 0.1 kg using a calibrated digital Seca scale, while the children were wearing light clothing with no shoes.

- The standing height was measured to the nearest 0.1 centimeter without shoes using a calibrated stadiometer.

- Waist circumference (WC) was measured horizontally at the navel's level to the nearest 0.1 cm, employing a non-stretchable measuring tape.

- Body mass index (BMI) was calculated as weight in kilograms over the height squared in meters. Child's BMI was classified according to the CDC age- and sex-specific growth chart with plotted percentile rankings. Underweight children are those with ranking less than 5th percentile; ideal weight children are those with a ranking of 5th percentile to less than the 85th percentile; overweight children are those with ranking from 85th to less than the 95th percentile; and obese children are those with ranking equal to or greater than the 95th percentile (2).

C) The WHO recommendation (12) was used for assessment and classification of parents' BMI classification, as follows:

- Underweight, if BMI <18.5 kg/m²,

- Normal weight, if BMI is 18.5 - 24.9 kg/m².

- Overweight if BMI is 25.0-29.9 kg/m²

- Obese, if is BMI ≥ 30.0 kg/m².

D) The dietary habits were investigated using the 1st section of the Arabic version of Comprehensive Feeding Practices Questionnaire (CFPQ). It comprises 12 questions and it is a reliable and valid instrument for assessing dietary habits and maternal feeding practices of children aged 6-12 years (13).

E) The child's lifestyle behavior was assessed using the physical activity and life style section of a questionnaire adapted from another study, which consists of 14 questions. The reliability of the questionnaire has been shown to be acceptable (14).

F) Parent's perception regarding their child's weight was assessed by the question that has been used by several international studies for the same purpose (15-17): *"I feel that my child is a) underweight, b) slightly underweight, c) about the right weight, d) overweight, or e) obese"*. However, due to the limited sample size in the present study and that the literature demonstrating that parental underestimation is more problematic among normal and overweight/obese children (4), the category 'slightly underweight' was omitted by the researcher. Moreover, in the light of literature review, two questions were added

to assess health literacy as a factor effecting parents' misperception of their children's actual weight. We defined misperception as: Parents incorrectly recognizing their child's weight in both normal weight and overweight groups (18).

A pilot study was conducted to test the clarity of the study questionnaire and the time needed to fill in the questionnaire. The questionnaire contents proved to be clear, well-understood and required about 15 minutes to be completed. Participants' data in the pilot study were not included in the final analysis.

Copies of the study questionnaire were distributed to potential participant parents, accompanied by a consent form, which also included study objectives, confidentiality of collected data, voluntary participation, all responses are anonymous, and their right to withdraw without any effect on received healthcare. Data were kept in a personal computer with password protection, and after its completion, data were kept in safe storage media which is in a safe locker.

The study data were analyzed using the Statistical Package for Social Sciences (IBM, SPSS version 26). The data were reported as frequencies and percentages. Kolmogorov-Smirnov test was applied to assess normality of data distribution. Non-parametric statistical tests were applied, i.e., Mann-Whitney to compare two groups and Kruskal-Wallis to compare more than two groups. P-values less than 0.05 were considered as statistically significant.

There was no conflict of interest or financial support. This study was completely funded by the researcher.

Results

Table (1) shows that about one-third of children (38.8%) were aged 9-12 years and almost two-thirds (62.5%) were girls. About two-thirds of children's academic achievements were excellent (67.5%). Age of 48.8% of participant parents was 29-37 years and the majority (95%) were currently married. Almost half of participant parents (47.5%) were university educated, while 55% had governmental jobs. Almost half of participants (47.5%) had a family monthly income of 5000-10000 SR. One quarter of children's parents were relatives.

Table 1: Demographic characteristics participant parents and their children (n = 80)

Personal characteristics	No.	%
Age groups (in years)		
• <6-9	49	61.3
• >9	31	38.8
Gender		
• Boys	30	37.5
• Girls	50	62.5
Academic achievement		
• Good	6	7.5
• Very good	20	25.0
• Excellent	54	67.5
Age group of child's parent (in years)		
• 29-37	39	48.8
• 38-46	30	37.5
• 47-56	11	13.8
Parents' current marital status		
• Married	76	95.0
• Divorced	3	3.8
• Widow	1	1.3
Parent's educational status		
• Illiterate	2	2.5
• Primary	8	10.0
• Elementary	2	2.5
• Secondary	16	20.0
• Diploma	14	17.5
• University	38	47.5
Parents' occupation		
• Governmental job	44	55.0
• Private sector employee	9	11.3
• Retired	2	2.5
• Housewife	25	31.3
Family monthly income (SR)		
• <5000	18	22.5
• 5000-10000	38	47.5
• >10000	24	30.0
Parents' degree of consanguinity		
• None	60	75.0
• Cousins	15	18.7
• Other	5	6.3

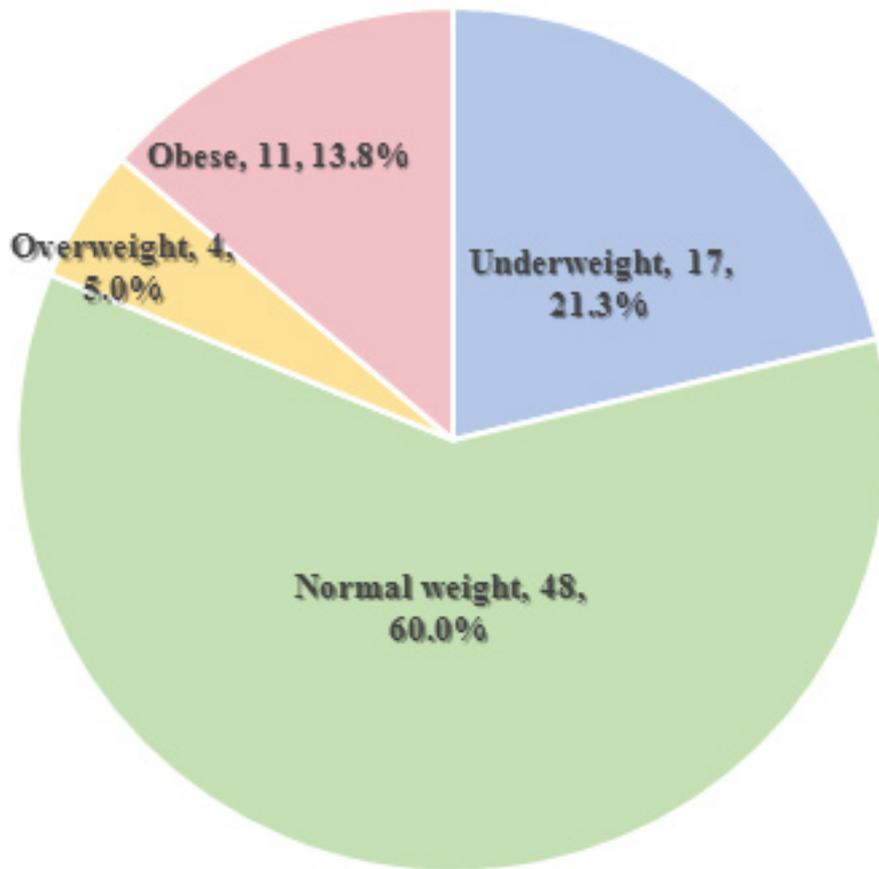
Figure 1: Distribution of children's body mass index

Figure 1 demonstrates that 5% of children were overweight, while 13.8% were obese.

Table 2: Dietary habits of children

Dietary habits of children	Responses	No.	%
Weekly consumption of fast foods (e.g., burger, broast, pizza, Frenchfries)	Once	48	60.0
	Twice	18	22.5
	Three times	9	11.3
	> three times	5	6.3
Weekly consumption of sweets (e.g., donuts, pancakes, basbousa, chocolate, ice cream, cake)	Once	32	40.0
	Twice	20	25.0
	3 times	14	17.5
	> 3 times	14	17.5
Weekly consumption of soft drinks (e.g., Pepsi, 7-Up, Merinda, Shani) by your child	Once	66	82.5
	Twice	7	8.8
	3 times	5	6.3
	> 3 times	2	2.5
Weekly consumption of fatty foods (chicken skin, fried foods, kabsa)	Once	50	62.5
	Twice	19	23.8
	3 times	6	7.5
	> 3 times	5	6.3
To what extent do you monitor the quantities of sweets that the child consumes (e.g., cakes, ice cream, chocolate, candies)?	Never	2	2.5
	Usually	7	8.8
	Often	28	35.0
	Always	13	16.3
	Sometimes	30	37.5
To what extent do you monitor the quantities of snacks that the child consumes (e.g., chips, Al-Durra chips)	Never	1	1.3
	Usually	8	10.0
	Often	26	32.5
	Always	20	25.0
	Sometimes	25	31.3
To what extent do you monitor the amounts of fatty (high-fat) foods the child consumes?	Never	4	5.0
	Usually	10	12.5
	Often	22	27.5
	Always	20	25.0
	Sometimes	24	30.0
To what extent do you monitor the quantities of drinks rich in sugar that the child consumes powdered juices? (e.g., Pepsi, Tang 7-Up)?	Never	6	7.5
	Usually	5	6.3
	Often	18	22.5
	Always	20	25.0
	Sometimes	31	38.8

Table 2 continued: Dietary habits of children

Dietary habits	Responses	No.	%
Do you let the child eat anything he wants?	Never	11	13.8
	Usually	21	26.3
	Often	30	37.5
	Always	10	12.5
	Sometimes	8	10.0
When a child is upset, is giving him something to eat the first thing you do?	Never	32	40.0
	Usually	22	27.5
	Often	17	21.3
	Always	8	10.0
	Sometimes	1	1.3
Do you give the child food if the child is upset or bored even if the child is not hungry?	Never	37	46.3
	Usually	27	33.8
	Often	9	11.3
	Always	5	6.3
	Sometimes	2	2.5

Table (2) shows that fast foods were consumed more than three times weekly by 6.3% of children. Sweets were consumed more than 3 times weekly by 17.5% of children. Soft drinks were consumed more than 3 times weekly by 2.5% of children. Fatty foods were consumed more than 3 times weekly by 6.3% of children. Only 16.3% of parents always monitor the quantities of sweets consumed by their children, while 25% of parents monitor the quantities of snacks, fatty foods or drinks rich in sugar consumed by their children. Only 13.8 never let their children eat anything they want. When the child is upset, 10% of parents start giving their children something to eat, while 6.3% of parents always give their children food when they feel upset or bored even if the children were not hungry.

Table (3) shows that more than one-third of children (36.3%) do not practice any sports, mainly as a result of being not used to (25%), or due to the lack of a suitable place for its practice (8.8%). Running, football and swimming were the most commonly practiced sports (20%, 10% and 8.8%, respectively), in addition to other kinds of sport practiced by children (16.3%). About one-third of children (36.3%) practice sports only for 30 minutes, and the main places for practicing sports were their homes or in the street (33.8% and 16.3%, respectively). Most children had bicycles (68.8%), which were being ridden by children mainly for about an hour (41.3%). Most children go to their schools by car (76.3%). Their usual walking pace was either slow or medium (32.5% or 45%, respectively). Their home activity is mainly active (40%), but most of them spend about two hours or more daily watching TV (33.8% and 32.5%, respectively), and more than two hours daily using their computers (47.5%). Playing was the activity being spent by most children (72.5%).

Table 3: Children's lifestyle behaviors

Lifestyle behaviors	Responses	No.	%
Does the child do any sports?	Yes	51	63.7
	No	29	36.3
Why doesn't your child practice any sports?	Laziness	3	3.8
	Not used to doing sports	20	25.0
	No available place	7	8.8
	Other	6	7.5
What kind of sport is being practiced by your child?	Football	8	10.0
	Running	16	20.0
	Swimming	7	8.8
	Table tennis	1	1.3
	Karate	1	1.3
	Several games	6	7.5
	Other	13	16.3
How many hours of daily practice?	30 minutes	29	36.3
	60 minutes	10	12.5
	90 minutes	9	11.3
	120 minutes	5	6.3
Where does your child practice sports?	At home	27	33.8
	In the street	13	16.3
	In the club	12	15.0
Does your child have a bicycle?	Yes	55	68.8
	No	25	31.3
How long does he spend riding a bike per day	15 minutes	3	3.8
	30 minutes	15	18.8
	60 minutes	33	41.3
	90 minutes	2	2.5
How does the child go to school?	Walking	7	8.8
	By car	61	76.3
	Other	12	15.0
What is the child's usual walking pace?	Slow	26	32.5
	Medium	36	45.0
	Fast	15	18.8
	Very fast	3	3.8

Table 3 Continued: Children's lifestyle behaviors

Lifestyle behaviors	Responses	No.	%
What is the child's activity rate at home and with the family?	Lazy	3	3.8
	Acceptable	18	22.5
	Medium	27	33.8
	Active	32	40.0
How long does a child spend watching TV per day?	0 minutes	9	11.3
	60 minutes	18	22.5
	120 minutes	27	33.8
	> 120 minutes	26	32.5
How many hours does the child spend using the computer per day?	0 minutes	21	26.3
	60 minutes	14	17.5
	120 minutes	7	8.8
	> 120 minutes	38	47.5
How many hours does a child spend in electronic games per day?	0 minutes	16	20.0
	60 minutes	28	35.0
	120 minutes	12	15.0
	> 120 minutes	24	30.0
How does the child spend most of his time?	Sitting	16	20.0
	Walking	6	7.5
	Playing	58	72.5

Table 4: Association between childhood obesity with children's socio-demographic factors

Socio-demographic Factors	Responses	Body mass index (BMI)				Mean Rank	P value
		Underweight No. (%)	Normal No. (%)	Overweight No. (%)	Obese No. (%)		
Child age	5-8	16/49(32.7)	23/49(47)	3/49(6.1)	7/49(14.2)	37.27	0.075
	9-12	1/31(3.3)	25/31(80.6)	1/31(3.2)	4/31(12.9)		
Child gender	Boys	7/30(23.3)	16/30(53.3)	1/30(3.3)	6/30(20)	39.91	0.739
	Girls	10/50(20)	32/50(64)	3/50(6)	5/50(10)		
Child's last academic achievement	Good	2/6(33.3)	4/6(66.7)	0/6(0.0)	0/6(0.0)	41.29	0.471
	Very good	4/20(20)	12/20(60)	1/20(5)	3/20(15)		
	Excellent	11/54(20.4)	32/54(59.3)	3/54(5.6)	8/54(14.8)		

Table 4 shows that children's BMI grades did not differ significantly according to their sociodemographic factors.

Table 5: Association between childhood obesity and parent's socio- demographic factors

Parents' socio-demographic factors	Responses	Body mass index (BMI)				Mean Rank	P value
		Underweight No. (%)	Normal No. (%)	Overweight No. (%)	Obese No. (%)		
Parent's age (in years)	29-37	9/39(23.1)	19/39(48.7)	4/39(10.3)	7/39(17.9)	42.68	0.541
	38-46	7/30(23.3)	20/30(66.7)	0/30(0.0)	3/30(10)		
	47-56	1/11(9.1)	9/11(81.8)	0/11(0.0)	1/11(9.1)		
Marital status	Married	15/76(19.7)	47/76(61.8)	4/76(5.3)	10/76(13.2)	40.86	0.051
	Divorced	2/3(66.7)	1/3(33.3)	0/3(0.0)	0/3(0.0)		
	Widow	0/1(0.0)	0/1(0.0)	0/1(0.0)	1/1(100)		
Educational level	Illiterate	0/2(0.0)	1/2(50)	0/2(0.0)	1/2(50)	43.68	0.038
	Primary	1/8(12.5)	3/8(37.5)	0/8(0.0)	4/8(50)		
	Intermediate	0/2(0.0)	2/2(100)	0/2(0.0)	0/2(0.0)		
	Secondary	5/16(31.2)	11/16(68.8)	0/16(0.0)	0/16(0.0)		
	Diploma	6/14(42.8)	6/14(42.8)	1/14(7.2)	1/14(7.2)		
	University	5/38(13.2)	25/38(65.8)	3/38(7.9)	5/38(13.1)		
Occupation	Government	11/44(25)	27/44(61.4)	0/44(0.0)	6/44(13.6)	37.94	0.209
	Private	4/9(44.5)	3/9(33.3)	1/9(11.1)	1/9(11.1)		
	Retired	0/2(0.0)	2/2(100)	0/2(0.0)	0/2(0.0)		
	Housewife	2/25(8)	16/25(64)	3/25(12)	4/25(16)		
Monthly income (in SR)	< 5000	4/18(22.2)	9/18(50)	0/18(0.0)	5/18(27.8)	41.09	0.591
	5000-10000	7/38(18.4)	24/38(63.2)	3/38(7.9)	4/38(10.5)		
	> 10000	6/24(25)	15/24(62.5)	1/24(4.2)	2/24(8.3)		
Parents' consanguinity	Cousins	3/15(20)	11/15(73.3)	1/15(6.7)	0/15(0.0)	41.34	0.838
	None	13/60(21.7)	34/60(56.7)	3/60(5)	10/60(16.6)		
	Others	1/5(20)	3/5(60)	0/5(0.0)	1/5(20)		

Table 5 shows that children's BMI grades differed significantly according to their parents' educational level ($p=0.038$), with highest prevalence of obesity among less educated parents (i.e., illiterate or primary education). However, children's BMI grades did not differ significantly according to other parents' characteristics.

Table 6: Association between childhood obesity and dietary habits

Dietary Habits	Responses	Body mass index (BMI)				Mean Rank	P value
		Underweight No. (%)	Normal No. (%)	Overweight No. (%)	Obese No. (%)		
Weekly consumption of fast foods	Once	14/48(29.2)	27/48(56.3)	1/48(2.1)	6/48(12.5)	36.75	0.078
	Twice	3/18(16.7)	12/18(66.7)	2/18(11.1)	1/18(5.6)		
	3 times	0/9(0.0)	6/9(66.7)	0/9(0.0)	3/9(33.3)		
	>3 times	0/5(0.0)	3/5(60)	1/5(20)	1/5(20)		
Weekly consumption of sweets	Once	8/32(25)	21/32(65.6)	1/32(3.13)	2/32(6.25)	36.28	0.424
	Twice	5/20(25)	10/20(50)	2/20(10)	3/20(15)		
	3 times	2/14(14.3)	9/14(64.3)	0/14(0.0)	3/14(21.4)		
	>3 times	2/14(14.3)	8/14(57.1)	1/14(7.1)	3/14(21.5)		
Weekly consumption of your child's intake of soft drinks	Once	17/66(25.9)	27/66(40.9)	3/66(4.6)	9/66(13.6)	38.88	0.327
	Twice	0/7(0.0)	5/7(71.4)	1/7(14.3)	1/7(14.3)		
	3 times	0/5(0.0)	5/5(100)	0/5(0.0)	0/5(0.0)		
	>3 times	0/2(0.0)	1/2(50)	0/2(0.0)	1/2(50)		
Weekly consumption of fatty foods	Once	13/50(26)	28/50(56)	1/50(2)	8/50(16)	38.93	0.424
	Twice	4/19(21.1)	11/19(57.8)	3/19(15.9)	1/19(5.2)		
	3 times	0/6(0.0)	6/6(100)	0/6(0.0)	0/6(0.0)		
	>3 times	0/5(0.0)	3/5(60)	0/5(0.0)	2/5(40)		
To what extent do you monitor the quantities of sweets that the child consumes?	Never	0/2(0.0)	1/2(50)	0/2(0.0)	1/2(50)	40.12	0.711
	Usually	2/7(28.6)	3/7(42.8)	0/7(0.0)	2/7(28.6)		
	Often	6/28(21.5)	19/28(67.8)	0/28(0.0)	3/28(10.7)		
	Always	2/13(15.4)	8/13(61.5)	2/13(15.4)	1/13(7.7)		
	Sometimes	7/30(23.3)	17/30(56.7)	2/30(6.7)	4/30(13.3)		
To what extent do you monitor the quantities of snacks that the child consumes	Never	0/1(0.0)	1/1(100)	0/1(0.0)	0/1(0.0)	40.15	0.933
	Usually	2/8(25)	3/8(37.5)	0/8(0.0)	3/8(37.5)		
	Often	6/26(23.1)	15/26(57.7)	1/26(3.8)	4/26(15.4)		
	Always	2/20(10)	16/20(80)	1/20(5)	1/20(5)		
	Sometimes	7/25(28)	13/25(52)	2/25(8)	3/25(12)		
To what extent do you monitor the amounts of fatty foods the child consumes?	Never	1/4(25)	3/4(75)	0/4(0.0)	0/4(0.0)	39.77	0.925
	Usually	2/10(20)	5/10(50)	1/10(10)	2/10(20)		
	Often	5/22(22.8)	13/22(59.1)	0/22(0.0)	4/22(18.1)		
	Always	2/20(10)	16/20(80)	1/20(5)	1/20(5)		
	Sometimes	7/24(29.2)	11/24(45.8)	2/24(8.33)	4/24(16.66)		

Table 6 Continued: Association between childhood obesity and dietary habits

Dietary Habits	Responses	Body mass index (BMI)				Mean Rank	P value
		Underweight No. (%)	Normal No. (%)	Overweight No. (%)	Obese No. (%)		
To what extent do you monitor quantities of drinks rich in sugar that the child consumes?	Never	1/6(16.7)	3/6(50)	1/6(16.7)	1/6(16.6)	42.32	0.614
	Usually	2/5(40)	3/5(60)	0/5(0.0)	0/5(0.0)		
	Often	4/18(22.2)	10/18(55.6)	1/18(5.6)	3/18(16.6)		
	Always	3/20(15)	16/20(80)	0/20(0.0)	1/20(5)		
	Sometimes	7/31(22.6)	16/31(51.6)	2/31(6.4)	6/31(19.4)		
Do you let the child eat anything he wants?	Never	1/11(9.1)	8/11(72.7)	0/11(0.0)	2/11(18.2)	41.45	0.894
	Usually	6/21(28.6)	11/21(52.4)	3/21(14.3)	1/21(4.7)		
	Often	6/30(29)	18/30(60)	1/30(3.3)	5/30(16.7)		
	Always	2/10(20)	7/10(70)	0/10	1/10(10)		
	Sometimes	2/8(25)	4/8(50)	0/8(0.0)	2/8(25)		
When a child is upset, is giving him something to eat the first thing you do?	Never	3/32(9.4)	21/32(65.6)	2/32(6.25)	6/32(18.8)	46.36	0.123
	Usually	6/22(27.3)	12/22(54.5)	1/22(4.5)	3/22(13.7)		
	Often	6/17(35.3)	9/17(52.9)	1/17(5.9)	1/17(5.9)		
	Always	1/8(12.5)	6/8(75)	0/8(0.0)	1/8(12.5)		
	Sometimes	1/1(100)	0/1(0.0)	0/1(0.0)	0/1(0.0)		
Do you give the child food when upset or bored even if not hungry?	Never	7/37(18.9)	22/37(59.5)	2/37(5.4)	6/37(16.2)	42.19	0.322
	Usually	5/27(18.5)	17/27(63)	1/27(3.7)	4/27(14.8)		
	Often	4/9(44.4)	5/9(55.6)	0/9(0.0)	0/9(0.0)		
	Always	4/5(80)	1/5(20)	0/5(0.0)	0/5(0.0)		
	Sometimes	1/2(50)	0/2(0.0)	1/2(50.0)	0/2(0.0)		

Table 6 shows that children's BMI grades did not differ significantly according to their dietary habits.

Table 7: Association between childhood obesity and lifestyle behaviors

Lifestyle behaviors	Responses	Body mass index (BMI)				Mean Rank	P value
		Underweight No. (%)	Normal No. (%)	Overweight No. (%)	Obese No. (%)		
Does the child do any sports?	Yes	13 (25.5)	30 (58.8)	2 (3.9)	6 (11.8)	38.18	0.177
	No	4 (13.8)	18 (62.1)	2 (6.9)	5 (17.2)		
If the child does not do any sports, why?	No	11 (25.0)	26 (59.1)	2 (4.5)	5 (11.4)	19.10	0.699
	Laziness	0 (0.0)	2 (66.7)	0 (0.0)	1 (33.3)		
	Not used to do sports	2 (10.0)	14 (70.0)	1 (5.0)	3 (15.0)		
	No suitable place	2 (28.6)	4 (57.1)	0 (0.0)	1 (14.3)		
What kind of sport?	Other	2 (33.3)	2 (33.3)	1 (16.7)	1 (16.7)	29.44	0.440
	No	5 (17.9)	16 (57.1)	2 (7.1)	5 (17.9)		
	Football	1 (12.5)	6 (75.0)	0 (0.0)	1 (12.5)		
	Running	2 (12.5)	11 (18.3)	1 (6.3)	2 (12.5)		
	Swimming	3 (42.9)	3 (42.9)	0 (0.0)	1 (14.3)		
	Table tennis	0 (0.0)	0 (0.0)	0 (0.0)	1 (100)		
	Karate	0 (0.0)	1 (100.0)	0 (0.0)	0 (0.0)		
	Several	2 (33.3)	3 (50.0)	0 (0.0)	1 (16.7)		
Other	4 (30.8)	8 (61.5)	1 (7.7)	0 (0.0)			
How long?	0 minutes	3 (12.0)	17 (68.0)	2 (8.0)	5 (20.0)	26.62	0.577
	30 minutes	8 (27.6)	17 (58.6)	0 (0.0)	4 (13.8)		
	60 minutes	2 (20.0)	5 (50.0)	2 (20.0)	1 (10.0)		
	90 minutes	3 (33.3)	6 (66.7)	0 (0.0)	0 (0.0)		
	120 minutes	1 (20.0)	3 (60.0)	0 (0.0)	1 (20.0)		
Where does your child practice sports?	No	3 (10.7)	18 (64.3)	2 (7.1)	5 (17.9)	25.72	0.673
	At home	9 (33.3)	13 (48.1)	1 (3.7)	4 (14.8)		
	In the street	1 (7.7)	11 (84.6)	0 (0.0)	1 (7.7)		
	In the club	4 (33.3)	6 (50.0)	1 (8.3)	1 (8.3)		
Does your child have a bicycle?	Yes	11 (20.0)	32 (58.2)	3 (5.5)	9 (16.4)	41.90	0.363
	No	6 (24.0)	16 (64.0)	1 (4.0)	2 (8.0)		
How long does your child spend riding a bike per day?	0 minutes	16 (59.3)	6 (22.2)	2 (7.4)	3 (11.1)	31.24	0.021
	15 minutes	2 (66.7)	1 (33.3)	0 (0.0)	0 (0.0)		
	30 minutes	5 (33.3)	9 (60.0)	0 (0.0)	1 (6.7)		
	60 minutes	3 (9.1)	21 (63.6)	2 (6.1)	7 (21.2)		
	90 minutes	1 (50.0)	1 (50.0)	0 (0.0)	0 (0.0)		

Table 7: Association between childhood obesity and lifestyle behaviors (continued)

Lifestyle behaviors	Responses	Body mass index (BMI)				Mean Rank	P value
		Underweight No. (%)	Normal No. (%)	Overweight No. (%)	Obese No. (%)		
How does the child go to school?	Walking	1 (14.3)	4 (57.1)	0 (0.0)	2 (28.6)	41.75	0.165
	By car	12 (19.7)	36 (59.0)	4 (6.6)	9 (14.8)		
	Other	4 (33.3)	8 (66.7)	0 (0.0)	0 (0.0)		
What is the child's usual walking pace?	Slow	4 (15.4)	20 (76.9)	0 (0.0)	2 (7.7)	42.96	0.764
	Medium	8 (22.2)	18 (50.0)	3 (8.3)	7 (19.4)		
	Fast	4 (26.7)	9 (60.0)	1 (6.7)	1 (6.7)		
	Very fast	1 (33.3)	1 (33.3)	0 (0.0)	1 (33.3)		
What is the child's activity rate at home and with the family?	Lazy	0 (0.0)	2 (66.7)	0 (0.0)	1 (33.3)	38.41	0.518
	Acceptable	3 (16.7)	10 (55.6)	2 (11.1)	3 (16.7)		
	Medium	5 (18.5)	19 (70.4)	1 (3.7)	2 (7.4)		
	Active	9 (28.1)	17 (53.1)	1 (3.13)	5 (15.6)		
How long does your child spend watching TV per day?	0 minutes	1 (11.1)	6 (66.7)	0 (0.0)	2 (22.2)	37.52	0.701
	60 minutes	4 (22.2)	11 (61.1)	1 (5.6)	2 (11.1)		
	2 hours	8 (29.6)	14 (51.9)	2 (7.4)	3 (11.1)		
	> 2 hours	4 (15.4)	17 (65.4)	1 (3.8)	4 (15.4)		
How long does your child spend using the computer per day?	0 minutes	2 (9.5)	11 (52.4)	2 (9.5)	6 (28.6)	37.79	0.072
	60 minutes	5 (35.7)	7 (50.0)	0 (0.0)	2 (14.3)		
	2 hours	2 (28.6)	4 (57.1)	0/7 (0.0)	1 (14.3)		
	> 2 hours	8 (21.1)	26 (68.4)	2 (5.3)	2 (5.3)		
How long does your child spend on electronic games per day?	0 minutes	2 (12.5)	9 (56.3)	2 (12.5)	3 (18.8)	38.13	0.438
	60 minutes	6 (21.4)	19 (67.9)	0 (0.0)	3 (10.7)		
	2 hours	4 (33.3)	6 (50.0)	1 (8.3)	1 (8.3)		
	> 2 hours	5 (20.8)	14 (58.3)	1 (4.2)	4 (16.7)		
How does your child spend most of his/her time?	Sitting	2 (12.5)	10 (62.5)	0 (0.0)	4 (25.0)	39.47	0.475
	Walking	2 (33.3)	3 (50.0)	0 (0.0)	1 (16.7)		
	Playing	13 (22.4)	35 (60.3)	4 (6.9)	6 (10.3)		

Table 7 shows that children's BMI grades differed significantly according to their duration of riding their bikes ($p=0.021$), with no prevalence of obesity or overweight among children riding their bikes for 15 or 90 minutes.

Table 8: Parents' perception regarding their children's actual body weight

Parent's perception regarding their children's weight	No.	%
How would you describe your child's weight?		
• Underweight	22	27.5
• Normal weight	51	63.7
• Overweight	6	7.5
• Obese	1	1.3
How do you judge your child's weight?		
• The opinion of those around him	9	11.3
• As stated by his treating doctor	26	32.5
• Body mass index calculator	11	13.8
• External body shape	34	42.5
How do you weigh your child?		
• Weight with a scale	45	56.3
• Weighing with a scale without shoes	16	20.0
• Using a body mass index calculator	3	3.8
• Calculate the body mass index and put it on a growth chart	16	20.0
What is your main source for information about ideal body weight?		
• Books and magazines	2	2.5
• Internet	16	20.0
• Social media	9	11.3
• Doctors	33	41.3
• Others	20	25.0

Table 8 shows that only 7.5% of parents perceived their children as overweight, while 1.3% perceived their children as obese. The commonest way for parents to judge their children's weight was by their external body shape (42.5%). Only 56.3% of parents used a scale to weigh their children. Doctors were the main source of information about children's ideal body weight for only 41.3% of parents.

Table 9: Association between childhood obesity and their parents' perception

Parents' Perception	Responses	Body mass index (BMI)				Mean Rank	P value
		Underweight No. (%)	Normal No. (%)	Overweight No. (%)	Obese No. (%)		
How would you describe your child's weight?	Underweight	5/22(22.7)	16/22(72.8)	0/22(0.0)	1/22(4.5)	40.62	0.154
	Normal	11/51(21.6)	30/51(58.8)	3/51(5.9)	7/51(13.7)		
	Overweight	1/6(16.7)	1/6(16.7)	1/6(16.6)	3/6(50)		
	Obese	0/1(0.0)	1/1(100)	0/1(0.0)	0/1(0.0)		
How do you judge your child's weight?	His treating doctor	8/26(30.8)	13/26(50)	3/26(11.5)	2/26(7.7)	42.47	0.776
	BMI calculator	1/11(9.1)	9/11(81.8)	0/11(0.0)	1/11(9.1)		
	External body shape	7/34(20.6)	19/34(55.9)	1/34(2.9)	7/34(20.6)		
How do you weigh your child?	Opinion of those around him	1/9(11.1)	7/9(77.8)	0/9(0.0)	1/9(11.1)	43.39	0.501
	Balance weight measure	7/45(15.6)	28/45(62.2)	3/45(6.6)	7/45(15.6)		
	Using a scale without shoes	5/16(31.3)	8/16(50)	0/16(0.0)	3/16(18.7)		
	BMI calculator	0/3(0.0)	3/3(100)	0/3(0.0)	0/3(0.0)		
What is your main source for information about health?	Plot BMI on a growth chart	5/16(31.3)	9/16(56.3)	1/16(6.2)	1/16(6.2)	38.08	0.863
	Books and magazines	0/2(0.0)	2/2(100)	0/2(0.0)	0/2(0.0)		
	Internet	2/16(12.5)	11/16(68.7)	0/16(0.0)	3/16(18.8)		
	Social media	2/9(22.2)	6/9(66.7)	0/9(0.0)	1/9(11.1)		
	The doctor	10/33(30.3)	16/33(48.5)	3/33(9.1)	4/33(12.1)		
Others	3/20(15)	13/20(65)	1/20(5)	3/20(15)			

Table 9 shows that parents' perception regarding their children's weight did not differ significantly according to how they judge their weight, the way they weigh their weight or their source of information about their children's weight.

Table 10: Association between parents' perception and their educational level

Parents' perception	Responses	Parents Education level					
		Illiterate No. (%)	Primary No. (%)	Intermediate No. (%)	Secondary No. (%)	Diploma No. (%)	University No. (%)
How would you describe your child's weight?	Underweight	0/22(0.0)	1/22(4.5)	1/22(4.5)	5/22(22.7)	5/22(22.7)	10/22(45.6)
	Normal	2/51(3.9)	6/51(11.8)	1/51(2)	10/51(19.6)	9/51(17.6)	23/51(45.1)
	Overweight	0/6(0.0)	1/6(16.7)	0/6(0.0)	1/6(16.7)	0/6(0.0)	4/6(66.6)
	Obese	0/1(0.0)	0/1(0.0)	0/1(0.0)	0/1(0.0)	0/1(0.0)	1/1(100)
Mean Rank	42.24						
P – value	0.648						
How do you judge your child's weight?	His treating doctor	0/26(0.0)	2/26(7.7)	1/26(4.5)	4/26(15.4)	6/26(23.1)	13/26(50)
	BMI calculator	0/11(0.0)	1/11(9.1)	1/11(9.1)	3/11(27.3)	2/11(18.2)	4/11(36.3)
	External body shape	1/34(2.9)	5/34(14.7)	0/34(0.0)	5/34(14.7)	6/34(17.7)	17/34(50)
	Opinion of those around him	1/9(11.2)	0/9(0.0)	0/9(0.0)	4/9(44.4)	0/9(0.0)	4/9(44.4)
Mean Rank	40.37						
P – value	0.301						
How do you weigh your child?	Balance weight measure	2/45(4.4)	7/45(15.6)	1/45(2.2)	7/45(15.6)	9/45(20)	19/45(42.2)
	Using a scale without shoes	0/16(0.0)	1/16(6.3)	0/16(0.0)	3/16(18.7)	4/16(25)	8/16(50)
	BMI calculator	0/3(0.0)	0/3(0.0)	0/3(0.0)	1/16(33.3)	1/16(33.3)	1/16(33.3)
	Plot BMI on a growth chart	0/16(0.0)	0/16(0.0)	1/16(6.3)	5/16(31.3)	0/16(0.0)	10/16(62.4)
Mean Rank	43.50						
P – value	0.135						
What is your source of information about your child's weight?	Books and magazines	0/2(0.0)	0/2(0.0)	0/2(0.0)	0/2(0.0)	1/2(50)	1/2(50)
	Internet	0/16(0.0)	1/16(6.3)	0/16(0.0)	3/16(18.8)	1/16(6.3)	11/16(68.6)
	Social media	0/9(0.0)	1/9(11.1)	0/9(0.0)	1/9(11.1)	2/9(22.2)	5/9(55.6)
	The doctor	0/33(0.0)	1/33(3)	1/33(3)	8/33(24.2)	6/33(18.2)	17/33(51.6)
	Others	2/20(10)	5/20(25)	1/20(5)	4/20(20)	4/20(20)	4/20(20)
Mean Rank	33.21						
P – value	0.032						

Table 10 shows that parents' sources of information about their children's weight differed significantly associated with their educational levels ($p=0.032$), with books and magazines being the main sources for information among highly educated parents (Diploma or University educated).

Figure 2: Parents' perception regarding their children's weight

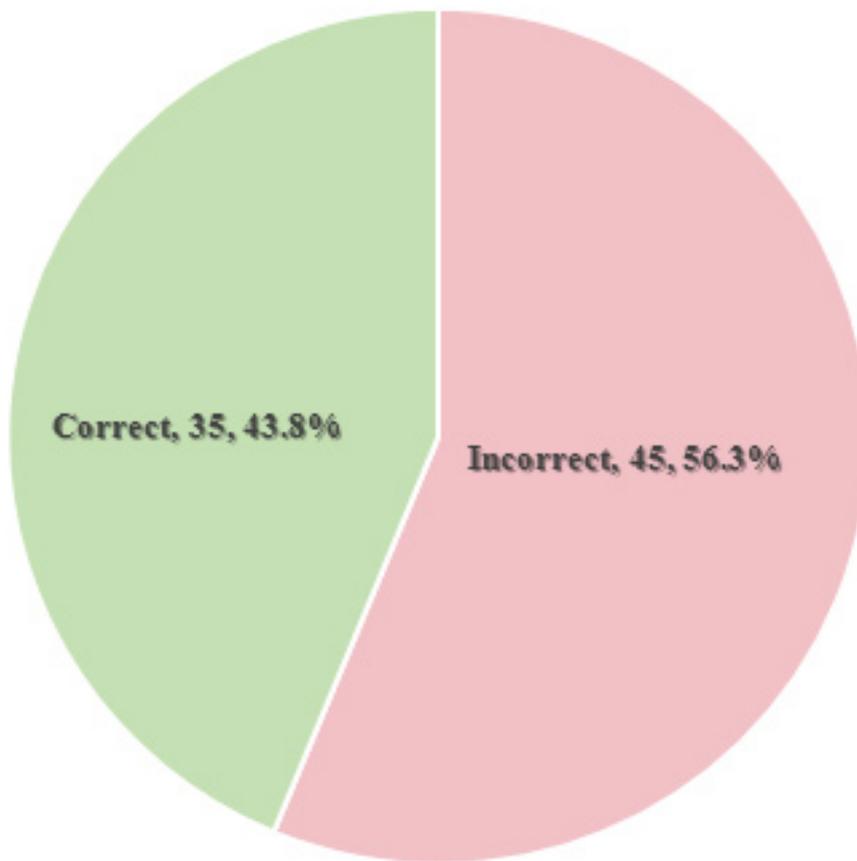


Figure 2 shows that 56.3% of parents incorrectly perceived their children's weight.

Table 11: Association between parents' health literacy and their perception regarding their children's weight

Parent's health Literacy	Responses	Incorrect Perception No. (%)	Mean Rank	P value
How do you judge your child's weight?	Measuring by his treating doctor	17/45 (37.8)	42.47	0.776
	BMI calculator	3/45 (6.7)		
	External body shape	18/45 (40)		
	Opinion of those around him	7/45 (15.5)		
How do you weigh your child?	Balance weight measurement	25/45 (55.6)	43.39	0.501
	Weighing with a scale without shoes	10/45 (22.2)		
	BMI calculator	1/45 (2.2)		
	Plot BMI on a growth chart	9/45 (20)		
What is the main source for their information about health?	Books and magazines	0/45 (0.0)	38.08	0.863
	Internet	7/45 (15.6)		
	Social media	6/45 (13.3)		
	Doctors	24/45 (54.3)		
	Other	8/45 (17.8)		

Table 11 shows that parents' incorrect perception regarding their children's weight did not differ significantly according to the way they judged their children's weight, how they weigh their children, or their sources of health literacy.

Table 12: Association between parent's sociodemographic and incorrect recognition of their children's weight

Parents' sociodemographic variables	Responses	Incorrect Perception No. (%)	Mean Rank	P-value
Parent's age	29-37	24/44 (54.6)	43.12	0.473
	38-46	14/44 (31.8)		
	47-56	6/44 (13.6)		
Marital status	Married	41/44 (93.2)	40.08	0.605
	Divorced	2/44 (4.5)		
	Widow	1/44 (2.3)		
Education level	Illiterate	1/44 (2.3)	41.66	0.787
	Primary	6/44 (13.6)		
	Intermediate	1/44 (2.3)		
	Secondary	8/44 (18.2)		
	Diploma University	6/44 (13.6) 22/44 (50)		
Occupation	Governmental	24/44 (54.5)	40.32	0.998
	Private sector	5/44 (11.4)		
	Retired	1/44 (2.3)		
	Housewife	14/44 (31.8)		
Monthly income (SR)	<5000	12/44 (27.3)	42.71	0.112
	5,000-10,000	23/44 (52.3)		
	>10,000	9/44 (20.4)		

Table 12 shows that parents' incorrect perception regarding their children's weight did not differ significantly according to parents' sociodemographic variables.

Discussion

Studies have shown that most overweight and obese children grow to become obese adults (19). Due to its great public health importance, up-to-date information on prevalence and trends in childhood obesity is necessary for developing and evaluating success of interventions for prevention of obesity in any country (20).

Our study demonstrated that prevalence of overweight/obesity was as high as 18.8% among children aged 6-12 years in Yanbu city, Saudi Arabia, with 5% being overweight (i.e., BMI is 25.0-29.9 kg/m²), while 13.8% being obese (i.e., BMI ≥30.0 kg/m²).

Previous studies in Saudi Arabia reported variable prevalence of obesity in children and adolescents based on the age and geographic region selected as well as the measurement reference (5; 21). Al-Shaikh et al. (21) reported that the overall prevalence of overweight/obesity among children aged 6-19 years in the western, central, and eastern regions is 21.5%. In 2010, Riyadh City, Saudi Arabia, the overall prevalence rate for overweight/obesity among children aged 6-16 years was as high as 26.1%, being 20.4% and 5.7% for overweight and obesity, respectively (22), while in 2019, prevalence of childhood overweight/obesity among the same age group became 31.6%, being 13.4% for overweight and 18.2%, for obesity (20).

In the Eastern Province, Saudi Arabia, Al-Dossary et al. (23) reported that about 50% of Saudi children had a BMI above the 85% percentile. They noted that by the age of 9 years, 21% of children were overweight and 21% obese—and their weight continued to increase into the adolescent years. In Taif, Saudi Arabia, Al Ghamdi (24) reported that prevalence of overweight and obesity among school children were 10.7% and 7.6%, respectively.

High prevalence of overweight/obesity were also reported in other Gulf countries. Malik and Bakir (25) reported that more than 30% of children aged 5-17 years in the United Arab Emirates were either overweight (21.5%) or obese (13.7%).

Moreover, high prevalence rates of overweight/obesity were reported by studies both in developed and developing countries. In the USA, prevalence rates of overweight and obesity in children 2-19 years of age were 31.9% and 11.3%, respectively (26). In Italy, Paduano et al. (27) reported that prevalence of overweight/obesity among primary school children was 25.2%.

In India, Gautam and Jeong (28) reported that prevalence of overweight and obesity among children aged 12-16 years were 10.8% and 6.2%, respectively. In Nepal, Karki et al. (29) reported that 25.7% of children aged 6-13 years were overweight or obese. In Ghana, Adom et al. (30)

reported a prevalence of 9.2% for overweight and 7.2% were obese for children aged 8-11 years. In South Africa, Negash et al. (31) reported a prevalence of overweight/obesity of 22.9% among children aged 7-18 years.

It is to be noted that early adolescence has been described as the critical period for the development for adult obesity (32). Therefore, early intervention before this age is critical for both their future health and their ability to sustain long-term weight control (33).

Our study revealed that unhealthy dietary habits were frequently adopted by participant children. Fast foods, soft drinks and fatty foods were frequently consumed by some children. In addition, there was limited parental monitoring of the quantities of sweets and other unhealthy dietary habits consumed by their children. Most parents let their children eat anything they want, or give them food when they feel upset or bored even if they were not hungry.

Our study also revealed that physical activities of most children were limited. Most children go to school by car. Even when they walk, their usual walking pace is either slow or medium. Children also spend much time in sedentary entertainment activities, such as viewing TV, computers and video games.

A study found that Saudi children consumed fast foods and were not engaged in sporting activities as much as their American counterparts (34). Hence, these commonly adopted unhealthy lifestyle could be attributed to the fact that children start going to school at the age of 6 years, and hence, there is a less control on their eating habits and nutrition. Therefore, these unhealthy dietary habits can be considered as a contributing factor to the resulting high prevalence of childhood overweight/obesity in the present study.

The daily per capita fat consumption in Saudi Arabia has risen to 143% and a similar trend in the reduction of energy expenditure has been recorded. Food has become more affordable to most people because they are able to earn significantly higher wages. Moreover, there has been remarkable changes in dietary and lifestyle habits. There has been increased consumption of fast foods, soda beverages, and unhealthy snacks and carbonated drinks along with physical inactivity among children and adolescents in Saudi Arabia (35-36).

Swinburn et al. (37) emphasized that the modifiable lifestyle factors such as physical inactivity, dining out, and excessive intake of high-fat, dense-caloric foods, and refined carbohydrates are largely responsible for the global increased prevalence of obesity and related health risks. Excessive media exposure has been repeatedly linked to unhealthy life choices.

In Riyadh, Saudi Arabia, Aljassim and Jradi (38) noted that prolonged daily use of screens for more than two hours increased the risk of being overweight/obese among children. Barker et al. (35) reported that, on average, children in Saudi Arabia spend about 6 hours per day in

front of screens. Moreover, children who spend long hours using screens tend to snack while doing so, and eventually, gain weight because they increase their energy intake while seated for a long period of time. Therefore, parents should abide by the recommendations for screen time use among children and employ strict parenting control when it comes to the excessive use of screens (39).

Malik and Bakir (25) argued that, it seems that the lack of parental control over their children's food consumption patterns and physical activity is due to a widespread perception among parents that overweight is a sign of better health, high social status, beauty, and prosperity, in addition to an overwhelming aspiration to own TV, satellite dishes and cars; which are considered to be markers of financial progress. Al-Rukban (40) added that the lack of physical activity in Saudi Arabia can be attributed to the ability of adolescents to drive cars, which helps minimize physical activity and provides easy access to buy unhealthy diets and to spend less time eating at home, where meals would be more nutritional.

Al-Nozha et al. (41) stressed that it is difficult to reduce excessive weight once it becomes established. It is becoming a priority to establish preschool, school and adolescent health programs, with the emphasis on increasing physical education hours and consumption of healthy food, by incorporating health messages into the school curricula.

It is worth noting that significant time spent watching television or playing video games was associated with physical inactivity, which in turn is a major risk factor for being overweight or obese in all age group (42-43).

Controlling screen time use among children and encouraging active play is challenging in Riyadh, Saudi Arabia, due to limited access to neighborhood parks that are safe for children, and unfavorable weather conditions with excessive heat throughout most of the year. Children in Riyadh seek entertainment with electronic devices because they spend long hours indoors with their caregivers, and in private cars commuting to schools in a country with a male dependent driver system that lacks public transportation (44).

Recently, women were permitted to drive in Saudi Arabia. However, the practice of driving remains limited to very few women with jobs and from families that perceive it as culturally acceptable. Public health efforts should focus on planning for accessible indoor exercise facilities and on finding strategies that parents can apply in order to replace the frequent use of screen time. Parental perception about child weight status was significantly associated with child weight. These results are in accordance with findings from other studies (45).

The present study revealed that children's BMI grades did not differ significantly according to their sociodemographic factors or dietary habits, but differed significantly according to their duration of riding their bikes. However, most children go to school by car. Moreover, children's BMI

grades differed significantly according to their parents' educational level, with highest prevalence of obesity among less educated parents.

Pan et al. (46) noted that there is an association between childhood obesity and the environmental factors that may support cycling. A bikeable environment will encourage children and adolescents to conduct more physical activities, such as cycling (47), which would be an important contributor to reducing rates of childhood overweight and obesity, within a broader socio-ecological context (48).

Pont et al. (49) studied the associations between environmental factors and active transportation, finding that bike lane access may be associated with higher rates of active transportation among young people aged 5–18 years. In previous studies, bike lane was only discussed as a subgroup variable, but no studies specifically examined cycling behaviors directly in relation to cycling infrastructure (50).

European Studies showed that the risk of childhood obesity was significantly higher in children with lesser parental educational level (51). In Modena, Italy, Paduano et al. (27) reported that prevalence of overweight/obesity among primary school children was significantly lower in children born to parents with a high education. Moreover, Muthuri et al. (52) found a more positive influence of paternal rather than maternal higher education on lowered child overweight in higher economic status countries (i.e., Australia, Croatia, Germany, Italy, Mexico, and the USA).

Wolfson et al. (53) explained the favorable association between higher parental educational levels and the lower prevalence of their children's obesity by that parent education levels affect parents' ability to process health information, which leads to improved health-related decisions in parenting practice and which also affects their motivation to adopt a healthy lifestyle as role models for their children. Kant and Graubard (54) added that children of more educated parents are usually more likely to eat breakfast and consume fewer calories from snacks and sweetened beverages.

Our study revealed a high incorrect parental perception (56.3%) regarding their children's overweight or obesity. This finding was not surprising, since most of their judgments were based upon their children's body shape, and doctors were their main source of health information for only about two-fifths of parents. Nevertheless, parents' perception regarding their children's weight did not differ significantly according to parents' sociodemographic variables, health literacy, how they assess their children's weight, or their source of health information.

Similarly, in Riyadh, Aljassim and Jradi (38) found that 40.24% of parents had incorrect perception regarding their actual children's weight. Also in Abha City, Saudi Arabia, Al-Qahtani et al. (55) found that most parents did not know the ideal weight for their children, and 57.6% of the parents of overweight or obese children were unaware that their children were overweight, and parents depended

mainly on body shape for their perception of their child's weight. In Al-Qassim, Saudi Arabia, Al-Mohaimeed (56) reported that parents with overweight/obese children aged 6-10 years had significantly more misclassification regarding their children's weight than those with normal weight children, where 90% of parents of overweight children misclassified and reported that their children had normal weight, while 65% of parents of the obese children, misclassified the child's weight status.

Also in developed countries, parents incorrectly perceived their children's excess weight. Baughcum et al. (39) reported that only 20% of mothers in northern Kentucky, USA, correctly identified their overweight preschool children as overweight, while in UK, Carnell et al. (57) found that only 6% of parents correctly described their overweight children as "overweight." In Modena, Italy, Paduano et al. (27) reported that most parents (84.7%) of overweight/obese children underestimated their child's weight status. Childhood overweight/obesity was significantly associated with unhealthy lifestyles.

Several meta-analyses concluded that about 50% of parents underestimate their children's overweight/obese status (4; 58). Therefore, parental perception of a child's overweight status is essential for adhering to dietary and physical activity recommendations early in life.

Some explanations for such high rates of parental underestimates of overweight/obese children's weight have been posited. Campbell et al. (59) stated that popular media reports regarding childhood obesity often stereotype overweight children by showing images of severely obese children, a practice that may distort parents' understanding of what actually qualifies as overweight. Latner et al. (60) argued that most parents are usually resistant to labeling or stigmatizing their children. They may frequently think that their children's weights are ideal if their children's peers have body weights comparable to those of their children. Moreover, they may deny that their children are overweight because doing so would require that they recognize that they, too, may need to implement healthy lifestyle changes.

However, Jain et al. (61) considered that parents' underestimates may not be so intentional, as parents do not judge their child to be overweight if he/she engages in physical activity, is not teased about his/her size, and has no obviously threatening health problems. Moreover, most parents believe that their children will eventually "grow out" of the excess weight and that steady increases in height and weight indicate good parenting and healthy nutrition. Hence, it is important to emphasize that early intervention efforts to manage childhood obesity are unlikely to be successful if parents are unaware or unconcerned about their children's real weight status.

The present study showed that parents' sources of information about their children's ideal weight differed significantly with their educational levels, with books and magazines being the main sources for knowledge among highly educated parents. Therefore, it is a pressing

necessity to develop new culturally sensitive models for referring to the child's weight status in our community. Moreover, we need to start campaigns to raise the awareness of parents about ideal weight and the risks of obesity and its prevention among their children.

Strengths and Limitations

This study addressed several aspects of an important health topic in the Saudi community, i.e., childhood obesity. However, there are some limitations that should be admitted. This study followed a cross-sectional design, which is good for hypothesis generation, rather than hypothesis testing, thus making it difficult to prove causation. Moreover, the generalization of results should be taken cautiously, since it targeted parents attending urban PHCCs in Yanbu Albahr City.

Conclusion

Based on findings of this study, it can be concluded that prevalence of obesity among primary school children in Yanbu Albahr City, Saudi Arabia is quite high. Unhealthy dietary habits (e.g., fast foods, sweets, fatty foods and soft drinks), and physical inactivity (prolonged screen times, slow-to-moderate walking pace and going to school by car) are common among Saudi primary school children. Parents' health literacy regarding childhood obesity is generally lacking, and most parents misperceive their children's actual body weight. Children's BMI grades did not differ significantly according to their sociodemographic factors or dietary habits, but differed significantly according to their duration of riding their bikes. Moreover, children's BMI grades differed significantly according to their parents' educational level, with highest prevalence of obesity among less educated parents.

Recommendations

It is necessary to develop new culturally sensitive models for referring to the child's weight status, and to raise parents' awareness regarding the ideal weight and the risks of obesity and its prevention among their children.

References

- World Health Organization Obesity and overweight 2018, feb 16 [Available from: <https://www.who.int/en/news-room/fact-sheets/detail/obesity-and-overweight>.
- CDC. Centers for Disease Control and Prevention Defining Childhood Obesity 2018, July 3 [Available from: <https://www.cdc.gov/obesity/childhood/defining.html>.
- Renew Bariatrics Report: Obesity Rates by Country – 2017 2019, jul 27 [Available from: <https://renewbariatrics.com/obesity-rank-by-countries/>.
- Lundahl A, Kidwell KM, Nelson TD. Parental underestimates of child weight: a meta-analysis. *Pediatrics*. 2014;133(3):e689-e703.
- Al Shehri A, Al Fattani A, Al Alwan I. Obesity among Saudi children. *Saudi Journal of Obesity*. 2013;1(1):3.
- Parry LL, Netuveli G, Parry J, Saxena S. A systematic review of parental perception of overweight status in children. *The Journal of ambulatory care management*. 2008;31(3):253-68.
- Doolen J, Alpert PT, Miller SK. Parental disconnect between perceived and actual weight status of children: a metasynthesis of the current research. *Journal of the American Academy of Nurse Practitioners*. 2009;21(3):160-6.
- Garrett-Wright D. Parental perception of preschool child body weight. *Journal of pediatric nursing*. 2011;26(5):435-45.
- Hearst MO, Sherwood NE, Klein EG, Pasch KE, Lytle LA. Parental perceptions of their adolescent's weight status: the ECHO study. *American journal of health behavior*. 2011;35(2):248-55.
- Dahiru T, Aliyu A, Kene TS. Statistics in Medical Research: Misuse of Sampling and Sample Size Determination. *Annals of African Medicine* 2006; 5(3):158–61.
- Abdalla SM, Alsaif BA, Al Jasser SJ, Al Sultan AS. Prevalence of Obesity and overweight among Primary School Children, in Majmaah Saudi Arabia. *Majmaah Journal of Health Sciences* 2017; 5(1): 30-40.
- World Health Organization Global Strategy on Diet, Physical Activity and Health 2020, Feb 5 [Available from: <https://www.who.int/dietphysicalactivity/childhood/en/>.
- Al-Qerem WA, Ling J, AlBawab AQ. Validation of the comprehensive feeding practice questionnaire among school aged children in Jordan: a factor analysis study. *International Journal of Behavioral Nutrition and Physical Activity*. 2017;14(1):23.
- Al-Muhaimeed AA, Dandash K, Ismail MS, Saqib N. Prevalence and correlates of overweight status among Saudi school children. *Annals of Saudi medicine*. 2015;35(4):275-81.
- Wake M, Salmon L, Waters E, Wright M, Hesketh K. Parent-reported health status of overweight and obese Australian primary school children: a cross-sectional population survey. *International journal of obesity*. 2002;26(5):717-24.
- He M, Evans A. Are parents aware that their children are overweight or obese?: Do they care? *Canadian family physician*. 2007;53(9):1493-9.
- Eckstein KC, Mikhail LM, Ariza AJ, Thomson JS, Millard SC, Binns HJ. Parents' perceptions of their child's weight and health. *Pediatrics*. 2006;117(3): 681-90.
- Ashraf H, Shamsi NI, Ashraf R. Parental perception and childhood obesity: Contributors to incorrect perception. *Journal of the Pakistan Medical Association*. 2017; 67(2):214.
- Daniels SR, Arnett DK, Eckel RH, Gidding SS, Hayman LL, Kumanika S, et al. Overweight in children and adolescents: pathophysiology, consequences, prevention, and treatment. *Circulation*, 2005, 19, 111(15):1999–2012.
- Al Shaikh A, Farahat F, Abaalkhail B, Kaddam I, Aseri K, Al Saleh Y, et al. Prevalence of Obesity and Overweight among School-Aged Children in Saudi Arabia and Its Association with Vitamin D Status. *Acta Biomed* 2020; 91(4): e20201333.

22. El Mouzan MI, Foster PJ, Al Herbish AS, Al Salloum AA, Al Omer AA, Qurachi MM, Kecojevic T. Prevalence of overweight and obesity in Saudi children and adolescents. *Ann Saudi Med* 2010; 30(3): 203-208.
23. Al-Dossary SS, Sarkis PE, Hassan A, Ezz El Regal M, Fouda AE. Obesity in Saudi children: A dangerous reality. *East Mediterr Health J* 2010; 16:1003-8.
24. AlGhamdi RA. Prevalence of Childhood Obesity among Primary School Students at Taif Governorate, Saudi Arabia. *Journal of Advances in Medicine and Medical Research*. 2019:1-21.
25. Malik M, Bakir A. Prevalence of overweight and obesity among children in the United Arab Emirates. *obesity reviews* 2007; 8:15-20.
26. Ogden CL, Carroll MD, Flegal KM. High body mass index for age among US children and adolescents 2003-2006. *JAMA*. 2008; 299:2401-5
27. Paduano S, Borsari L, Salvia C, Arletti S, Tripodi A, Pinca J, et al. Risk Factors for Overweight and Obesity in Children Attending the First Year of Primary Schools in Modena, Italy. *Journal of community health*. 2019:1-9.
28. Gautam S, Jeong HS. Childhood Obesity and Its Associated Factors among School Children in Udipi, Karnataka, India. *J Lifestyle Med*. 2019; 9:27-35.
29. Karki A, Shrestha A, Subedi N. Prevalence and associated factors of childhood overweight/obesity among primary school children in urban Nepal. *BMC Public Health* 2019; 19:1055.
30. Adom T, Kengne AP, De Villiers A, Puoane T. Association between school-level attributes and weight status of Ghanaian primary school children. *BMC Public Health*. 2019;19(1):577.
31. Negash S, Agyemang C, Matsha TE, Peer N, Erasmus RT, Kengne AP. Differential prevalence and associations of overweight and obesity by gender and population group among school learners in South Africa: a cross-sectional study. *BMC Obes* 2017; 4:29.
32. Steinbeck K. Childhood obesity. Treatment options. *Best Practice and Research Clinical Endocrinology and Metabolism* 2005; 19:455-469.
33. Baker S, Barlow S, Cochran W, Fuchs G, Klish W, Krebs N, et al. Overweight children and adolescents: a clinical report of the North American Society for Pediatric Gastroenterology, Hepatology and Nutrition. *Journal of Pediatric Gastroenterology and Nutrition*, 2005; 40:533-543.
34. Liu G. In the neighborhood: connecting plant biomass and childhood obesity. *Contemporary Pediatrics*, 2005, (May):14.
35. Al-Othaimeen AI, Al-Nozha M, Osman AK. Obesity: An emerging problem in Saudi Arabia. Analysis of data from National Nutritional Survey. *East Mediterr Health J* 2007; 13:441-7.
36. Aliss EM, Sutaih RH, Kamfar HZ, Alagha AE, Marzouki ZM. Physical activity pattern and its relationship with overweight and obesity in Saudi children. *International Journal of Pediatrics and Adolescent Medicine* 2020; 7:181-185.
37. Swinburn BA, Jolley D, Kremer PJ. Estimating the effects of energy imbalance on changes in body weight in children. *Am J Clin Nutr* 2006; 83:859e63.
38. Aljassim H, Jradi H. Childhood overweight and obesity among the Saudi population: a case-control study among school children. *Journal of Health, Population and Nutrition* 2021; 40:15.
39. Baughcum AE, Chamberlin LA, Deeks CM, Powers SW, Whitaker RC. Maternal perceptions of overweight preschool children. *Pediatrics*. 2000; 106(6):1380-6.
40. Al-Rukban MO. Obesity among Saudi male adolescents in Riyadh, Saudi Arabia. *Saudi Medical Journal*, 2003, 24:27-33.
41. Al-Nozha MM, Al-Mazrou YY, Al-Maatouq MA, Arafah MR, Khalil MZ, Khan NB, et al. Obesity in Saudi Arabia. *Saudi Medical Journal*, 2005, 26:824-829.
42. Tambalis KD, Panagiotakos DB, Psarra G, Sidossis LS. Concomitant associations between lifestyle characteristics and physical activity status in children and adolescents. *J Res Health Sci*. 2019; 19(1):e00439.
43. Ensenyat A, Serra-Paya N, Sagarra-Romero L. Objectively measured sedentary behaviour in overweight and obese prepubertal children: challenging the school. *International journal of environmental health research*. 2020;30(5):533-44.
44. Al-Hazzaa HM. Physical inactivity in Saudi Arabia revisited: a systematic review of inactivity prevalence and perceived barriers to active living. *Int J Health Sci (Qassim)*. 2018;12(6):50-64.
45. Tchicaya A. Relationship between children's body mass index and parent's obesity and socioeconomic status. *Scientific Res*. 2014; 6:2322-32.
46. Pan X, Zhao L, Luo J, Li Y, Zhang L, Wu T, et al. Access to bike lanes and childhood obesity: A systematic review and meta-analysis. *Obesity Reviews*.2021;22(S1): e13042.
47. de Vries SI, Bakker I, van Mechelen W, Hopman-Rock M. Determinants of activity-friendly neighborhoods for children: results from the SPACE study. *Am J Health Promot*. 2007; 21(4 Suppl): 312-316.
48. Gascon M, Vrijheid M, Nieuwenhuijsen MJ. The built environment and child health: an overview of current evidence. *Current Environmental Health Reports*. 2016;3(3):250-257.
49. Pont K, Ziviani J, Wadley D, Bennett S, Abbott R. Environmental correlates of children's active transportation: a systematic literature review. *Health Place*. 2009;15(3):827-840.
50. Fraser SD, Lock K. Cycling for transport and public health: a systematic review of the effect of the environment on cycling. *Eur J Public Health*. 2011;21(6):738-743.
51. El-Enazy WH, Al-Dahi SK, Al-Hariri IM. Prevalence of overweight and obesity among Saudi primary school students in Tabuk, Saudi Arabia. *Saudi Journal of Obesity* 2014; 2(1):13-18.
52. Muthuri SK, Onywera VO, Tremblay MS, Broyles ST, Chaput J-P, Fogelholm M, et al. Relationships between Parental Education and Overweight with Childhood Overweight and Physical Activity in 9-11 Year Old Children: Results from a 12-Country Study. *PLoS One* 2016;11(8): e0147746.
53. Wolfson JA, Gollust SE, Niederdeppe J, Barry CL. The role of parents in public views of strategies to address childhood obesity in the United States. *Milbank Q*. 2015; 93:73-111.

54. Kant AK, Graubard BI. Family income and education were related with 30-year time trends in dietary and meal behaviors of American children and adolescents. *J. Nutr.* 2013; 143:690–700.
55. Al-Qahtani SM, Alsultan BS, Awdah NA, Alshehri MA, Alqahtani AS, Al Assiri KM, et al. Parental perception and knowledge about ideal weight among preschool-aged children in Abha city, southwestern Saudi Arabia. *Saudi Journal of Obesity.* 2017;5(2):85.
56. Al-Mohaimeed AA. Parents' perception of children's obesity, in Al-Qassim, Saudi Arabia. *Journal of family & community medicine.* 2016;23(3):179.
57. Carnell S, Edwards C, Croker H, Boniface D, Wardle J. Parental perceptions of overweight in 3–5 year olds. *International Journal of Obesity.* 2005; 29: 353-355.
58. Alhraiwil NJ, Jradi H. Parental perception and attitude toward their children's weight status in Riyadh, Saudi Arabia. *Eur J Public Health.* 2016; 26(suppl_1): ckw171.020. <https://doi.org/10.1093/eurpub/ckw171.020>.
59. Campbell MW, Williams J, Hampton A, Wake M. Maternal concern and perceptions of overweight in Australian preschool-aged children. *Med J Aust* 2006; 184:274–277.
60. Latner JD, Stunkard A J, Wilson TG. Stigmatized students: Age, sex, and ethnicity effects in the stigmatization of obesity. *Obesity Research* 2005; 13:1226–1231.
61. Jain A, Sherman SN, Chamberlin LA, Carter Y, Powers SW, Whitaker RC. Why don't low-income mothers worry about their preschoolers being overweight? *Pediatrics* 2001; 107:1138–1146.