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Original Research

Association of socioeconomic gradients with obesity in children

Mahsa Mohajeri [1]

Ali Barzegar [1*]

Ali Nemati [2]

[1] Nutrition Faculty, Tabriz University of Medical Sciences, Tabriz, Iran

[2] Nutrition Faculty, Ardebil University of Medical Sciences, Ardebil, Iran

***** *Corresponding author:*
Ali Barzegar
Department of Nutrition, Community Nutrition Group, Tabriz University of Medical Sciences, Tabriz, Iran
mohajerim@tbzmed.ac.ir
tel: +989143594134-04133357581
fax: 04133359680

Abstract

The objective of this study was to determine the influence of socioeconomic status on the body mass index (BMI) of primary school children.

A cross-sectional study was conducted with a sample of 280 children aged 6 to 11 years allocated to three groups based on BMI: underweight, ideal weight and overweight/obesity. Socioeconomic status was determined based on the responses of parents/caregivers to a specific form. Data analysis involved the employment of the Kruskal–Wallis, Mann–Whitney U and chi-square tests as well as simple and multiple linear regression analyses.

In the final multiple regression model, BMI was influenced by monthly household income (coef=0.223; CI: 1.014 to 1.503).

Children from families with a higher monthly income had a higher BMI.

Keywords: children, obesity, socioeconomic gradients

Introduction

Childhood obesity has been a health concern in recent years. Obesity is a key contributor to a number of chronic diseases with, for example, 44% of the diabetes burden, 23% of the heart disease burden and between 7% and 41% of the burden of cancers attributed to overweight and obesity [1]. Of main concern is the fact that childhood obesity has also grown rapidly in recent years, thereby escalating the burden of both immediate and long-term health effects [1, 2]. For example, while most of the costs associated with obesity among children will be incurred in the future, research has shown that obesity-related problems amongst children cost the health service as much as $14.1 billion annually [3]. Several studies have shown the existence of a socioeconomic gradient with respect to obesity in different countries. These findings indicated that prevalence is higher in socioeconomically disadvantaged groups, that is, those with lower levels of education, low income and belonging to a lower social class [4]. Despite the increase in obesity in all sociodemographic groups, some authors highlight a trend of increasing social inequality since the late 1980s and the increase in prevalence has tended to focus on individuals of lower socioeconomic status (SES) as a result of two main factors: the change in eating habits (resulting from the high availability of cheap high-energy food), and the evolution in physical activity patterns (the increase of inactivity, particularly among the most socially disadvantaged individuals) [5]. The onset of the economic crisis in 2008 has also been noted as a probable cause of the most recent increase in social inequality linked to obesity [6]. Low-income families have been forced to cut their food budgets, which has increased the purchase of cheaper and less healthy food products. It is assumed that energy-dense diets are more affordable than diets based on healthy foods [7]. It is well known that the socioeconomic environment has a significant effect on the prevalence of a high number of diseases, including obesity [8]. However, more evidence is needed regarding the mechanisms through which SES affects health outcomes in order to effectively combat health problems as well as socioeconomic inequalities in health [9]. In this paper, we estimate the socioeconomic gradient of obesity in Ardebil, Iran by using corrected concentration indices, and provide new evidence about how SES affects obesity. Path analysis may be very helpful in this task, since it contributes to disentangling the direct and indirect effects of a variable of interest on another. The paper proceeds with a discussion of the data and methods used in the analysis, including the measurement of child obesity and family SES in Ardebil primary school children.

Methods

Sample and study design

A cross-sectional study was conducted with a sample of male and female primary school children aged 6 to 11 years in the city of Ardebil, Iran. The sample size was calculated using the formula for the comparison of two means and the parameters determined during a pilot study, which was conducted with 30 children allocated to three groups based on BMI: underweight, ideal weight and overweight/obesity. Considering a standard deviation of 2.33 (referring to the BMI), a one-point difference to be detected among groups, an 80% statistical power and 5% standard error, a minimum sample of 200 children was determined for each group. Eighty children were added to each group to compensate for possible dropouts, to give a total of 280 children. The results of the pilot study demonstrated that no changes to the methods were needed. Convenience sampling was performed for the recruitment of children

from daycare centres and preschools in the city. The weight and height of each child were measured for the determination of BMI, which was the basis for the allocation of the children to the different groups.

Anthropometric evaluation

Weight was measured with the child positioned with the feet together and shoulders erect on a calibrated digital scale with a precision of 100 g. The children stood barefoot on the scale in their school uniforms and 200 g were subtracted from the total body mass due to the weight of the clothing. Height was measured using a portable stadiometer with a sliding vertical bar. The children were positioned with their backs to the stadiometer and the Frankfurt plane parallel to the floor. The sliding bar was positioned at the highest part of the top of the head. BMI was calculated as weight (kg) divided by height (m) squared (kg/m^2). Children with a BMI higher than the 96th percentile were considered obese, those between the 85th and 96th percentiles were considered overweight, those between the third and 85th percentile were considered to be within the ideal range and those with a BMI below the third percentile were considered underweight. In this study, children categorized as being overweight or obese were included in a single group. The consent form was completed by the mothers. This study was approved at the Children's Health Research Center of Tabriz University of Medical Sciences.

Socioeconomic form

A specific form addressing the child's sex and age as well as the mother's schooling and monthly household income was sent to the parents/caregivers of the children to be filled out.

Statistical analysis

Statistical analysis was conducted using Stata 9. Descriptive analysis was performed initially to determine the distribution of the data. The Kolmogorov–Smirnov test was used to determine the normality of the data. The Kruskal–Wallis, Mann–Whitney U and chi-squared tests were used to compare the distribution or mean and standard deviation (SD) values of the independent variables among the groups of children (underweight, ideal weight and overweight/obesity). Simple and multiple linear regression analyses were conducted to determine the strength of associations between the independent variables (age, sex, monthly household income, mother's schooling) and BMI. Explanatory variables with a p value ≤0.20 were selected for the multiple linear regression model using the stepwise method to determine which independent variables remained associated with BMI. Only explanatory variables with a p value <0.05 after the adjustments remained in the final model.

Results

There were no significant differences among groups with regard to the child's age or the child's sex. With regard to monthly household income, there were significant differences among groups (**Table 1**).

In the simple linear regression analysis, the independent variables were significantly

	Ideal (n=95)	Overweight/Obese (n=93)	Underweight (n=92)	*p*
BMI: mean (SD)	16.23(0.72)	19.25(0.14)	13.02(0.20)	0.125*
Age: mean (SD)	8.25(0.11)	8.36(0.15)	8.12(0.22)	0.356*
Sex: n (%)				
Female	40(42)	44(47)	42(45)	0.128#
Male	55(58)	49(53)	50(55)	
Household income: n (%)				
<10000000(RLs)	38(40)	31(34)	54(58)	0.021#
>10000000(RLs)	57(60)	62(66)	38(42)	
Mother's schooling: n(%)				
Up to 8 years of study	15(16)	25(27)	12(14)	0.015#
8 to 12 years of study	50(52)	35(37)	45(48)	
More than 12 years of study	30(32)	33(36)	35(38)	
*Kruskal–Wallis test #Chi-squared test				

Table 1 Demographic variables of the study population

associated with BMI: monthly household income (coef=0.254; 95% CI: 1.016 to 1.509) and the mother's schooling (coef=0.168; 95% CI: 0.356 to 0.915) (**Table 2**). In the final multiple regression model (**Table 3**), BMI was influenced by monthly household income (coef=0.223; 95% CI: 1.014 to 1.503).

Dependent variable	Independent variable	Standard error	Coef	95% CI (Lower–Upper)	*p*
BMI	Age	0.191	0.052	-0.456–0.036	0.455
	Sex	0.254	0.075	-0.166–0.54	0.115
	Household income	0.234	0.254	-0.159–1.016	0.001
	Mother's schooling	0.186	0.168	-0.569–0.356	0.001

Table 2 Simple linear regression using the association test for independent variables and BMI

Dependent variable	Independent variable	Standard error	Coef	CI (Lower)	*p*
BMI	Monthly household income	0.266	0.223	1.014	0.0001

Table 3 Multiple linear regressions (stepwise method) for independent variables and BMI

Discussion

Childhood obesity is a major risk factor for adulthood obesity [10]. In this study, for the first time we evaluated the association of socioeconomic gradients with obesity in children from primary school in Ardebil. In the present study, a higher monthly household income was associated with a higher BMI among children aged 6 to 11 years. Different results are found regarding the association between SES and obesity. In this study, children from higher monthly household income families had a higher BMI. The role of parental education in the food consumption of children is a key factor that influences obesity in children [11-13]. Walsh, in one study, indicated that the majority of the inequality in childhood obesity is explained by parental level variables [14]. His results show that the socioeconomic gradient is more pronounced for obesity in children. The extensive range of variables assessed within our dataset allows us to deconstruct the socioeconomic inequalities into their specific determinants, facilitating a more in-depth analysis and understanding of childhood obesity prevalence rates. It is important that the factors underpinning socioeconomic inequalities in child obesity prevalence rates are understood and this is the first time such a decomposition analysis has been undertaken for obesity in a childhood population in a developed country. To date, results regarding the association between the higher educational level of the mother with better knowledge of food and its nutritional information, and therefore, with a higher likelihood of preferring healthy and less energy-dense foods, are consistent [15].

Studies indicate that in developing countries obesity is more prevalent in children from families with a higher SES and whose mothers have a higher level of schooling, which may be related to a greater availability of foods [16].

This seems to be typical behavior in regions that are in economic transition, where a higher income is associated with an increase in the number of individuals who are overweight and obese and this tends to change in subsequent transition phases, with an increase in the prevalence of overweight and obesity among poorer portions of the population [17]. Studies conducted mainly in developed countries report that obesity is less prevalent among children in families with a higher SES, which is related to greater access to information on healthier dietary patterns and physical exercise [18]. A study limitation here was that it did not take into account energy expenditure and physical activity in terms of controlling for confounding factors in obesity. Another limitation was that this study was cross-sectional, so we cannot determine the causal relationships.

Conclusion

Children living in a household with a higher monthly income had a higher BMI.

Conflict of Interest

The authors declare no conflicts of interest.

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