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PARENTAL PERCEPTION OF CHILDREN'S WEIGHT STATUS: THE ROLE OF CONTEXTUAL FACTORS

A.O. ARTIGO ORIGINAL

A PERCEÇÃO DOS PAIS SOBRE O PESO DAS CRIANÇAS: O PAPEL DE FATORES CONTEXTUAIS

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ABSTRACT

INTRODUCTION: When parents are unable to accurately perceive their child's weight status, they may fail to recognise the need to adopt healthy behaviours, leading to an increased risk of obesity.

OBJECTIVES: The present study aimed to investigate which children, parental and context characteristics are associated with parental misperception of their child's weight status.

METHODOLOGY: This cross-sectional study used data from the second round of the Nutritional Status and Physical Activity Monitoring System conducted by *Câmara Municipal do Porto* in 2019/2020, with a final sample of 700 children. Parental perception of their child's weight was assessed using a three-option question (underweight, normal weight, overweight) and compared to the child's actual weight. Parental perception was considered incorrect, if parents' perception regarding child's weight was not the same as the child's BMI-based weight. A multinomial logistic regression model was used to estimate the association between individual, family and contextual variables and parental perception of child's weight status through odds ratio (OR) and 95% confidence intervals (CI).

RESULTS: About 39.0% of parents incorrectly perceived their child's weight, and 76.9% of parents of children with overweight perceived them as having normal weight. When adjusted for children's sex and sports practice, parent's education and income level and community areas, parents with basic/secondary education (vs. university) were more likely to underestimate overweight in their child (OR= 1.56; 95% CI 1.05-2.30), and parents whose income was insufficient were more likely to underestimate normal weight (OR= 4.32; 95% CI 1.95-9.59).

CONCLUSIONS: Parental misperception of their child's weight status was associated with children's body mass index, parental education level and family income. Addressing this issue alongside these populations at a higher risk of misperception may contribute to the prevention and management of childhood obesity.

KEYWORDS

Paediatric Obesity, Parents, Risk Factors, Weight Perception

RESUMO

INTRODUÇÃO: A não identificação correta do peso das crianças por parte dos pais pode levar a não reconhecer a necessidade de adotar hábitos alimentares saudáveis, conduzindo a um maior risco de obesidade.

OBJETIVOS: O presente estudo teve como objetivo identificar quais as características individuais, familiares e contextuais que se associam à perceção errónea dos pais sobre o peso das crianças.

METODOLOGIA: Este estudo transversal utilizou dados da 2.ª Ronda do Sistema de Monitorização do Estado Nutricional Infantil e de Atividade Física, conduzido pela Câmara Municipal do Porto no ano letivo de 2019/2020, com uma amostra final de 700 crianças. A perceção dos pais sobre o peso das crianças foi recolhida através de uma questão de escolha múltipla (baixo peso, peso normal, excesso de peso) e comparada com o peso real das crianças. A perceção foi considerada incorreta quando a perceção dos pais não correspondeu ao peso real da criança. Um modelo de regressão multinomial foi utilizado para estimar a associação das variáveis individuais, familiares e contextuais com a perceção dos pais, através de *odds ratio* (OR) e intervalos de confiança (IC) a 95%.

RESULTADOS: Cerca de 39,0% dos pais categorizaram incorretamente o peso da sua criança; entre os pais de crianças com excesso de peso, 76,9% percecionaram-nas com peso normal. Após ajuste para o sexo e a prática desportiva das crianças, o nível de escolaridade e rendimento dos pais e as freguesias, os pais com ensino básico/secundário (*vs.* universitário) tiveram maior probabilidade de subestimar o peso da criança (OR= 1,56; IC 95% 1,05-2,30), e os pais com rendimento insuficiente maior probabilidade de subestimar o peso normal (OR= 4,32; IC 95% 1,95-9,59).

CONCLUSÕES: A perceção equivocada dos pais associou-se com a categoria de peso da criança e com o nível de escolaridade e rendimento dos pais. Abordar este problema junto das populações com um maior risco de percecionar de forma errónea o peso das crianças pode contribuir para prevenir a obesidade infantil.

PALAVRAS-CHAVE

Obesidade Infantil, Pais, Fatores de Risco, Perceção de Peso

INTRODUCTION

Childhood obesity is an important global public health issue, with around 31.9% of Portuguese children with overweight (OW), according to the Childhood Obesity Surveillance Initiative 2022 (1). Given the strong tracking of childhood obesity into adulthood, preventing OW and obesity at the earliest possible stage of life is essential to protect the well-being and health of younger generations (2, 3). Parental recognition of children's excessive weight is determinant for early prevention, as children's physical activity and eating habits are heavily shaped by parental practices (4). When parents are unable to accurately perceive their child's weight status and potential health risks, they may fail to recognise the need to adopt healthy behaviours, leading to an increased risk of obesity (5-7).

As studied in previous research, parental misperception of children's weight status was associated with children's body mass index (BMI), age and gender, as well as parent's BMI, education and income levels (8). In fact, most of the determinants studied are based on individual or family factors, with only a few studies having investigated its association with the prevalence of OW in peers (9), family residence area (7, 10) or school location (11). However, to our knowledge, no study has examined how individual, family, and broader community-level factors jointly relate to parental misperception of children's weight status, particularly in the Portuguese context. Understanding these combined influences is essential to effectively improve parental perception of children's weight status and develop community-tailored weight misperception and childhood obesity prevention strategies. We hypothesised that individual, family and community-level factors would jointly contribute to parental misperception of children's weight status, with community areas of higher socioeconomic vulnerability and OW prevalence associated with greater misperception.

OBJECTIVES

The aim of this study was to identify the characteristics associated with parental misperception of their child's weight status. Specifically, it aims: 1) to describe the prevalence of parental misperception, according to the child's weight category; and 2) to examine the association of individual (child's sex, sports practice), family (parental education and income), and contextual characteristics (community area) with parental misperception.

METHODS

This cross-sectional study used data from the second round of the Children's Nutritional Status and Physical Activity Monitoring System (SMENIAF) conducted by *Câmara Municipal do Porto* in 2019/2020 (12). Primary schools' sample was based on the following criteria: [1] at least one school per group of schools, [2] at least one school per community area, [3] in the event of a tie, the school with the highest number of students and [4] maximum of three schools per community area. Overall, 16 of the 46 primary schools in the municipality (34.8%) were recruited, covering all seven community areas, with between one and three schools selected per area. In each school, random sampling was used to select a class from each 1st, 2nd and 4th year class. Exclusion criteria were the following: [1] age over 11.5 years and [2] having any condition preventing anthropometric assessment. The informed consent of parents was obtained prior to the assessment, along with the assent of the child at the time of the evaluation.

Of 1074 eligible primary school children, 795 children participated in the study, with a proportion of participation ranging from 61.5% to 100% in schools, but only 718 children had the families' questionnaire answered. For the present study, only the questionnaires answered by the parents themselves (the mother or the father) were considered, resulting in a final sample of 700 children.

Information was obtained through two questionnaires: [1] children's questionnaire — administered by investigators, included children's anthropometric measures (weight, height and waist circumference) and eating habits; and [2] families' questionnaire — completed by the child's guardian, with questions related to socio-demographic data, child's sports practice and parents' perception on child's weight (with a three-option question: underweight, normal weight, OW). Trained professionals collected anthropometric measurements, according to World Health Organization (WHO) standardised protocol. BMI was calculated using weight(kg)/height(m)^2 formula and classified according to the sex and age-specific WHO cut-off points for BMI (13).

Given that the parental perception question did not distinguish pre-obesity from obesity, children's objectively measured weight status (underweight, normal weight, pre-obesity, obesity) was recoded for comparison purposes, combining pre-obesity and obesity into a single OW category. Parental perception was considered a) correct, if parents' perception regarding child's weight was the same as the child's BMI-based category (underweight, normal weight, or pre-obesity/obesity); b) underestimation of OW, if parents perceived a child with OW or obesity as having normal weight; c) underestimation of normal weight, if parents perceived a child with normal weight as underweight; or d) overestimation, if the perceived weight category was higher than child's actual weight category.

Porto is administratively divided into two macro-regions comprising seven parish unions (freguesias), to which schools were assigned according to their geographic location (community areas). To contextualise these areas, parish-level indicators from the 2021 National Census (Statistics Portugal), namely the unemployment rate and the proportion of residents with completed higher education, were retrieved and are used descriptively in the discussion.

Statistical Analysis

Descriptive analyses were conducted to describe the characteristics of the 700 children and their parents, according to school community area. Continuous variables were presented as median and interquartile range (IQR), while categorical variables were described as absolute (n) and relative frequencies (%). Associations between categorical variables were tested using the Chi-Square test. Weighted kappa was calculated to measure the agreement between parental weight perception and child's BMI-based weight status. Given that misperception categories reflect distinct types of misclassification rather than an ordered severity scale, the association between the different characteristics and misclassification of parent's perceived weight status was estimated through odds ratio (OR) and 95% confidence intervals (CI) using a multinomial logistic regression model, using the category of correct perception as the reference category for the outcome variable. The adjusted model included the variables: children's sex and sports practice, parental education level and income, and community areas. As a sensitivity analysis, the adjusted model was re-estimated excluding community area, to assess the stability of the associations for children's and parental characteristics, and the estimates did not materially change. Multicollinearity was assessed using variance inflation factors (VIF) and no multicollinearity was detected among the predictors (all VIF ≤ 1.16). Data was analysed using IBM SPSS Statistics version 29, and the significance level was set at 0.05.

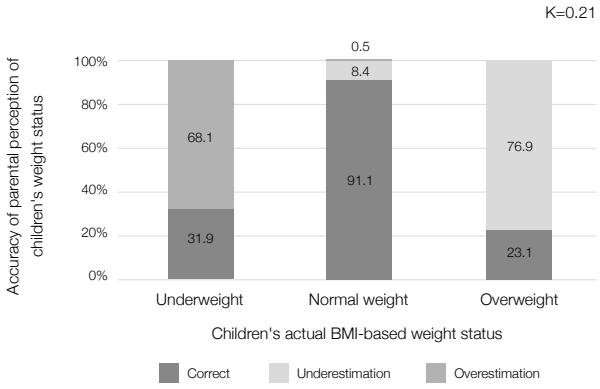
RESULTS

The characteristics of the children and their parents are described in Table 1. The prevalence of underweight, normal weight, pre-obesity and obesity were 6.8%, 55.0%, 19.4% and 18.9%, respectively. Although differences in children's BMI categories across community areas were not statistically significant, União de Freguesias (UF) Lordelo do Ouro and Massarelos (56.5%) and Bonfim (43.1%) had the highest combined prevalence of pre-obesity and obesity, while UF Aldoar, Foz do Douro and Nevogilde (UF AFDN) had the lowest (30.8%). UF AFDN also had the highest proportion of parents with a university degree (61.1%) and of families with very/totally sufficient income to cover necessities (32.6%), contrasting with Bonfim, which had the lowest proportion of both.

There was a fair agreement between parents' perception and the actual weight status of their child (K=0.218, p<0.001), with 76.9% of parents misperceiving their child with OW as having normal weight (Figure 1). Parental perception of children's weight status regarding children and parental characteristics is presented in Table 2. Incorrect parental perception, predominantly underestimation, was higher in children with OW (p<0.001), in parents that reported a lower family income to cover necessities (p<0.001), and in parents with a lower education level, despite not showing significant differences (p=0.226). Among children with OW, the proportion whose parents underestimated their weight ranged from 69.2% (UF Lordelo do Ouro and Massarelos) to 85.7% (UF AFDN).

Figure 1

Parental perception of children's weight status in comparison with children's actual weight status



BMI: Body Mass Index

Table 1

Children and parental characteristics, by school community area

		OVERALL n=700	UF ALDOAR, FOZ DO DOURO AND NEVOGILDE n=91	BONFIM n=44	CAMPANHÃ n=106	PARANHOS n=143	UF CEDOFEITA, ST. ILDEFONSO, SÉ n=126	UF LORDELO DO OURO AND MASSARELOS n=69	RAMALDE n=121	p-VALUE
CHILDREN CHARACTERISTICS										
Sex, n (%)	Female	349 (49.9)	38 (41.8)	18 (40.9)	55 (51.9)	71 (49.7)	71 (56.3)	40 (58.0)	56 (46.3)	0.202
	Male	351 (50.1)	53 (58.2)	26 (59.1)	51 (48.1)	72 (50.3)	55 (43.7)	29 (42.0)	65 (53.7)	
Age, n (%)	6-8 years old	498 (71.1)	63 (69.2)	35 (79.5)	80 (75.5)	99 (69.2)	91 (72.2)	39 (56.5)	91 (75.2)	0.085
	9-11 years old	202 (28.9)	28 (30.8)	9 (20.5)	26 (24.5)	44 (30.8)	35 (27.8)	30 (43.5)	30 (24.8)	
Anthropometric measures, median (IQR)	Weight (kg)	26.4 (9.6)	26.0 (8.6)	25.1 (7.8)	26.3 (10.0)	26.7 (9.7)	26.1 (9.7)	30.1 (14.2)	25.7 (8.6)	
	Height (cm)	125.9(13.3)	125.6(13.6)	125.0 (9.1)	126.0 (12.4)	126.0 (12.5)	126.1 (13.7)	127.7 (16.3)	125.0 (11.7)	
	BMI (kg/m^2)	16.6 (3.3)	16.1 (3.1)	16.5 (3.3)	16.7 (3.0)	16.7 (3.3)	16.6 (3.2)	18.0 (5.4)	16.4 (3.1)	
BMI categories, n (%)	Underweight	47 (6.8)	9 (9.9)	4 (9.1)	7 (6.6)	8 (5.6)	5 (4.0)	4 (5.7)	10 (8.2)	0.120
	Normal weight	385 (55.0)	54 (59.3)	21 (47.7)	61 (57.5)	81 (56.6)	71 (56.3)	26 (37.7)	71 (58.7)	
	Pre-obesity	136 (19.4)	18 (19.8)	13 (29.5)	18 (17.0)	23 (16.1)	23 (18.3)	18 (26.1)	23 (19.0)	
	Obesity	132 (18.9)	10 (11.0)	6 (13.6)	20 (18.9)	31 (21.7)	27 (21.4)	21 (30.4)	17 (14.0)	
Sports practice, n (%) [missing=7]	Yes	391 (56.4)	58 (63.7)	17 (39.5)	56 (52.8)	89 (62.7)	70 (56.5)	28 (41.8)	73 (60.8)	0.011
	No	302 (43.6)	33 (36.3)	26 (60.5)	50 (47.2)	53 (37.3)	54 (43.5)	39 (58.2)	47 (39.2)	
PARENTAL CHARACTERISTICS										
Education level, n (%) [missing=13]	Primary	48 (7.0)	5 (5.6)	2 (4.8)	8 (7.8)	4 (2.8)	13 (10.5)	6 (9.0)	10 (8.3)	<0.001
	Basic/ Secondary	340 (49.5)	30 (33.3)	28 (66.7)	55 (53.9)	69 (48.9)	73 (58.9)	36 (53.7)	49 (40.5)	
	University degree	299 (43.5)	55 (61.1)	12 (28.6)	39 (38.2)	68 (48.2)	38 (30.6)	25 (37.3)	62 (51.2)	
Employment status, n (%) [missing=12]	Working	563 (81.8)	74 (82.2)	39 (90.7)	83 (78.3)	124 (87.9)	101 (82.8)	47 (70.1)	95 (79.8)	0.099
	Not working	116 (16.9)	16 (17.8)	4 (9.3)	20 (18.9)	17 (12.1)	20 (16.4)	18 (26.9)	21 (17.6)	
	Other	9 (1.3)	0	0	3 (2.8)	0	1 (0.8)	2 (3.0)	3 (2.5)	
Income to cover necessities, n (%) [missing=12]	Very/totally insufficient	26 (3.8)	1 (1.1)	4 (9.1)	4 (3.8)	7 (5.0)	4 (3.2)	1 (1.5)	4 (4.3)	0.021
	Insufficient	109 (15.8)	10 (11.2)	11 (25.0)	15 (14.3)	18 (12.9)	27 (21.4)	9 (13.4)	19 (16.2)	
	Sufficient	407 (59.2)	49 (55.1)	25 (56.8)	61 (58.1)	84 (60.0)	82 (65.1)	42 (62.7)	64 (54.7)	
	Very/totally sufficient	146 (21.2)	29 (32.6)	4 (9.1)	25 (23.8)	31 (22.1)	13 (10.3)	15 (22.3)	29 (24.8)	
Perception of child's weight, n (%) [missing=4]	Underweight	48 (6.9)	5 (5.5)	2 (4.7)	3 (2.8)	10 (7.0)	12 (9.6)	4 (5.8)	12 (10.0)	0.188
	Normal weight	585 (84.1)	82 (90.1)	37 (86.0)	95 (89.6)	121 (85.2)	101 (80.8)	53 (76.8)	96 (80.0)	
	Overweight	63 (9.1)	4 (4.4)	4 (9.3)	8 (7.5)	11 (7.7)	12 (9.6)	12 (17.4)	12 (10.0)	

BMI: Body Mass Index
IQR: Interquartile Range
UF: União de Freguesias

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Table 2

Association between child's, family and context characteristics and parental perception of children's weight status

			n (%)				p-VALUE
			CORRECT	UNDERESTIMATION		OVERESTIMATION	
				OVERWEIGHT	NORMAL WEIGHT		
	Overall		424 (60.9)	206 (29.6)	33 (4.7)	33 (4.7)	
CHILDREN CHARACTERISTICS	Sex	Female	214 (61.5)	101 (29.0)	16 (4.6)	17 (4.9)	0.981
		Male	210 (60.3)	105 (30.2)	17 (4.9)	16 (4.6)	
	Age	6-8 years old	302 (61.0)	140 (28.3)	25 (5.1)	28 (5.7)	0.224
		9-11 years old	122 (60.7)	66 (32.8)	8 (4.0)	5 (2.5)	
	BMI categories	Underweight	15 (31.9)	0	0	32 (68.1)	<0.001
		Normal weight	347 (91.1)	0	33 (8.7)	1 (0.3)	
		Pre-obesity	9 (6.6)	127 (93.4)	0	0	
		Obesity	53 (40.2)	79 (59.8)	0	0	
	Sports practice	Yes	243 (62.6)	108 (27.8)	16 (4.1)	21 (5.4)	0.432
		No	177 (58.8)	95 (31.6)	17 (5.6)	12 (4.0)	
PARENTAL CHARACTERISTICS	Education level	Primary	28 (58.3)	14 (29.2)	3 (6.3)	3 (6.3)	0.226
		Basic/Secondary	193 (56.9)	116 (34.2)	15 (4.4)	15 (4.4)	
		University degree	196 (66.0)	72 (24.2)	15 (5.1)	14 (4.7)	
	Employment status	Working	345 (61.6)	162 (28.9)	26 (4.6)	27 (4.8)	0.902
		Not working	67 (57.8)	37 (31.9)	6 (5.2)	6 (5.2)	
		Other	5 (55.6)	4 (44.4)	0	0	
	Income to cover necessities	Very/totally insufficient	16 (61.5)	9 (34.6)	0	1 (3.8)	<0.001
		Insufficient	52 (48.6)	34 (31.8)	15 (14.0)	6 (5.6)	
		Sufficient	257 (63.1)	122 (30.0)	12 (2.9)	16 (3.9)	
		Very/totally sufficient	93 (64.6)	36 (25.0)	6 (4.2)	9 (6.3)	
CONTEXT CHARACTERISTICS	School city location	Western region	247 (61.0)	118 (29.1)	22 (5.4)	18 (4.4)	0.747
		Eastern region	177 (60.8)	88 (30.2)	11 (3.8)	15 (5.2)	
	School community area	UF AFDN	57 (62.6)	24 (26.4)	3 (3.3)	7 (7.7)	0.404
		Bonfim	22 (51.2)	15 (34.9)	2 (4.7)	4 (9.3)	
		Campanhã	68 (64.2)	30 (28.3)	2 (4.7)	6 (5.7)	
		Paranhos	87 (61.3)	43 (30.3)	7 (4.9)	5 (3.5)	
		UF Cedofeita, St. Ildefonso, Sé	72 (57.6)	38 (30.4)	11 (8.8)	4 (3.2)	
		UF Lordelo do Ouro and Massarelos	38 (55.1)	27 (39.1)	2 (2.9)	2 (2.9)	
		Ramalde	80 (66.7)	29 (24.2)	6 (5.0)	5 (4.2)	

BMI: Body Mass Index
UF: União de Freguesias

Table 3

Multinomial logistic regression model for the association of children, parental and context characteristics with parental misperception of children's weight

	OR (95% CI)					
	CRUDE			ADJUSTED*		
	PARENTAL UNDERESTIMATION		PARENTAL OVERESTIMATION	PARENTAL UNDERESTIMATION		PARENTAL OVERESTIMATION
	OW	NORMAL WEIGHT		OW	NORMAL WEIGHT	
CHILDREN CHARACTERISTICS						
Sex						
Female	0.94 (0.68-1.32)	0.92 (0.45-1.88)	1.04 (0.51-2.12)	0.88 (0.62-1.25)	0.83 (0.40-1.72)	1.31 (0.62-2.79)
Male	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Sports practice						
No	1.20 (0.86-1.69)	1.46 (0.73-2.97)	0.78 (0.38-1.64)	1.00 (0.69-1.46)	1.30 (0.59-2.89)	0.64 (0.28-1.49)
Yes	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
PARENTAL CHARACTERISTICS						
Education level						
Primary	1.36 (0.68-2.73)	1.40 (0.38-5.14)	1.50 (0.40-5.55)	1.16 (0.54-2.49)	0.80 (0.20-3.26)	1.30 (0.26-6.60)
Basic/Secondary	**1.64 (1.15-2.33)**	1.02 (0.48-2.13)	1.09 (0.51-2.31)	**1.56 (1.05-2.30)**	0.60 (0.26-1.38)	1.28 (0.55-2.95)
University degree	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Income						
Insufficient	1.40 (0.91-2.14)	**4.29 (2.06-8.93)**	1.44 (0.60-3.47)	1.20 (0.76-1.89)	**4.32 (1.95-9.59)**	1.18 (0.44-3.18)
Sufficient	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.

Table 3

Multinomial logistic regression model for the association of children, parental and context characteristics with parental misperception of children's weight (continuation)

	OR (95% CI)					
	CRUDE			ADJUSTED*		
	PARENTAL UNDERESTIMATION		PARENTAL OVERESTIMATION	PARENTAL UNDERESTIMATION		PARENTAL OVERESTIMATION
	OW	NORMAL WEIGHT		OW	NORMAL WEIGHT	
CONTEXT CHARACTERISTICS						
Community area						
UF Aldoar, Foz do Douro and Nevogilde	1.16 (0.61-2.20)	0.70 (0.17-2.92)	1.96 (0.59-6.50)	1.19 (0.61-2.31)	0.79 (0.19-3.38)	2.51 (0.70-9.07)
Bonfim	1.88 (0.86-4.11)	1.21 (0.23-6.43)	2.91 (0.72-11.76)	2.02 (0.89-4.57)	1.14 (0.21-6.30)	4.24 (0.95-18.94)
Campanhã	1.22 (0.66-2.23)	0.39 (0.08-2.01)	1.41 (0.41-4.83)	1.11 (0.59-2.10)	0.43 (0.08-2.25)	1.44 (0.37-5.61)
Paranhos	1.36 (0.78-2.39)	1.07 (0.35-3.33)	0.92 (0.26-3.29)	1.39 (0.78-2.48)	1.17 (0.37-3.71)	1.13 (0.29-4.38)
UF Cedofeita, St. Ildefonso, Sé	1.46 (0.83-2.60)	2.04 (0.72-5.79)	0.89 (0.23-3.44)	1.51 (0.83-2.75)	2.25 (0.77-6.61)	1.06 (0.25-4.48)
UF Lordelo do Ouro and Massarelos	1.96 (1.02-3.76)	0.70 (0.13-3.63)	0.84 (0.16-4.54)	1.90 (0.96-3.79)	0.83 (0.16-4.45)	1.10 (0.19-6.40)
Ramalde	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.

* Estimates were adjusted for all variables in the table.
CI: Confidence Interval
OR: Odds Ratio
OW: Overweight
UF: União de Freguesias

Factors associated with parental misperception of children's weight are presented in Table 3. Parents with basic/secondary education had about 1.6 times the odds of underestimating the weight of their child with OW (OR= 1.56; 95% CI 1.05-2.30), in comparison with parents with a university degree; the association was not significant for primary education (OR= 1.16; 95% CI 0.54-2.49). Likewise, parents whose family income was insufficient to cover necessities were more likely to underestimate the weight of their child with normal weight (OR= 4.32; 95% CI 1.95-9.59), when compared with parents whose income was sufficient.

DISCUSSION OF THE RESULTS

This study confirms the high prevalence of parental misperception regarding children's weight, which was associated with parental education level, income to cover necessities and children's BMI. Our findings show that nearly two in five parents incorrectly perceived their child's weight, with a tendency for underestimation, similar to prior national evidence (10).

Evidence suggests that parents might compare their child to peers, assessing their weight status regarding other children rather than using an absolute scale (10). Consequently, with the rising prevalence of childhood obesity, the weight perceived as "normal" has increased, which may lead to parents developing inaccurate weight perceptions (14-16). Accordingly, we hypothesised that in areas with a high prevalence of OW and obesity, parents were more likely to underestimate their child's weight. Testing this hypothesis using a multilevel model was not possible, as the sample size in each of the community areas was small, with existing heterogeneity in each area regarding schools. The descriptive results did not support this hypothesis. Although the areas with the highest prevalence of OW (Bonfim and UF Lordelo do Ouro and Massarelos) also had the highest proportion of children whose weight was underestimated (34.9% and 39.1% of all children), this largely reflects their higher OW prevalence: among children with OW, underestimation ranged from 69.2% (UF Lordelo do Ouro and Massarelos) to 85.7% (UF AFDN), with no pattern in relation to area-level OW prevalence. Moreover, differences between areas were not statistically significant, the adjusted estimates were imprecise, and the number of children with OW per area was small (19 to 54). Moreover, differences between areas did not follow the socioeconomic gradient suggested by 2021 Census indicators: Campanhã, the most deprived parish (unemployment rate 17.6% *vs*. 8.5% to 12.2% in the other areas; higher education 17.5% *vs*. 37% to 49%), had one of the lowest proportions of misperception (35.8%), whereas UF Lordelo do Ouro and Massarelos, with relatively favourable Census indicators (unemployment 10.4%; higher education 42.5%), had the highest proportion of underestimated overweight among all children (39.1%), largely reflecting its high OW prevalence. These observations are exploratory and should be interpreted with caution.

Parents with a lower education level and lower reported income to cover necessities were more likely to perceive their child's weight incorrectly, compared to parents with higher education and income. This finding is consistent with previous evidence suggesting that socio-educational disparities may relate to differences in nutrition and health knowledge, potentially contributing to inaccurate identification of children's weight status (4, 17, 18). However, as health literacy was not directly assessed in this study, this remains a plausible explanation rather than a mechanism demonstrated by our data. Contrary to prior evidence (8), our study did not find a significant association between children's sex, age and sports practice and parental misperception of children's weight status.

Our results showed that children with OW had their weight more often misperceived than children with normal weight. Given that the correct identification of children's weight status by their parents is associated with healthier diets and, in parents who correctly perceived their child with OW, with a motivation to make lifestyle changes (17, 19), this finding is relevant because incorrect perception of children's weight status might hinder parental and child participation in therapeutic intervention programmes, potentially leading to ongoing engagement in obesogenic behaviours, making it difficult to prevent severe obesity-related consequences (20, 21).

Parents with a lower educational level were at higher risk of underestimating their child's overweight, and misperception was more frequent in children with OW. At the community-area level, only Bonfim combined lower parental education and income with a high prevalence of OW, and this pattern was not consistent across areas. Community-tailored interventions may therefore benefit from more robust area-level data before prioritising specific areas. However, interventions should address this issue in an equitable way, to avoid parents experiencing

stigma, which could stop them from seeking proper care and make changes. Instead, these strategies should empower, support and educate parents on healthy lifestyles, helping them understand how it impacts the child's weight, growth and health (4).

While this study contributes to a better understanding of the factors associated with parental misperception of body weight status in their children, offering a broader perspective on these factors, several limitations should be acknowledged and discussed when interpreting these results. First, the use of cross-sectional data from the SMENIAF may result in reverse-causality bias, as it is not possible to determine the direction of the associations for some of the variables. Moreover, since the study was not specifically designed to investigate parental perception of children's weight, its design might have increased the possibility of misperception because of 1) the use of a question to measure the parental perception of their child's weight, instead of a silhouette rating scale (14); and 2) the evaluation of perceived children's weight status in only 3 categories (underweight, normal weight and OW) (8), as many parents might overlook the signs of their child having OW, if they are not visibly with obesity (18, 22). Notably, this three-category perception scale does not allow distinguishing whether parents specifically fail to recognise obesity as distinct from OW, which may lead to an underestimation of the true magnitude of parental misperception among children with obesity. Prior evidence also suggested that parent's BMI could influence their perception of children's weight status (8); however, as this information was not available, this association could not be studied. Additionally, sample size varied substantially across community areas (ranging from 44 children in Bonfim, covered by a single school, to 143 in Paranhos), which did not allow for a robust study of how community-level characteristics affect parental misperception of children's weight. Furthermore, as most community areas were represented by only one to three schools, it cannot be ruled out that the observed differences between areas partly reflect characteristics specific to the schools sampled, rather than the community area as a whole. In addition, the multinomial model did not include the child's weight category; since underestimation of OW can only occur in children with pre-obesity or obesity, and underestimation of normal weight only in children with normal weight, the associations with parental and contextual characteristics may partly reflect differences in the distribution of children's weight status. The Census indicators used to contextualise the areas refer to 2021 and to the resident population of each parish, not to the families of the sampled children. Campanhã, the most deprived parish according to the Census, was represented by only two schools, and the proportion of parents with a university degree in its sample (38.2%) was higher than in Bonfim (28.6%) and UF Cedofeita, St. Ildefonso and Sé (30.6%), contrary to what the Census indicates (although the two populations are not directly comparable). The sample may therefore not fully capture the socioeconomic heterogeneity within parishes. In addition, although participation among eligible children was relatively high (74.0%), only 65.2% of the initially eligible sample had a parent-completed questionnaire included in this analysis, with child participation ranging from 61.5% to 100% across schools. Parents who completed the questionnaire themselves may differ systematically from non-respondents (e.g., in education level or health engagement), potentially introducing selection bias and affecting the generalisability of the misperception estimates. Nonetheless, several strengths should also be highlighted. Children's weight and height were objectively measured by trained professionals in accordance with WHO standardised protocol, avoiding recall or reporting bias in the classification of children's weight status. The study achieved a relatively high overall participation rate (74.0% of eligible children) and covered all seven community areas of the municipality, despite uneven numbers of schools per area. Finally, by distinguishing between underestimation and overestimation of children's weight status, rather than using a binary correct/incorrect classification, this study allowed for a more nuanced characterisation of parental misperception, which may be relevant for tailoring future prevention strategies.

CONCLUSIONS

In this study, parental misperception of their child's weight status was frequent, and associated with children's BMI, parental education level and family income. These findings, based on a sample of primary school children in the municipality of Porto, highlight the need for combined efforts from parents, health professionals, schools and policymakers to address parental misperception, particularly among populations at higher risk, as a potential contribution to childhood obesity prevention and management strategies.

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CONFLICTS OF INTEREST

None of the authors reported a conflict of interest.

AUTHORS' CONTRIBUTION

RM, JA: Conceptualization; FP, HA, SC, TR, VA, NB: Data curation and fieldwork; RM, JA: Formal analysis and manuscript drafting; JA: Supervision.

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