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Behavioral traits and Socio-economic factors associated with overweight in primary-school children

Risk factors of childhood overweight

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The prevalence of childhood obesity in Italy is decreasing, but still one of the highest in Europe. Numerous lifestyle and socio-demographic factors have been found related to obesity in children, for example being only child have been found to be associated with higher likelihood of overweight and obesity¹. Finally, a number studies have suggested that overweight in youth can be associated with behavioral traits and psychopathological risk, and particularly with depressive and aggressive symptoms².

With the aim to generate a comprehensive picture of the socio-demographics, lifestyles, and behavioral traits associated with Body Mass index (BMI) among Italian children, we've carried out a cross-sectional study in a sample of primary-school children. It's based on a survey administered to the children's mothers right before starting a health promotion project (called "*Le Buone Abitudini* [Healthy Habits]") at primary schools in the province of Padua (north-east Italy) during school year 2018-2019.

Our study sample included children in their first school year (6-7 years old) among 21 classes at 14 different schools. The children's mothers were asked to anonymously answer a self-administered, ad hoc questionnaire investigating several variables related to their children's lifestyles and behavioral traits, and the family's socio-economic status. Parents were asked to give their written informed consent to participate.

The questionnaire contained 34 multiple-choice items and touched on a number of factors about the social sphere and demographics, family setting, lifestyle, and behavioral traits, as well as children's weight and height (which were used to calculate BMIs). Children were classified as normal weight or overweight/obese using the International Obesity Task Force cut-offs, as suggested by Cole et al³.

The questionnaire investigated the average time spent watching television and using a smartphone or tablet (less or more than 1 hour) on a typical school day. Children's behavioral traits were measured on the basis of their mothers' reports using the Italian version of the Strengths and Difficulties Questionnaire (SDQ)⁴. Risk tertiles were identified for each behavioral trait, with the

first tertile including individuals showing a given behavioral trait the least, and the third those showing it the most.

The questionnaire also covered family's socio-economic factors, including: whether the child had siblings, and the family's disposable income, measured with the question "How do you make ends meet with your finances?" ("very/quite easily" or "with some/great difficulty").

Proportions and 95% confidence intervals for overweight and obesity by sex were calculated.

Then, a preliminary bivariate analysis was run to identify the distributions of overweight or obesity by socio-demographic, behavioral, and lifestyle variables. In particular, the χ^2 test was applied to test for differences in how the categorical variables were distributed by the children's weight group (normal vs overweight/obese), while Student's t-test was used to check for differences in the means of the continuous variables, again by weight group.

Finally, a multivariate logistic regression was performed with a robust variance, taking school cluster into account to test the association between weight group, entered as the dependent variable, and the other variables associated in the bivariate analysis ($p < 0.10$), used as independent variables.

The STATA software, ver. 14.1, was used for all the statistical analyses.

Almost one in four of the children involved in this study, 23.5% (95% CI 18.0%-29.7%) were classifiable as overweight or obese according to the International Obesity Task Force cut-offs⁴, with a similar proportion in boys and girls (25.9%; 95% CI 18.7%-36.5% in females vs 20.2%; 95% CI 13.1%-28.9% in males). In particular, 14.3% (95% CI 9.9%-19.7%) of the children were classifiable as overweight, and the proportion was similar in both sexes (14.4%; 95% CI 8.3%-22.7% in females vs 13.8%; 95% CI 7.9%-21.7% in males), while 9.2% (95% CI 5.7%-13.9%) were classifiable as obese, 11.5% (95% CI 6.1%-19.3%) in females and 6.4% (95% CI 2.6%-12.8%) in males.

Table I shows the results of the multivariate analysis. As for socio-economic factors, the odds of children being overweight or obese were higher for only children than for those with siblings (OR 2.12; 95% CI 1.01-4.47), and those whose mothers reported having less disposable income (OR

2.01; 95% CI 0.99-4.10). Among the behavioral traits investigated, more severe peer relationship problems were related to higher odds of being overweight or obese (OR 3.27; 95% CI 1.32-8.15 and OR 2.69; 95% CI 1.18-6.12, respectively).

These findings suggest having no siblings increases the likelihood of overweight and obesity among children and reinforce the overall notion that family structure plays a role in body weight among children¹. Overweight rates were higher among children growing up in low-income families than for children in high-income families.

Among the five behavioral traits examined, peer relationship problems were found significantly associated with the risk of being overweight. It should be noticed that the reverse sequence of events needs to be considered too, since the cross-sectional design of our study prevents any conclusions from being drawn on causal associations.

There may also be a common underlying cause for peer relationship difficulties and overweight: a poor emotional regulation, or personality traits such as emotional immaturity, could lead to maladaptive, awkward behavior toward peers, but also to abnormal eating behavior as a coping strategy⁵.

Our study has a number of limitations. First, its design prevented us from establishing any causality for the significant associations examined. Second, our data on BMI and other variables were obtained by means of questionnaires. Our findings therefore suffer from the inherent limitations of self-reported data. Moreover, some variables, such as children's behavioral traits, might be a sensitive topic for their mothers, who may have exaggerated or played down their children's behavior. A further limitation is the absence of any data concerning the birth weight and the family history of overweight in the study population.

In conclusion, our study indicates and confirms the association between overweight and a number of socio-economic variables and behavioral traits among children, suggesting the opportunity to seek potential causal relationships and mechanisms with appropriate study designs. It also reinforces the need to consider the role played by family environment and relationships with peers

on children's weight control, underscoring the importance for health promotion programs to nurturing a healthy lifestyle overall, since outcomes like good nutrition, physical exercise, and a limited use of screen-based media are mutually dependent. More broadly speaking, it would be useful to consider interventions adopted at school that also include activities to strengthen children's relationships with their peers as part of health promotion programs.

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TABLES

Table I: Multivariate logistic regression model. Associations between overweight or obesity and socio-demographic, behavioral traits, and lifestyles variables.

		Odds ratio	95% CI	p-value
Variables concerning the child				
Being an only child		2.12	1.01 – 4.47	0.046
More than 1 hour a day spent watching television		1.58	0.76 – 3.25	0.218
More than 1 hour a day spent using a smartphone/tablet		2.02	0.67 – 6.12	0.213
Peer relationship problems				
<i>Ref: 1st tertile = lowest level of problems</i>	Second tertile	3.27	1.32 – 8.15	0.011
	Third tertile	2.69	1.18 – 6.12	0.018
Variables concerning the mother				
Low disposable income		2.01	0.99 – 4.10	0.056