ORIGINAL ARTICLE

Nutritional surveillance in Tuscany: maternal perception of nutritional status of 8-9 y-old school-children

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Key words

Nutritional status • Body Mass Index • Silhouette

Summary

Introduction. *Overweight and obesity in the developmental age has become a public health problem. For this reason, prevention projects must be developed in advance with the aim to involve not only children, but their parents as well.*
Our objective is to evaluate the accuracy of the mothers' perceptions of adolescent nutritional status.
Methods. *Cross-sectional study. We selected a statistical sample of 3,076 subjects (1,583 males, 1,493 females), 8-9 y-old school-children of 164 3rd-grade elementary school classes from throughout Tuscany, as well as their mothers.*
The mothers' information was gathered via self-administered questionnaires, while the children were given an eating behaviour survey under the supervision of qualified personnel.
Mothers' education level (self-reported) height and weight were collected; children's height and weight were measured.
The former were asked how they perceived their children's body image.
Results. *A correlation exists between the mothers' perceptions of the nutritional state of their children via the silhouettes and the BMI classes of the children, which is equal to 80% with a κ-Cohen for agreement equal to 0.58 (SE = 0.02; P < 0.0001). However, no correlation exists between the mothers' responses to the question "In your opinion, is your child …?" and the child's actual BMI class (the exact percentage correlation is equal to 75%, with a κ-Cohen for agreement equal to 0.43 SE = 0.014; P < 0.0001).*
Discussion. *Mothers have an accurate perception of the nutritional status of their children, correctly choosing the silhouette that corresponds to the child's BMI profile without variation by gender.*
We can assume that mothers in our sample have a good concept about healthy nutritional status.

Introduction

In Europe, the state of being overweight is becoming more prevalent in children of all ages [1]. Overweight children are more likely to become obese adults [2]; for this reason, it is important that obesity prevention should begin early in life. Many factors may influence overweight/obesity in children.
Parents have a fundamental role in their children's food choices and healthy lifestyles; therefore, it is necessary to directly involve them in any obesity prevention projects in the pre-scholastic years, as other studies have emphasized [3-5]. It is also essential that parents are aware of the ponderous state of their children and the complications that excess weight may bring to their health status as adults [6].
In fact, many sources have identified the problem of the impact of the body models that dominate our society on individual behaviour. For this, recent studies have posed the problem of evaluating the correlation between the perception of one's actual physical form and one's current nutritional status [7-10]. In order to assess body image, silhouette rating scales have been utilized [11, 8]. Another important factor that influences children's lifestyles is the family's culture; in fact, the prevalence of obese children tends to decrease with an increase in the respective parent's level of education [12-14].
This investigation was conducted in order to evaluate mothers' perceptions of their children's nutritional status, an issue that has important implications for the success or failure of overweight/obese prevention [15] and health promotion interventions with children. In addition, we aimed to investigate the factors that affect mothers' misclassifications of children's nutritional status.

Methods

Questionnaire Development

This study investigated the evaluation of the nutritional state and the eating behaviours of 8-9 y-old school-children in Tuscany. Two questionnaires were used: one eating behaviour survey for children, and another self-administered questionnaire for parents, developed in collaboration with the national research group of the project "Nutritional Surveillance based on local data for prevention of chronic disease".

In this study, the Body Mass Index (BMI) analysis, the parents' educational level and age, as well as their perception of the nutritional status of their children in relation to the child's BMI, were examined.

Participants

Participants included 3,076 (1,583 males, 1,493 females) 8-9 year-old school-children and their mothers. Further details on this project are described elsewhere [12, 16]. This sample was further modified by eliminating the missing data of the current subject items in this survey.

Questionnaire Items

In order to examine the mothers' perceptions of the nutritional status of their children, we asked them to respond to the following question: "Which of these figures is most similar to your child?". They were then given the possibility of choosing among seven figures (Fig. 1).

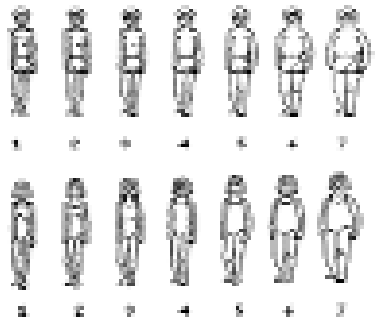
The above figures are those used in the pilot project: "Nutritional Surveillance based on local data for prevention of chronic desease" [16, 17]. Here, we have considered Figures 1-3 as representing underweight, Figure 4 as representing normal weight, Figure 5 as overweight and Figures 6 and 7 as obese.

In order to further examine the mothers' perceptions of these figures as representing a good state of health, we asked them to respond to the following question: "In your opinion, which of these figures should a child of your son/daughter's age resemble in order to be in a good state of health"?

In addition to the silhouettes used to asses the mothers' perceptions of their children's nutritional status, mothers were asked to complete the statement "In your opinion your child is …" by giving 1 of 6 possible responses: "very thin, a little thin, normal, a little fat, fat and very fat".

Additional information was collected on the mothers' age and education level, classified as low (elementary, middle school or below) and high (high school and college diploma).

Fig. 1. Figure Rating Scales.



Hill AJ, Silver EK. 1995 [7] modified [17].

Anthropometric measures

Maternal BMI was based on the mothers' self-reported height and weight; the validity of this method in adults has been established [18, 19], and their BMI was categorized according to World Health Organization criteria [20].

All children were measured directly by qualified personnel. BMI cut-off rates were calculated according to the age z-score method [21]; more information on this protocol is available elsewhere [12].

Statistical Analysis

Data were analyzed using the SPSS statistical package. Bivariate analyses of categorical variables were conducted with χ^2 tests. In order to quantify the level of agreement between the mothers' perceptions of the rating of their children's nutritional status (assessed from responses to the question "Which of these figures is most similar to your child?") and a definitive criterion variable, the BMI classified according to Cole [21], we calculated the proportion of overall agreement and the κ-Cohen of agreement ($\kappa < 0.40$ fair agreement; $0.40 < \kappa < 0.60$ moderate agreement; $\kappa > 0.60$ substantial agreement).

Results

This study examined a sample of 2,835 mothers, of which 241 did not provide the data necessary for our analyses. Of these, 1,285 (45%) had a low level of education, and 1,550 (55%) a high level of education (Tab. I).

Of the mothers with a low level of education, 6.6% are obese, as compared with 3.0% of those with a high level of education.

Obesity PPR = 6.6/3.0 = 2.2 (CI 95%: 1.55-3.12).

When evaluating, for each child, the correlation between the BMI class corresponding to the figure chosen by the mother and the corresponding BMI class according to Cole [20], we find that a percentage of overall agreement exists that is equal to 80% with a κ-Cohen equal to 0.58 (SE = 0.02; $P < 0.0001$), indicative of a moderate level of agreement.

In Table II, the mothers' misclassifications of the silhouettes according to an under or overestimation of the children's BMI class are reported.

We may note that out of 665 children in the overweight category, 234 (35%) were underestimated by their mothers, who indicated a figure corresponding to that of an inferior nutritional status. There was no reported difference between the sexes.

The percentage of underestimation for the overweight category results as 24% of all children that could have been underestimated, being the 665 overweight children plus the 297 obese children, for a total of 962.

Similarly, the underestimation rate of the mothers of obese children is 53%, which results as 16% (157/962) if we consider the proportion of obese children that were underestimated as compared to the overall sample of overweight and obese children.

Tab. I. Maternal educational level compared with nutritional status.

	Maternal education level*		
	Low	High	Total
Maternal nutritional status*			
Underweight	42 (3.3%)	89 (5.7%)	131
Normal weight	927 (72.1%)	1223 (79.0%)	2150
Overweight	231 (18.0%)	192 (12.3%)	423
Obese	85 (6.6%)	46 (3.0%)	131
Total	1,285 (100%)	1,550 (100%)	2,835
		Obesity PPR = 6,6/3,0 = 2,2 [1,55-3,12]	

* P < = .001; PPR = Prevalence Rate Ratio; Low education (elementary, middle school or below) and high education (high school and college diploma)

Next, with the question "In your opinion, which of these figures should a child of your son/daughter's age resemble in order to be in a good state of health?", we find that 64% (1,785) of mothers indicated Figure 4, 21% (587) of mothers indicated Figure 3, 14% (411) indicated Figure 5, and 1% [20] indicated Figure 2; therefore, more than half of the mothers studied associate the concept of "good health" with Figure 4 (Tab. III).

Furthermore, 100% of the mothers of obese children chose, as an image of good health, a figure that belonged to a BMI class at least one level lower to the one they had indicated in the Silhouette Rating Scale.

When comparing the responses to the two questions, respectively, "Which of these figures is most similar to your child?" and "In your opinion, which of these figures should a child of your son/daughter's age resemble in order to be in a good state of health?", and keeping in mind that, in this study, Figure 4 represents normal weight, Figure 5 overweight, and Figures 6 and 7 obesity, we see how 84% of the mothers that identified their children with Figure 4 (normal weight) associate the same figure with the idea of good health (Tab. IV). Among mothers that identify their children with Figure 5, 63% associate Figure 4 with "good health"; instead, among mothers that view their children as resembling Figures 6 and 7, 40% still choose Figure 4 as a representation of good health, while 58% choose Figure 5. Therefore, the majority of the percentages for all categories, except for those of the underweight and obese, always correspond to Figure 4.

From the evaluation of the question posed to mothers "In your opinion, your child is …?": "very thin, a little thin, normal, a little fat, fat and very fat", in relation to the nutritional state of their children [21], one clearly notices the mothers' perception of an elevated underestimation of overweight and obesity of their children as compared to their perception as evaluated using the silhouettes. In fact, though the percentage of overall agreement remained high (75%), we obtained a κ-Cohen of 0.43 (SE = 0.014; P < 0.0001), close to the threshold of low agreement (κ = 0.40).

We also evaluated if some factors, such as the education level and the BMI class of the mothers, were associated with the failure of mothers in perceiving when their overweight/obese children were overweight/obese (Tabs. VI and VII). The χ^2 tests, however, did not demonstrate any significant association between mothers' underestimation of their children's nutritional status and their own educational level (P = 0.89) and BMI class (P = 0.055).

Tab. II. Mothers' misclassifications of the silhouettes according to the children's BMI class in the overweight and obese subject samples.

	Silhouette underestimation	Silhouette overestimation	Total
Children's BMI [10]			
Overweight	234 (35%)	34 (5%)	665
Obese	157 (53%)	—	297
Total			962

Tab. III. Maternal perception of ideal body shape for their healthy children.

U			N	OW	O		
1	2	3	4	5	6	7	Total
—	20 (1%)	587 (21%)	1,785 (64%)	411 (14%)	2 (0%)	—	2,805

(U = underweight, 1-2-3; N = normal weight, 4; OW = Overweight, 5; O = Obese, 6-7

Tab. IV. A comparison between how mothers view their children and the figure that they feel represents a good state of health for a child of their children's age.

		Ideal figure for good health							
			U		N	OW		O	
		1	2	3	4	5	6	7	Total
Current figure									
	1	—	—	—	—	—	—	—	
U	2	—	8%	57%	34%	1%	—	—	208
	3	—	1%	48%	50%	1%	—	—	745
N	4	—	—	8%	84%	8%	—	—	994
OW	5	—	—	5%	63%	32%	—	—	687
O	6	—	1%	—	40%	58%	1%	—	171
	7	—	—	—	—	—	—	—	—
Total									2,805

(U = underweight, 1-2-3; N = normal weight, 4; OW = Overweight, 5; O = Obese, 6-7)

Discussion

This data confirms that a misclassification error exists in the mothers' perceptions of the nutritional state of their children; this has also been noted in other studies [5, 15]. These errors regard, in particular, mothers of overweight and obese children, and their range varies, depending on if the evaluation is undertaken with a multiple-choice question or through the choice of a silhouette from the Rating Scale proposed in the questionnaire. The mothers' perceptions of the nutritional state of their children results as being more accurate with a percentage of overall agreement equal to 80% (κ-Cohen equal to 0.58; SE = 0.02; $P < 0.0001$), according to a percentage of overall agreement (75%) with a κ-Cohen of 0,43 (SE = 0.014; $P < 0.0001$) of the direct question.

The lower rate of accuracy of the research method based on direct multiple-choice questioning is also noted by other Authors [5, 15]. It may be hypothesized that mothers feel uncomfortable when responding to the question in which they must distinctly classify their children into the categories "fat or very fat", even because of the emotional and motivational factors that may intervene during the evaluation process. These ap-

Tab. V. Mothers' perceptions of the nutritional state of their children, based on children's BMI class, regarding the question "In your opinion, your child is …?" from the questionnaire.

Weight category	Underestimation *vs.* question	Overestimation *vs.* question	
Overweight	394 (59%)	9 (1%)	672
Obese	262 (87%)	—	301
Total			973

Tab. VI. Mother's underestimation of the comparable Figure based on mother's BMI class.

Mothers' BMI classes	Silhouette underestimation of overweight/ obese children	Silhouette non-underestimation of overweight/ obese children	Total
Underweight	4 (18%)	18 (82%)	22 (100%)
Normal weight	253 (39%)	386 (61%)	639 (100%)
Overweight	93 (46%)	108 (54%)	201 (100%)
Obese	30 (42%)	41 (58%)	71 (100%)
Total			933

$\chi^2 = 7.60$ d.o.f. = 3 P = 0.055

Tab. VII. Mother's underestimation of the comparable Figure based on children's BMI class and on the mother's level of education.

Mother's Education Level	Overweight/ obese children Silhouette underestimation	Overweight/ obese children Silhouette non-underestimation	Total
Low	199 (41%)	288 (59%)	487 (100%)
High	192 (40%)	283 (60%)	475 (100%)
Total			962

$\chi^2 = 0.02$ d.o.f. = 1 P = 0.89

pear to prevale over processes that are purely cognitive and perceptive.

In fact, evaluation processes are influenced by defense mechanisms (avoidance and denial) related to the problematic confrontation with the expectations of others and oneself (for example, with the prevalent social models that are experienced in a depressed manner as unattainable). These dynamics are, as noted, increasingly present in the symptomatology of eating disorders.

Research on the factors that determine the "gap" that has been revealed in the present work between the cognitive and perceptive evaluations and the cognitive verbal responses could be of notable importance in obtaining significant elements in order to formulate intervention projects that will be effective in the greater community.

In regards to the mothers' awareness of the individuation of the figure that is most representative of a good state of health for a child the same age as her son/daughter, two-thirds of them correctly indicated Figure 4 of the Rating Scale that corresponds to normal weight.

The mothers that individuated Figure 6 (obese) as corresponding to the nutritional state of their children also indicated Figure 5 (overweight) in 58% of cases, and Figure 4 (normal weight) in 40% of cases, as representative of a good state of health. In the same manner, the mothers that individuated Figure 2 (underweight) as corresponding to the nutritional state of their children indicated Figure 3 in 57% of cases, and Figure 4 (normal weight) in 40% of cases, as representative of a good state of health.

Overall, one may note a clear tendency of the entire sample to converge towards the individuation of the central silhouettes as representing a good state of health. This tendency is indicative of the diffusion in this population of a culture of good health, which may represent the basis upon which strategies of projects for effective action in promoting good health may be built.

An analysis of the relationship between the mothers' educational level and the BMI class of their children shows how a higher level of education corresponds with the lowest percentage of obesity, and, vice-versa, that the lowest level of education corresponds with the highest percentage of obesity and the lowest percentage of normal weight ($P < 0,0001$) [11].

In addition, it has been confirmed by other Authors [8] that, for mothers, a low level of education implicates a greater risk of obesity.

Other Authors [5, 8] with diverse population samples and methods have individuated a clear influence of level of education on the perception of nutritional status of their children.

In order to thoroughly study the role of the mothers' educational level on their perception of their child's nutritional status, we proceeded to a multiple analysis that considered many factors (age, BMI and mothers' level of educational); however, we found no direct associations among these elements.

In conclusion, the use of the silhouette with the Rating Scale is more effective than direct questioning using multiple choice responses in order to evaluate the mothers' perceptions of their children's nutritional status. Overall, with the Silhouette Rating Scale, a 20% rate of variance remains, suggesting that improvements to this research tool are necessary in order to increase its accuracy before regularly utilizing it in epidemiological investigations.

In the next studies will be suitable to investigate the perceptions that mothers have of their own nutritional status, considering that the parents' obesity is certainly one of the most important factors that favour the increase in weight and obesity in children [22, 23].

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