

ORIGINAL ARTICLE

Maternal perception of the child's nutritional status from the perspective of adjusted residual analysis

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Abstract

Background: The maternal perception of the nutritional status of their children has several important social factors in its composition and it can be important in determine quality of children's food.

Objective: To assess social factors influencing maternal perception of her children's nutritional status.

Methods: Cross sectional study with school children from 6 to 10 years from a public school in São Paulo, Brazil. The data was obtained through a structured questionnaire applied to mothers and through children's body mass index. Associations between variables were analyzed by the Qui-square test and by the adjusted residues analysis, with 5% of significance. The agreement between maternal perception and nutritional status was assessed through the Kappa test.

Results: We found incorrect perception in 45.8% of cases, from which 98.2% were underestimation, with 80% of underestimation for overweight children. We found poor and slight agreement for all cases. Adjusted residuals pointed eutrophic underestimation; better maternal perception for the obese; better perception for mothers that attained middle and high school levels; underestimation for eutrophic boys and correct perception for eutrophic girls. Single mothers and those who do not work outside tended to underestimate their eutrophic children.

Conclusion: We found poor agreement for almost all cases, with exception to mothers of girls and those that do not work outside. A correct perception was related positively with lower education levels, being worse for mothers without a partner and for those who do not work outside. Mothers of girls, compared to mothers of boys, had a more accurate perception.

Keywords: maternal behavior, nutritional status, child; overweight, obesity.

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Authors summary

Why was this study done?

Maternal perception of a child's nutritional status is a determining factor in the care to be taken with their children. It can significantly influence children's food both qualitatively and quantitatively. Understanding the factors associated with the variation in mothers' perception of their children's nutritional status can be an important key for public health decision making in nutrition.

What did the researchers do and find?

We applied a questionnaire, with questions asked based on the current literature, on parents of children between six and ten years old from a public school in the city of São Paulo, and compared the answers with the objective anthropometric assessment of this population of students. Mothers with low schooling and children with obesity tend to perceive the nutritional status correctly, while single mothers, who work outside the home and with male children tend to make more mistakes when perceiving the nutritional status of their children.

What do these findings mean?

The application of the statistical analysis of adjusted residuals allowed a better interpretation of social factors associated with the maternal perception of the nutritional status of their children. Factors such as children with obesity and low maternal education, which classically have been related to a worse perception of mothers, were more associated with better levels of assertiveness. Mothers who need to spend more time away from home, such as those who work outside the home and who do not have a partner, tend to commit more mistakes in the perception of their children's nutritional status.

INTRODUCTION

Maternal perception of their child's nutritional status is substantial since it determines standards of care that defines mother's eating habits and practices with their children, as well as the future personal eating habits of these children. Recent studies¹ show that the prevalence of overweight among children in Latin America has been increasing. It is known that obesity in childhood is directly associated with the persistence of this condition in adulthood, determining a higher occurrence of comorbidities, such as hypertension, diabetes, and cardiovascular problems¹.

Incorrect feeding is a determining factor in the prevalence of obesity at any age², with the highest occurrence of children's eating errors being a factor associated with mistaken maternal perception, which is a factor associated with greater difficulty in implementing diets for children who are improperly fed³. A systematic review⁴ on the topic found that mothers have difficulty in correctly assessing their children's nutritional status. In this context, adequate maternal perception is a fundamental factor in coping, especially with childhood obesity, as this allows for better maternal adherence in dietary interventions³.

The parent's mistakes can be related to different factors⁵, such as maternal education level⁴, marital status, parents' work routine⁶ and the child's sex⁷. Their understanding of the nutritional status is a decisive tool for making preventive actions to combat childhood obesity⁸.

This study aims to assess the influence of social factors related to the maternal perception (MP) of their child's nutritional status (NS).

METHODS

We performed a cross-sectional study with convenience sampling of children from 6 to 10 years old, students of a federal elementary public school in the city of São Paulo. The school is dedicated to educating the children of hospital staff at the Federal University of São Paulo, in which the authors worked and, therefore, was chosen for the study.

Data were collected from a structured questionnaire based on a previous national study⁹, applied personally to mothers in a school parents' meeting, trying to cover

all students. In case of abstention, the document was sent for individual filling. In the questionnaire, the following variables were assessed: age and sex of the child, education, marital status, the mother's work routine and the perception of her child's NS.

Of the 235 questionnaires that were applied, 122 returned fully completed and four were excluded because they were incomplete, totaling a sample of 118 individuals.

An informed consent form was sent to all mothers. After authorization, the children were weighed and measured in a single moment by two pediatricians with experience in anthropometry, who measured each child individually. When weighing, a stable platform scale, from the Filizola brand, was used, with a precision of 5g. Height was measured using a fixed stadiometer with a precision of 0.1 cm. The children were barefoot and wore light clothing, suitable for the procedure.

Maternal age, weight, height and body mass index (BMI) of the child were the variables expressed by measures of central tendency (mean and standard deviation). The variables of the child's sex, mother's work routine, marital status and education were expressed in absolute and relative frequencies. Children were also nutritionally classified according to the BMI value (kg / m²) and divided into four categories, according to the World Health Organization: thinness ($p1 < BMI < p3$), eutrophy ($p3 < BMI < p85$), overweight ($p85 < BMI < p97$) and obesity that included children with obesity or severe obesity ($BMI > p97$). A fifth category called excessive weight was considered, formed by the classifications of overweight and obesity ($BMI > p85$).

The maternal perception of the children's NS was shown in frequency tables, in relation to the total sample, the child's sex, and the mothers' education, marital status and work routine (tables 1 to 4, respectively). The variables BMI and maternal perception were analyzed using the Chi-square test (χ^2), at a significance level of 5%, in relation to the total sample, the child's sex and the mothers' education, marital status and work routine. The respective p-values obtained were displayed in tables 1 to 4. In cases of significant association, the data had its residuals calculated and adjusted.

The adjusted residual (AR) analysis can be used as an aid in the interpretation of data organized in contingency tables. Through it, it is possible to evaluate how the different values expressed in the tables contribute to the Chi-square value and, therefore, to the association between the variables tested. For a significance level of 5%, a statistically significant adjusted residual is the one that, in a module, is greater than 1.96 standard deviations (SD). Significant and positive residual values express a positive trend, that is, when more cases were observed than expected, while significant and negative residuals indicate a negative trend, that is, situations in which fewer cases were observed than expected¹⁰. The calculated AR values were expressed next to each observed frequency for cases in which the calculated Chi-square indicated a significant association (p-value <0.05).

For this study, we consider that a desirable trend in maternal behavior occurs when $AR > +1.96 SD$ and there is correct perception, as in cases where the mother classifies a normal child as normal, or when $AR < -1.96 SD$ and there is an incorrect perception, as the mother classifying an overweight child as normal one. Undesirable trends in maternal behavior happen in the opposite situations, that is, when there is incorrect perception and $AR > +1.96 SD$ or correct perception and $AR < -1.96 SD$.

The agreement between mother perception and the child's nutritional status was assessed using the Kappa test. The analysis of the results was made for the total sample, by sex of the children and by mothers' education, marital status and work routine. The classifications adopted for

the Kappa values¹¹ were: poor (0-0.19); light (0.20-0.39); moderate (0.40-0.59); substantive (0.60-0.79) and almost perfect (0.80-1.00).

The analyzes were conducted using the Statistic Package for Social Sciences software v.23 (IBM SPSS for Windows, Chicago, USA). The study was approved by the Research Ethics Committee of the Federal University of São Paulo with registration number 1503/10.

RESULTS

The mean maternal age was 38 years ($SD \pm 7$ years). Regarding education, 10.2% of the mothers who participated in the survey completed middle school, 61.9% completed high school and only 28% had university education completed. Of the mothers interviewed, 79.7% had a partner and 92.4% worked outside the home.

Of the total of 118 children, 55.1% were male. The mean weight, height and BMI were, respectively: 32.3 kg ($SD \pm 8.8$ years), 130 cm ($SD \pm 0.10$ cm) and 18.4 kg / m² (minimum and maximum BMI were 13.4 and 33, respectively). As for nutritional classification, 30 (25.4%) were overweight and 26 (22%) obese, no child was classified as thinness.

We found 47.4% (56) of excessive weight children, with 46.4% (26) of them being obese and the remaining 53.6% (30) being overweight. The mothers of eutrophic children correctly classified 74.2% (46) of their children, representing 71.87% of the correct answers regarding eutrophic and excessive weight children combined (Table 1).

Table 1: Association between mother perception (MP) of children nutritional status and their nutritional status classification.

MP (p- value<0.001) K= 0.14		Nutritional Status Classification			
		Eutrophic	Overweight	Obesity	Total (Fi)
Thinness	Fi/RA	15/2.207 ^b	5/-0.048 ^b	0/-2.609 ^b	20
Normal	Fi/RA	46/1.760 ^a	19/-0.488 ^b	14/-1.609 ^b	79
Excessive Weight	Fi/ RA	1/-4.506 ^c	6/0.673 ^a	12/4.722 ^a	19
Total (Fi)		62	30	26	118

Fi= Absolute frequency observed; AR= adjusted residual; MP= Mother perception of their children nutritional status; a=Correct perception; b= Underestimation; c= Overestimation; K= Kappa.

Mothers agreed on the nutritional classification of their children in 54.2% (64) in all cases, in 20% (6) of overweight children and 46.2% (12) of obese children. Among the mothers who made mistakes in their perception, 98.15% (53) underestimated the nutritional status of their children (they considered their children thinner than they really were) and 1.85% (1) as overestimated.

Mother perception was associated with the nutritional classification of their children, as well as

for all sociodemographic variables (tables 1 to 4). The agreement analysis by Kappa showed poor agreement for: the total sample (0.14), mothers' education (middle, high school and university education with 0.19, 0.13 and 0.10, respectively), male (0.17), mothers' marital status (0.17 and 0.13 for those with and without partners, respectively) and for mothers' working outside the home (0.11). Mothers of girls and those who do not work out slightly agreed (0.36 and 0.27, respectively).

Table 2: Scholarity level and the association of mother perception (MP) of children nutritional status and their nutritional status classification

ED (p-value < 0.001)	MP		Fi/AR	Nutritional Status Classification			Total (Fi)
				Eutrophic	Overweight	Obesity	
Middle School K= 0.19	Thinness		Fi/AR	0/0.000 ^b	0/0.000 ^b		
		0					
	Normal		Fi/AR	5/2.070 ^a	2/0.000 ^b		
		8					
	Excessive weight		Fi/AR	0/-2.070 ^c	1/0.000 ^a	3/2.165 ^a	4
	Total (Fi)			5	3	4	12
High School K= 0.13	Thinness		Fi/AR	8/1.315 ^b	4/0.382 ^b		
		12					
	Normal		Fi/AR	27/1.642 ^a	13/-0.440 ^b	8/-1.503 ^b	48
	Excessive weight		Fi/AR	1/-3.311 ^c			
		8/3.809 ^a	13				
	Total (Fi)			36	21	16	73
University K= 0.10	Thinness		Fi/AR	7/1.612 ^b			
		0/-1.532 ^b	8				
	Normal		Fi/AR	14/-0.501 ^a			
		5/0.804 ^b	23				
	Excessive weight		Fi/AR	0/-1.930 ^c	1/1.204 ^a	1/1.204 ^a	2
	Total (Fi)			21	6	6	33
Total Scholarity (Fi)				62	30	26	118

Fi= Absolute frequency observed; AR= Adjusted residual; MP= mother perception of their children nutritional status; a= Correct perception; b= Underestimation; c= Overestimation; K= Kappa.

Table 3: Association of mother perception (MP) of children nutritional status and their nutritional status classification, according to child's gender.

Gender (p-value <0.001)	MP		Fi/AR	Nutritional Status Classification			Total (Fi)
				Eutrophic	Overweight	Obesity	
Male K= 0.17	Thinness		Fi/AR	8/2.054 ^b	3/-0.383 ^b	0/-2.016 ^b	11
	Normal		Fi/AR	16/-0.178 ^a	12/0.285 ^b	8/-0.106 ^b	36
	Excessive weight		Fi/AR	0/-2.400 ^c	2/0.100 ^a	4/2.700 ^a	6
	Total (Fi)		24	17	12	53	
Female K= 0.36	Thinness		Fi/AR	7/1.267 ^b	2/0.180 ^b	0/-1.693 ^b	9
	Normal		Fi/AR	30/2.586 ^a	7/-1.049 ^b	6/-2.080 ^b	43
	Excessive weight		Fi/AR	1/-4.153 ^c	4/1.085 ^a	8/3.922 ^a	13
	Total (Fi)		38	13	14	65	
Total Gender (Fi)			62	26	30	118	

Fi= Absolute frequency observed; AR= Adjusted residual; MP= mother perception of their children nutritional status; a=Correct perception; b= Underestimation; c= Overestimation; K= Kappa.

Table 4: Work routine and marital status in the association between mother perception (MP) of children nutritional status and their nutritional status classification, according to child's gender.

		MP	Nutritional Status Classification				
				Eutrophic	Overweight	Obesity	Total (Fi)
Marital Status (p-value<0.001)	With a partner K= 0.17	Thinness	Fi/AR	3/1.168 ^b	2/0.130 ^b	0/-1.451 ^b	5
		Normal	Fi/AR	6/0.641 ^a	5/-0.214 ^b	3/-0.478 ^b	14
		Excessive weight	Fi/AR	0/-1.947 ^c	2/0.130 ^a	3/2.031 ^a	5
		Total (Fi)		9	9	6	24
	Single Mother K= 0.13	Thinness	Fi/AR	12/2.012 ^b	3/-0.279 ^b	0/-2.196 ^b	15
		Normal	Fi/AR	40/1.509 ^a	14/-0.279 ^b	11/-1.544 ^b	65
		Excessive weight	Fi/AR	1/-4.027 ^c	4/0.607 ^a	9/4.262 ^a	14
		Total (Fi)		53	21	20	94
	Total Marital Status (Fi)			62	30	26	118
	Work routine (p-values<0.001)	Work outside home K= 0.11	Thinness	Fi/AR	14/1.968 ^b	5/-0.130 ^b	0/-2.343 ^b
Normal			Fi/AR	43/1.490 ^a	19/-0.628 ^b	12/-1.174 ^b	74
Excessive weight			Fi/AR	1/-4.100 ^c	6/1.000 ^a	9/4.100 ^a	16
Total (Fi)				58	30	21	109
Work inside home K= 0.27		Thinness	Fi/AR	1/1.186 ^b	0/0.000 ^b	0/-1.186 ^b	1
		Normal	Fi/AR	3/1.050 ^a	0/0.000 ^b	2/-1.050 ^b	5
		Excessive weight	Fi/AR	0/-1.897 ^c	0/0.000 ^a	3/1.897 ^a	3
		Total (Fi)		4	0	5	9
Total Work Routine (Fi)			62	30	26	118	

Fi= Absolute frequency observed; AR= Adjusted residual; MP= mother perception of their children nutritional status; a= Correct perception; b= Underestimation; c= Overestimation; K= Kappa.

DISCUSSION

The proportion of excessive weight children in our study was higher than that found by some researchers^{12,13}. Two studies^{14,15} obtained significantly lower values for overweight: 5.2% and 9, 7%, respectively.

The correct classifications of nutritional status varied little from the data in the literature for the total number of cases, for overweight and obese children. Among the incorrect classifications of mothers, our study showed a lower prevalence of overestimation in relation to the studies consulted^{13,14,16-27}.

We found similarity with some studies for the Kappa result, which showed poor agreement for the general data^{16,17,21} while others obtained agreement ranging from mild to moderate^{14,25,27,28}. Regarding gender, the agreement obtained in our study was similar to a study carried out in daycare centers in a city in southern Brazil²⁹, being higher for mothers of girls; greater agreement for these mothers was also found in a study conducted with preschooler^{s17}. None of the consulted sources evaluated the agreement regarding the mothers' education, work routine and marital status.

The eutrophic mothers were the ones who most correctly classified their children's NS. According to a systematic review⁴, most studies showed a higher percentage of correct responses between the mother perception and nutritional status of the children when they were eutrophic^{7,13,18,20,23-32}. We found greater accuracy for the normal / eutrophic item. Nevertheless, the residual for lean / eutrophic (2.207) shows a mathematically significant underestimation. This indicates that a significant number of mothers underestimated them, even though, in absolute terms, most of them had a correct perception.

The same systematic review⁴ indicates that there is a tendency of underestimation for overweight children, being even greater for obese children in the studies that make this stratification^{18,20,23,25-27,32}. In our study, the greatest contribution percentage of underestimation was for excessive weight children - 35.19% (38) of the total of mothers, in which 80% (24) of mothers of overweight children underestimated their children - however, the residuals for underestimation were not significant, indicating that this behavior was already expected. The underestimation of overweight children has a high

prevalence, but it was not accompanied by an increasing trend of incorrect perception. Underestimation regarding the NS of eutrophic and obese children were, respectively, 24.1% (15) and 46.1% (14).

A study on MP in day care centers in a city in southern Brazil²⁹ stated that mothers of overweight or obese children may have a better perception of nutritional status, since the clinical signs would be more visually perceptible. However, the consulted systematic review⁴ points out that studies have not confirmed this hypothesis. They show low mothers' ability to identify their excessive weight children and a better ability to identify normal weight for eutrophic children^{7,13,18,20,23-32}. However, our study suggests that mothers of obese children tend to classify them correctly, as the adjusted residues point to a significant decrease in underestimation and a significant increase in correct perception. We believe that the non-realization of inferential statistics (residual analysis) for each correlation presented by the other authors may be the reason for the disagreement between our results and that verified in the systematic review, since none of these studies applied this statistical method.

Some studies have been devoted to investigating possible factors for incorrect maternal perception, such as the level of maternal education. Lower levels of education are often associated with worse levels of perception^{7,13,23,26,27,31,32}, which was not found in this study. Proportionally, just as in a study on MP in the Federal District, in Brazil¹⁶, there was a worsening in perception with the increase in schooling, given that mothers with middle education got it right in 75% (9) of the cases, followed by mothers with high school, with 53.4% (39) of correct answers. Mothers with university education had correct perception in 48.4% (16) of the cases. Statistically, there were desirable tendencies to decrease underestimation and increase correct perception for mothers with primary and secondary education, but no residue was significant for those with university education. This corroborates the percentage data, as, statistically, lower school levels showed desirable trends in maternal behavior.

Mothers of boys have less correct perception in relation to mothers of girls^{18,26,32}. A cross-sectional study carried out in private schools¹⁶ demonstrated that mothers of boys are more likely to underestimate them due to the idealization of a male body archetype as a more robust one and therefore linked to the idea of health. On the other hand, mothers of girls tend to be more critical in relation to nutritional status, yearning for a thinner silhouette, which is a reflection of cultural and social impositions. A study on the agreement between the NS measured and perceived by mothers of preschoolers¹⁷ concluded that many of them believe that the child's overweight will spread throughout his growth and he will not become an overweight teenager. Our study supports these statements given that 64.6% (42) of the mothers of girls had a correct perception, compared to 41.5% (22) of the mothers of boys. The residues suggest a tendency for underestimation of boys NS when they were eutrophic (2,054) and a tendency to correct perception for eutrophic and obese girls (2,586 for normal / eutrophic and 3,922 for overweight / obesity). The residuals corroborate the descriptive data, since a greater number of mothers of

eutrophic boys, compared to mothers of eutrophic girls, underestimated them, 33.3% (8) against 18.42% (7), respectively.

Mothers of children of both sexes, according to the residual analysis, tend to underestimate less if their children is obese, despite having 66.7% underestimation of boys NS. Mothers of overweight boys also underestimated them more by percentage, 88.8% (15) against 69.2% (9) underestimation of overweight girls, but statistically this did not represent a trend, since the residuals were not significant.

So far, few studies have been dedicated to exploring the association of mothers' work routine with maternal perception. Some studies^{2,29} evaluated maternal occupation, but did not obtain statistical significance. For our study, this variable had a significant association and, although more than half of the mothers were correct in their perception, the adjusted residuals (1,968) suggest that those who work outside tend to underestimate more eutrophic children in relation to those who do not. Obese children were also significantly less underestimated by working outside the home mothers.

A descriptive study conducted in a city in northern Mexico³ also assessed the mothers' marital status, but found no statistical association. In our study, single mothers tend to underestimate their children's NS when they are eutrophic (2,012). Proportional data also indicate a greater misperception, given that 54.1% (41) of them were mistaken in perception.

A study carried out in Tuscany²⁵, obtained a higher Kappa when the silhouette scale was used than the simple questionnaire, however, both values indicated moderate agreement between the MP and NS of their children. However, there is no consensus on the best tool used to assess maternal perception. Recent studies have used silhouette scales and simple questionnaires. Authors⁴ described that it was possible to identify differences in the ability of the two methods to assess maternal perception, with the caveat that the questionnaire method is likely to increase the underestimation percentages, when compared to the silhouette scale, which can be a limitation of our study.

We did not find in the literature another study that used the adjusted residual analysis as a statistical tool to assess the differences between maternal perception and nutritional status. The studies reviewed for the purpose of discussing this work were limited to using only descriptive statistics to assess the degree of correlation between the variables studied, given the significant statistical association. We believe that this may be the reason for the disagreement between the results obtained and those mentioned. Still, we conflict with descriptive statistics with the residual analysis to point out that there may be behavioral trends that are not identifiable in percentage.

CONCLUSION

The agreement between maternal perception and nutritional status was poor for the general data, for sex and mothers' education, work routine and marital status, with the exception of mothers of girls and those who do

not work outside the home, having a slightly agreement.

Mothers of obese children tend to classify them correctly. This was not verified statistically for eutrophic and overweight children. Single mothers and mothers who work outside the home of eutrophic children tend to underestimate their children's NS.

Lower education levels (middle and high school) showed a tendency of correct perception, which was not observed for mothers with university education. There is a tendency of underestimation for boys and of correct perception for girls, that is, mothers of girls perceive their daughters more correctly compared to mothers of boys.

Author Contributions

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Conflicts of Interest

The authors declare to having no conflict of interests.

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Resumo

Introdução: A percepção materna do estado nutricional de seus filhos apresenta diversos fatores sociais importantes em sua composição e ela pode ser um importante na determinação da qualidade de alimentação das crianças.

Objetivo: Avaliar os fatores sociais que influenciam a percepção materna sobre o estado nutricional de seus filhos.

Método: Estudo transversal com escolares de 6 a 10 anos de uma escola pública de São Paulo, Brasil. Os dados foram obtidos por meio de um questionário estruturado aplicado às mães e a partir de antropometria das crianças. As associações entre as variáveis foram analisadas pelo teste do Qui-quadrado e pela análise dos resíduos ajustados, com 5% de significância. A concordância entre a percepção materna e o estado nutricional foi avaliada por meio do teste Kappa.

Resultados: Encontramos percepção incorreta em 45,8% dos casos, dos quais 98,2% foram de subestimação, com 80% de subestimação para crianças com sobrepeso. Encontramos concordância pobre e leve para todos os casos. Os resíduos ajustados apontaram para subestimação eutrófica; melhor percepção materna para o obeso; melhor percepção para mães que atingiram o ensino fundamental e médio; subestimação para meninos eutróficos e percepção correta para meninas eutróficas. As mães solteiras e as que não trabalham fora tendem a subestimar seus filhos eutróficos.

Conclusão: Encontramos baixa concordância para quase todos os casos, com exceção das mães de meninas e das que não trabalham fora. A percepção correta relacionou-se positivamente com a menor escolaridade, sendo pior para as mães sem companheiro e que não trabalham fora. As mães de meninas, em comparação com as mães de meninos, tiveram uma percepção mais precisa.

Palavras chave: comportamento materno, estado nutricional, criança, sobrepeso, obesidade.