



Childhood overweight and obesity in Bariloche, Argentina: Beyond eating habits and physical activity

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ABSTRACT

The incidence of overweight and obesity is alarming worldwide. In Argentina, multifactorial studies are scarce despite the high rates of childhood overweight and obesity (OW/OB). In this study we assessed the prevalence of childhood OW/OB and the associated risk factors from a multicausal perspective: we analyzed sleep habits, screen use, chronic stress in children and their caregivers, social relationship problems, eating habits, and physical activity.

Of the 397 first and seventh graders who completed the questionnaires, 41% had childhood OW/OB. In children with obesity, a lower level of physical activity, a lower consumption of protective foods, a higher risk for sleep disorders, higher levels of chronic stress (in both children and their caregivers), and higher rates of peer rejection were observed. Widespread use of screens before bedtime was noted in most children.

This study evidences the diversity of factors associated with childhood OW/OB and highlights the convenience of a multidimensional approach to address it. In addition, the results of this study suggest the need to consider lifestyle habits as a preventive and therapeutic strategy for the management of OW/OB from early stages.

Keywords: *childhood obesity; psychological stress; sleep habits; lifestyle.*

doi: <http://dx.doi.org/10.5546/aap.2022-02854.eng>

To cite: D'Adamo P, Garibotti G, Leive L, Guaresti G, et al. Childhood overweight and obesity in Bariloche, Argentina: Beyond eating habits and physical activity. *Arch Argent Pediatr* 2023;121(5):e202202854.

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Funding: School of Medical Sciences of Universidad Nacional del Comahue.

Conflict of interest: None.

Received: 9-14-2022

Accepted: 11-17-2022



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INTRODUCTION

Childhood overweight and obesity (OW/OB) is a serious public health problem that intensifies over time. In Argentina, 41% of the pediatric population has OW/OB.¹ Approaches to this problem have mostly focused on reducing calorie intake and increasing energy expenditure.² However, despite various efforts, a notable increase in the prevalence of childhood OW/OB in the region continued to be observed in the clinical setting: in Bariloche, 30% of the local pediatric population had OW/OB in 2018.¹

Obesity results from a complex, multifactorial structure: it may be associated with lifestyles that tend to deregulate diet, sleep, and physical activity schedules, together with emotional dysregulation.³ Recent studies show that some sleep disorders lead to inflammatory diseases that worsen obesity.^{4,5} For example, it has been observed that short sleep duration can increase the risk for obesity.⁶ Furthermore, sleep disturbances increase chronic stress and anxiety in both adults and children, factors that have been associated with obesity.⁷ Moreover, parental stress has been found to be associated with weight gain in their children.⁸ In addition, several studies have addressed the relationship between interpersonal relations and obesity, and highlight how the latter may even lead to social stigmatization.⁹ Another factor that has been associated with obesity is screen use; excessive use of electronic devices may promote a sedentary lifestyle and interfere with adequate quantity and quality of sleep.¹⁰

The aforementioned factors show the need for a multifactorial approach to childhood OW/OB that allows us to go beyond the individual analysis of each child's situation and thus favor strategies that promote psychological and physical health.

In this study, in addition to nutritional and physical activity aspects, sleep habits, screen use, stress perceived by children and their caregivers, and social integration among peers were assessed. Our objective was to assess the prevalence of childhood OW/OB in a population of first and seventh graders attending public schools in Bariloche, and to analyze its relationship with these parameters.

METHODS

This was a cross-sectional, analytical study. First and seventh graders (6–7 and 12–13 years of age, respectively) from seven public schools in Bariloche participated during 2019.

As part of the School Health Program,

pediatricians from Hospital Bariloche weighed and measured the children. Their body mass index (BMI) and Z-score (BMI Z-score) were estimated (WHO REF). They were classified into normal weight (NW) ($-2 < \text{BMI Z-score} < 1$), overweight (OW) ($1 \leq \text{BMI Z-score} < 2$), obese (O) ($\text{BMI Z-score} \geq 2$), or underweight ($\text{BMI Z-score} \leq -2$). The following questionnaires were then delivered, and completed by the children and their caregivers:

- a. Sociodemographic characteristics. Children's age and sex, and maximum level of education attained by the mother.
- b. Dietary habits. Frequency of consumption of the different food groups in the past month, based on the Dietary Guidelines for the Argentine Population.¹¹
- c. Sleep. BEARS sleep disorder screening questionnaire for children aged 6–12 years. It asks about 5 main areas of sleep: bedtime issues, excessive daytime sleepiness, frequent night awakenings, insomnia/nightmares, and snoring. It includes 1 question per area with a dichotomous answer (yes/no). A single affirmative answer is indicative of risk and assessment of that area is recommended.¹²
- d. Screen use. Use of television, computer, tablet, or mobile phone 1 hour before bedtime.
- e. Physical activity. Pictorial Children's Physical Activity Questionnaire: self-perception of physical activity (low, medium, high) during the week, on weekends, at school, and outside school.¹³
- f. Perceived stress among seventh graders. Children's Daily Stress Inventory: perception of self-image problems, health, and daily problems in the academic, family, and peer relations domains.¹⁴ It is made up of 25 dichotomous answer items (yes/no) and its goal is to assess stressors in daily life in children aged 6–12 years. A total score is obtained for each child by adding the number of affirmative responses (Yes = 1, No = 0) and then an average score is estimated for each nutritional status. A higher score is associated with a higher level of stress.
- g. Stress perceived by caregivers (mother/father/legal guardian). The Perceived Stress Scale analyzes the frequency with which people perceive stressful situations in their daily lives.¹⁵ This parameter is widely used to estimate the extent to which people feel they are in control of life situations or feel overwhelmed by them. The scale is made

up of 14 items that assess the frequency of different situations experienced in the past month. Each item is rated on a 5-point Likert-like scale (0 = never, 1 = almost never, 2 = occasionally, 3 = often, 4 = very often). The total scale is scored from 0 to 56. A higher score is associated with a higher level of stress.

- h. Social integration. Peer social relations were assessed using a sociometric analysis that allows to estimate how each child's social networks are structured within a group: number of peers with whom they choose to play and number of peers whom they reject.¹⁶ This method is widely used to assess acceptance and rejection among peers, based on simple questions that children answer spontaneously, thus capturing the dynamics of social relations within a group.

Ethical aspects

The research protocol was approved by the Provincial Commission for the Assessment of Human Health Research Projects, Ministry of Health of the Province of Río Negro, Resolutions no. 2762/19 and 8217/21. Participants provided their informed consent before completing the questionnaire.

Statistical analyses

The sociodemographic characteristics were described using contingency tables; the difference by nutritional status was assessed using the χ^2 test.

The differences in the distribution of factors related to dietary habits, sleep, physical activity, and stress according to nutritional status were assessed using the χ^2 test.

The analysis of the factors considered associated with the presence of overweight and obesity was studied by means of univariate logistic regression models. For these analyses, categorical factors were dichotomized.

Statistical analyses were performed using the R statistical package, version 4.2.1.

RESULTS

A total of 397 children participated in the study. Of these, 51.9% corresponded to first graders and 48.1%, to seventh graders (*Table 1*). Forty-one percent (41%) of the studied population had childhood OW/OB (36.8% of first graders and 45.2% of seventh graders). No significant sex differences were observed in either first graders ($p = 0.13$) or seventh graders ($p = 0.30$).

Dietary habits

Significant differences were observed in the consumption of fruits ($p = 0.05$), vegetables ($p = 0.00$), whole grains or legumes ($p = 0.02$), and tree nuts ($p = 0.01$) according to their nutritional status (*Figure 1*). Among obese children, 14.3% consumed fruits less than once a week, compared to 2.6% of children with overweight and to 4.0% of children with normal weight. Among obese children, 22.7% consumed vegetables less than once a week, compared to 10.8% of children with overweight and to 13.6% of children with normal weight. Almost 70% of children with normal weight consumed whole grains or legumes 3 times a week or less, and this percentage was higher in children with obesity (84.3%). Tree nuts were consumed 3 times a week or less by 82.9% of the children, a percentage that rose to 90.6% among children with obesity.

Children who eat fruits, vegetables, grains or legumes, tree nuts, and fish less than once a week are 2.0 to 4.5 times more likely to be obese than those who eat them more frequently (*Table 2*).

Approximately 50% of the children ate while watching TV 4 times a week or more. Those who eat while watching TV every day are 1.7 times more likely to be obese (*Table 2*).

Sleep

Significant differences were observed in the BEARS screening tool based on nutritional status ($p = 0.03$): children with obesity are more likely to have 3 or more risk items (*Table 3*). At least 1 risk item was observed in 92.4% of the participants.

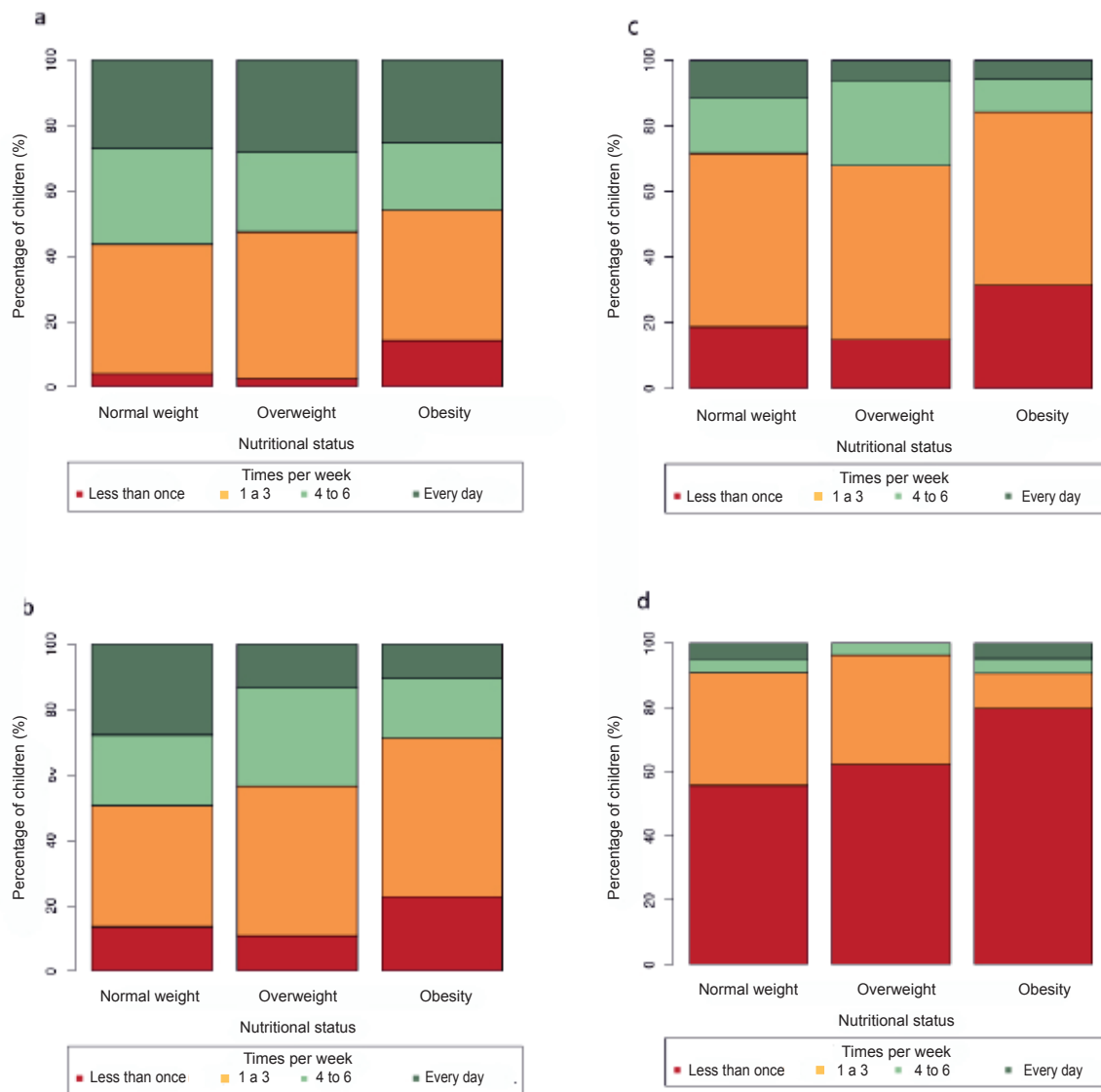
Screen use

It was observed that 86.4% of the children used screens before bedtime. This percentage varied depending on their age: 83% among first graders and 91% among seventh graders ($p = 0.0284$). No significant differences were observed by nutritional status ($p = 0.7091$).

Physical activity

A low level of physical activity during the week was reported in 5.6% of the children; this percentage rose to 24.0% on weekends. A low level of physical activity outside school was reported in 22.7% of the children; this percentage was 23.1% among children with normal weight and 34.3% among obese children ($p = 0.01$).

Figure 1. Consumption of fruits, vegetables, whole grains or legumes, and tree nuts in relation to nutritional status



A: Consumption of fruits ($p = 0.0450$); B: Consumption of vegetables ($p = 0.0025$); C: Consumption of whole grains or legumes ($p = 0.0235$); D: Tree nuts ($p = 0.0055$).

TABLE 1. Demographic data and nutritional status in children

	Total		Nutritional status						p value
			NW		OW		OB		
	n	%	n	%	n	%	n	%	
Sex									0.1784
Female	200	50.1	118	59.9	49	24.9	30	15.2	
Male	197	49.6	114	58.8	38	19.6	42	21.6	
Grade									0.2124
First	206	51.9	129	63.2	42	20.6	33	16.2	
Seventh	191	48.1	103	54.8	45	23.9	40	21.3	

NW: normal weight; OW: overweight; OB: obesity.

TABLE 2. Association of dietary habits, sleep, physical activity, and stress factors with overweight and obesity

	Overweight N = 87	Obesity N = 73
Dietary habits†		OR (95% CI)
Consumption of fruits less than once a week	NS	4.4 (1.7, 11.6)
Consumption of vegetables less than once a week	NS	2.0 (1.0, 3.8)
Consumption of grains or legumes less than once a week	NS	2.1 (1.2, 3.8)
Consumption of tree nuts less than once a week	NS	2.5 (1.3, 5.0)
Consumption of fish less than once a week	NS	2.9 (1.5, 5.8)
Consumption of cold cuts less than once a week	0.6 (0.3, 0.9)	NS
Breakfast at home less than once a week	NS	2.8 (1.6, 4.9)
Uncommon family meals less than once a week	NS	NS
Eating while watching TV every day	0.5 (0.3, 0.9)	1.7 (1.0, 2.9)
Sleep		
BEARS: three or more risk items	NS	2.2 (1.0, 4.3)
Screen use before bedtime	NS	NS
Physical activity		
Little physical activity during the week	NS	NS
Little physical activity during the weekend	NS	NS
Little physical activity outside the school	NS	1.9 (1.0, 3.3)
Stress		
As perceived by seventh graders	NS	1.1 (1.0, 1.3)
As perceived by parents	NS	1.0 (1.0, 1.1)

†In relation to foods, only those significantly associated with overweight or obesity are reported. Significant odds ratios from univariate logistic regression models are shown. NS: not significant; OR: odds ratio; CI: confidence interval.

TABLE 3. Results of the BEARS sleep screening questionnaire, overall and in relation to nutritional status

	Nutritional status								
	Total		NW		OW		O		p value
	n	%	n	%	n	%	n	%	
BEARS									0.0840
0	30	7.6	16	6.9	5	5.7	9	12.3	
1	221	55.7	136	58.6	51	58.6	30	41.1	
2	103	25.9	56	24.1	26	29.9	21	28.8	
3	32	8.1	18	7.8	5	5.7	9	12.3	
4 or more	11	2.8	6	2.6	0	0.0	4	5.5	

NW: normal weight; OW: overweight; O: obesity.

Perceived stress

Significant differences were observed among seventh graders by nutritional status ($p = 0.02$): the average perceived stress of children with obesity (8.3) was higher than that perceived by those with overweight (6.7) and normal weight (6.3).

The average perceived stress of caregivers was 20.9 points (range: 0 to 46). Significant differences were observed in relation to nutritional status ($p = 0.02$). The average perceived stress

of caregivers of obese children was higher (22.8) than that perceived by those of overweight children (19.3).

Social integration

Peer rejection was higher among children with obesity (44%) than among those with normal weight (32%) or overweight (36%); such difference was not significant ($p = 0.06$), although a marked tendency was noted.

DISCUSSION

This study reports several risk factors associated with childhood OW/OB among first and seventh graders attending public schools in Bariloche. The consumption of protective foods, physical activity outside school, sleep habits, perceived stress, and peer relations seem to be related to obesity in these developmental stages. The diversity of factors associated with this problem suggests the importance of integrating individual, sociocultural, and ecological aspects, such as lifestyle, habits, and routines. Taking into account dietary quality, physical activity, healthy sleep habits, and stress coping strategies may contribute to the promotion of greater well-being and quality of life during childhood. This perspective is in line with recommendations from previous studies, which highlight the importance of a multifactorial approach to childhood OW/OB from early stages,¹⁷ including family participation in changing habits.¹⁸

It is worth mentioning that the diet of children with different nutritional statuses showed differences only in relation to the consumption of protective foods; i.e., children with obesity consumed fewer vegetables, fruits, fish, legumes, and seeds than the other children. However, no differences were observed in the consumption of sugars and fats. This highlights the importance of promoting the consumption of protective foods and not just restricting calorie intake. In addition, eating while watching TV every day was associated with an increased risk for obesity.

Our findings revealed that children with obesity are more likely to have a greater risk for sleep disorders, which confirms previous results showing the relationship between poor sleep quality and obesity.¹⁹ These disorders involve an alteration in the organization of circadian rhythms and their synchronization with the socio-environmental setting.⁶ It is concerning that almost all children (90%), regardless of their nutritional status, had at least one sleep risk indicator, as is the generalized screen use before bedtime. Some studies have reported sleep disturbances in the pediatric population as a consequence of excessive screen use,²⁰ especially before bedtime.²¹ This is alarming and highlights the urgent need for prevention based on the recommendations for screen use of less than 2 hours per day and their elimination from the bedroom.¹⁸ Sleep health education programs during childhood and behavioral interventions implemented with families, at school or as part

of community workshops²² may help to raise awareness about this alarming situation. Likewise, we suggest the introduction of sleep disorders screening in the initial consultation of children with OW/OB in order to work with families on the organization of daily life in regular schedules that allow adequate rest. Previous studies have shown that specific interventions aimed at improving sleep duration may impact both sleep and nutritional status.^{23,24}

The levels of physical activity observed here were similar in all groups during weekdays, but were lower in the obese population on weekends. This fact highlights the key role played by schools in relation to physical activity and the importance of favoring diverse bodily activities that are appealing to children with obesity.

The results in relation to perceived stress are consistent with studies that established an association between chronic stress and childhood obesity.^{7,25} The higher level of stress found in children with obesity leads us to reflect on the need to seek, together with the families, possible strategies that may bring about changes in their daily lives. In this regard, some studies have demonstrated a beneficial effect of teaching stress coping strategies and emotional regulation in the treatment of obesity from early stages.⁷

Conflicts among peers are a significant stressor in childhood.^{2,9} A tendency of a higher rate of peer rejection towards children with obesity has been observed and suggests the presence of difficulties in terms of social integration, a problem that has been documented in several studies related to stigmatization issues.⁹ In turn, it has been observed that such social stigma may result in greater physiological stress;² thus creating a vicious circle in which stress contributes to obesogenic processes and obesity, which in turn cause, through social stigmatization, more stress. It may be interesting to introduce tools that favor greater emotional regulation, as well as the development of social networks, which are clear examples of strategies that tend to reduce stress and favor resilience and social relations.^{26,27}

Here we reflect on how to approach childhood OW/OB in primary care, where a change of strategy focused initially on the perception of well-being of children and their families, and on their possibilities to manage changes in their daily lives, may result in a more comprehensive approach to such a complex problem.

The strengths of this study are related not only to the diversity of variables analyzed, but

also to the interdisciplinary and inter-institutional collaboration in the planning and conduct of this project. In addition, the use of internationally validated surveys allows for the reproducibility of the study. However, the use of self-reporting may be questioned due to potential response biases. In addition, genetic and cultural factors have not been taken into account, and only first and seventh graders from public schools have been studied. Although such age groups are representative of 2 key periods of primary education, it would be interesting to record also the nutritional status of children of other ages. Given that the COVID-19 pandemic seems to have increased the incidence of childhood OW/OB, it would be convenient to assess these parameters at present.

CONCLUSIONS

Forty-one percent (41%) of the studied population had childhood OW/OB. Obese children consumed fewer protective foods, did less physical activity outside school, and had more items indicative of sleep risk than those who had normal weight/overweight. Obese children in seventh grade had a higher level of perceived stress. It is worth noting a generalized use of screens before bedtime, as well as a higher risk for obesity in children who eat while watching TV every day. ■

Acknowledgments

We would like to thank the School Health Program, the management of Hospital Zonal Bariloche and its health centers for actively helping with data collection, and the schools and children who participated in the study.

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