

## Brief original article

## Multiple lifestyle risk behaviours and excess weight among adolescents in Barcelona, Spain

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## ABSTRACT

**Objective:** We aimed to analyse the prevalence of having multiple lifestyle risk behaviours (LRB) and the potential relationship between excess weight (including overweight and obesity) and cumulative multiple LRB among adolescents in Barcelona, Spain.

**Methods:** A cross-sectional study was performed among a representative sample of 3,114 secondary school students in Barcelona. Height and weight were objectively measured and excess weight was defined in accordance with World Health Organization criteria. Information on screen time, breakfast, physical activity and sleep duration was obtained through a self-administered questionnaire.

**Results:** More than 80% of the students had at least two LRBs. In compulsory schooling, the adjusted prevalence ratio (aPR) of excess weight increased with a higher number of reported LRBs (four LRBs: aPR = 1.56; 95% confidence interval: 1.19–2.05).

**Conclusions:** These results highlight the importance of a multiple-behaviour approach in preventive programmes aimed at reducing adolescent obesity.

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## Múltiples conductas de riesgo y exceso de peso en adolescentes de Barcelona, España

## RESUMEN

**Objetivo:** Estimar la prevalencia de adoptar múltiples conductas de riesgo y analizar la potencial asociación entre exceso de peso y adopción de conductas de riesgo en adolescentes de Barcelona, España.

**Métodos:** Estudio transversal realizado a una muestra representativa de 3114 estudiantes de secundaria de Barcelona. Se obtuvieron medidas objetivas de peso y altura, y se definió el exceso de peso según criterios de la Organización Mundial de la Salud. Las conductas de riesgo analizadas fueron el tiempo delante de pantallas, las horas de sueño, el desayuno y la actividad física, obtenidas mediante un cuestionario autoadministrado.

**Resultados:** Más del 80% de los estudiantes declaró adoptar al menos dos conductas de riesgo. En estudiantes de educación secundaria obligatoria, la razón de prevalencia ajustada (RPa) de presentar exceso de peso aumentaba con el número de conductas de riesgo adoptadas (cuatro conductas de riesgo: RPa = 1,56; intervalo de confianza del 95%: 1,19-2,05).

**Conclusiones:** Los resultados muestran la importancia de un enfoque multicomponente en los programas de prevención de la obesidad infantojuvenil.

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## Palabras clave:

Tiempo delante de pantallas

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## Introduction

Obesity is a major public health concern worldwide. Over the last decade, some strategies have been implemented to decrease obesity among adolescents.<sup>1</sup> However, in Spain, 24.9% of boys

and 17.4% of girls aged 10 to 17 years old were overweight or obese in 2011–2012.<sup>2</sup> Although scientific evidence shows higher prevalences of obesity among adolescents living in rural areas, the prevalence in urban areas is not negligible.<sup>3</sup> Moreover, there is no consistent evidence of differences between rural and urban areas in potential obesogenic behaviours.<sup>4</sup>

Excess weight has been strongly associated with skipping breakfast<sup>5</sup> and low physical activity (PA) levels.<sup>6</sup> Additionally, although the reported relationships are not totally consistent, previous studies have also shown a positive association with higher

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levels of screen time<sup>6</sup> and short sleep duration.<sup>7</sup> Furthermore, gender differences have been found. Boys are less likely to meet food consumption and screen time guidelines and skip breakfast<sup>7</sup> while girls are less likely to meet PA and sleep duration guidelines.<sup>8</sup> Studies assessing the association between excess weight and multiple lifestyle risk behaviours (LRB) with a gender perspective could be relevant to address these factors in preventive programs.

This study aimed to analyse the prevalence of having multiple LRB among adolescents and the potential relationship between excess weight (including overweight and obesity) and cumulative multiple LRB among adolescents in Barcelona, Spain.

## Methods

A cross-sectional study was carried out among a representative sample of 3,492 students in compulsory (year 8 [13–14 year-olds] and year 10 [15–16 year-olds]) and post-compulsory (year 12 [17–18 year-olds]) education attending secondary schools in Barcelona. Classrooms (sample unit) were randomly selected considering nine strata according to the type of school (state/private/subsidized) and the socioeconomic status (SES) of the school's neighbourhood (low/medium/high). The schools that declined to participate ( $n = 11$ ) were replaced. In the study, 164 classrooms were included. Data were collected during the 2011–2012 academic year through a lifestyle risk factors survey (*Factores de Riesgo en Escolares* [FRESC]). The questionnaire was anonymous and self-reported.<sup>9</sup> The study was approved by the Research Committee of the Public Health Agency of Barcelona.

### Dependent variable

Weight status was defined using age- and sex-specific body mass index (BMI) cut-offs.<sup>10</sup> The variable was categorized as underweight, normal weight, overweight and obesity. Height and weight were objectively measured.

### Independent variables

Four self-reported lifestyle behaviours were obtained: 1) screen time, 2) breakfast, 3) PA, and 4) sleep duration. Based on health-behaviour recommendations, a dichotomous variable was created for each behaviour. The following LRB were considered: 1) excessive screen time ( $\geq 2$  h/day); 2) skipping breakfast before leaving home; 3) low PA ( $< 1$  h/day of moderate-to-vigorous PA); and 4) short sleep duration ( $< 8$  h/day on a school day). The number of the LRB was calculated in a new variable of multiple LRB (score range: 0–4) by adding the four LRB considered when the answer was positive.

The socio-demographic variables included were age, sex, the student's Family Affluence Scale (FAS), type of school, and the SES of the school's neighbourhood.

### Statistical analysis

Students with missing values in any of the variables used to create the multiple LRB index were excluded ( $n = 378$ ; 10.8%). Characteristics of excluded students were not statistically different.

Frequencies and percentages were calculated. The dependent variable was dichotomized into underweight or normal weight and excess weight (referring both overweight and obesity). Multivariate Poisson regression models with robust variance were conducted to estimate associations between excess weight and LRB,<sup>11</sup> obtaining adjusted prevalence ratios (aPR). Regarding the variable multiple LRB, the 0- and 1-risk behaviour categories were collapsed since the percentage of students without LRB was too low

(<2%) to be analyzed as a single category. All multivariate models were firstly conducted stratifying by sex and grade. However, since the PR estimates obtained for boys and girls were almost identical, all models were adjusted by socio-demographic variables stratifying by grade. All analysis were conducted using STATA v10.

## Results

Of the 3,114 students analysed, 51.5% were girls and the mean age was 15.9 years. In compulsory schooling, the prevalence of excess weight (including overweight and obesity) was 32.4% in boys and 23.0% in girls ( $p < 0.001$ ). In the post-compulsory schooling, 23.7% of boys and 15.1% of girls were overweight ( $p = 0.001$ ) (Table 1).

Less than 2% of students had no one LRB. 80.4% of boys and 85.4% of girls in compulsory schooling ( $p = 0.002$ ) and 94% of students in post-compulsory schooling had  $\geq 2$  LRB. The prevalence of 4 LRB in compulsory schooling was 10.4% in boys and 17% in girls ( $p < 0.001$ ). In post-compulsory schooling, these percentages were 23.2% and 29.0%, respectively (Table 1).

In compulsory schooling, the aPR of excess weight increased with the number of LRB reported. The highest probability of excess weight was found among students with 4 LRB (aPR = 1.56; 95% confidence interval: 1.19–2.05) (Table 2).

## Discussion

This study shows that more than 80% of students have multiple LRB, observing a higher prevalence of multiple LRB in girls. Additionally, excess weight is positively associated with a higher number of LRB among students in compulsory schooling.

In general, adolescents fail to meet health-behaviour guidelines. More than 50% of Swiss adolescents do not meet health-behaviour guidelines when considering screen time, PA and diet.<sup>12</sup> Likewise, nearly 80% of the US adolescents have multiple dietary and PA risk behaviours.<sup>13</sup> Similarly, we found that more than 80% of the adolescents were involved in  $\geq 2$  LRB. Additionally, among the compulsory schooling students, we found a higher prevalence of multiple LRB in girls. Although the Swiss study<sup>12</sup> did not show gender differences, other published studies<sup>13,14</sup> are in line with the gender differences observed in our study.

PA and short sleep duration were not associated with excess weight. The PA reported by the students referred to exercise that implied physical effort. Accordingly, not all the sources of PA were assessed, such as walking to/from school, which has been related to excess weight.<sup>15</sup> This underestimation of PA could partly explain the lack of association.

In compulsory education, we found that the prevalence of being excess weight was more than 32% higher among adolescents who reported  $\geq 1$  LRB. This percentage rose to 56% in adolescents reporting 4 LRB. The analysis conducted for boys and girls separately showed similar aPR for both sexes. Similarly to our results, a US study showed that adolescents with a higher number of LRB were more likely to be overweight, when analysing watching television, PA and fruit/vegetable intake.<sup>13</sup> Finally, a study performed among Spanish adolescents<sup>14</sup> found that the combination of not meeting the recommendations for PA, television watching, sleep duration and meal frequency was associated with higher levels of body fat and excess weight.

This study has some limitations. First, LRB data were self-reported, which could lead to an information bias. However, anonymous questionnaires were used to minimize this bias. Second, there was a high percentage of missing data (10%) when the variable multiple LRB was built. However, no differences were found between included and excluded students. A strength of this

**Table 1**  
Distribution of lifestyle risk behaviours and weight status among secondary school students (13-19 years-old) by grade and sex. FRESC Survey<sup>a</sup> 2012, Barcelona (Spain).

	8th and 10th years (compulsory) (n=2,143)				12th year (post-compulsory) (n=971)			
	Boys % (n)	Girls % (n)	p value <sup>b</sup>	Total	Boys % (n)	Girls % (n)	p value <sup>b</sup>	Total
<b>Weight status<sup>c,d</sup></b>								
Underweight/normal weight	67.6 (723)	77.0 (822)	<0.001	72.2 (1,545)	76.3 (336)	84.9 (448)	0.001	81.0 (784)
Overweight	22.7 (243)	17.6 (188)		20.2 (431)	18.9 (83)	10.6 (56)		14.4 (139)
Obesity	9.7 (104)	5.4 (58)		7.6 (162)	4.8 (21)	4.5 (24)		4.6 (45)
<b>Excessive screen time (TV, videogames or computer) (<math>\geq 2</math> h/day)<sup>e</sup></b>								
No	21.3 (228)	28.3 (303)	<0.001	24.8 (531)	18.0 (79)	25.8 (137)	0.003	22.3 (216)
Yes	78.7 (843)	71.7 (769)		75.2 (1,612)	82.0 (361)	74.2 (394)		77.7 (755)
<b>Skipping breakfast before leaving home at least once a week</b>								
No	69.4 (743)	57.8 (620)	<0.001	63.6 (1,363)	59.3 (261)	52.0 (276)	0.022	55.3 (537)
Yes	30.6 (328)	42.2 (452)	<0.001	36.4 (780)	40.7 (179)	48.0 (255)		44.7 (434)
<b>Low moderate to vigorous physical activity (&lt;1 h/day)</b>								
No	20.5 (220)	7.0 (75)		13.8 (295)	15.3 (67)	4.7 (25)	<0.001	9.5 (92)
Yes	79.5 (851)	93.0 (997)		86.2 (1,848)	84.8 (373)	95.3 (506)		90.5 (879)
<b>Short sleep duration (&lt;8 h/day)</b>								
No	60.6 (649)	54.9 (589)	0.008	57.8 (1,238)	22.1 (97)	25.8 (137)	0.173	24.1 (234)
Yes	39.4 (422)	45.1 (483)		42.2 (905)	77.9 (343)	74.2 (394)		75.9 (737)
<b>Multiple Lifestyle Risk Behaviour Index<sup>f</sup></b>								
0 risk behaviours	1.8 (19)	0.7 (8)	<0.001	1.2 (27)	0.2 (1)	0.0 (0)	0.193	0.1 (1)
1 risk behaviour	17.8 (191)	13.8 (148)		15.8 (339)	5.5 (24)	5.8 (31)		5.7 (55)
2 risk behaviours	41.2 (441)	35.2 (377)		38.2 (818)	26.1 (115)	25.6 (136)		25.8 (251)
3 risk behaviours	28.8 (309)	33.3 (357)		31.1 (666)	45.0 (198)	39.6 (210)		42.0 (408)
4 risk behaviours	10.4 (111)	17.0 (182)		13.7 (293)	23.2 (102)	29.0 (154)		26.4 (256)

<sup>a</sup> FRESC Survey [*Factores de Riesgo en Escolares* (Risk Factors in Schoolchildren)].<sup>b</sup> p value for the chi-squared test.<sup>c</sup> Missing values <0.5%.<sup>d</sup> Age- and sex-specific body mass index z-score cut-offs defined by the World Health Organization.<sup>e</sup> Watching television, playing videogames or using the computer for leisure purposes  $\geq 2$  h/day.<sup>f</sup> Lifestyle risk behaviours considered: exceeding screen time recommendations ( $\geq 2$  h/day), skipping breakfast at least once a week, not following physical activity recommendations (<1 h/day) and not sleeping the recommended amount of time (<8 h/day).**Table 2**  
Prevalence of overweight (refers to overweight and obesity) according to lifestyle risk behaviours and association between excess weight<sup>a</sup> and multiple lifestyle risk behaviours among secondary school students by grade. FRESC Survey<sup>b</sup> 2012, Barcelona (Spain).

	8th and 10th years (compulsory)		12th year (post-compulsory)	
	% (n)	aPR <sup>c</sup> (95%CI)	% (n)	aPR <sup>c</sup> (95%CI)
<b>Excessive screen time (TV, videogames or computer) (<math>\geq 2</math> h/day)<sup>d</sup></b>				
No	21.1 (112)	1	14.4 (31)	1
Yes	29.9 (481)	1.27 (1.05-1.53)	20.4 (153)	1.27 (0.89-1.80)
<b>Skipping breakfast before leaving home at least once a week</b>				
No	25.9 (352)	1	18.5 (99)	1
Yes	30.9 (241)	1.26 (1.10-1.45)	19.6 (85)	1.06 (0.82-1.38)
<b>Low moderate to vigorous physical activity (&lt;1 h/day)</b>				
No	30.5 (90)	1	26.4 (24)	1
Yes	27.3 (503)	0.98 (0.81-1.20)	18.2 (160)	0.82 (0.55-1.22)
<b>Short sleep duration (&lt;8 h/day)</b>				
No	28.3 (350)	1	16.3 (38)	1
Yes	27.0 (243)	1.05 (0.91-1.21)	19.9 (146)	1.23 (0.89-1.69)
<b>Multiple Lifestyle Risk Behaviour Index<sup>e</sup></b>				
0-1 risk behaviours	21.3 (78)	1	20.0 (11)	1
2 risk behaviours	28.6 (234)	1.32 (1.05-1.66)	15.1 (38)	0.77 (0.43-1.41)
3 risk behaviours	29.1 (193)	1.42 (1.12-1.79)	20.4 (83)	1.00 (0.57-1.75)
4 risk behaviours	30.1 (88)	1.56 (1.19-2.05)	20.3 (52)	1.03 (0.58-1.85)

aPR: adjusted prevalence ratio; 95%CI: 95% confidence interval.

<sup>a</sup> Underweight and normal weight were considered as the reference group.<sup>b</sup> FRESC Survey [*Factores de Riesgo en Escolares* (Risk factors in schoolchildren)].<sup>c</sup> Independent models adjusted by sex, age, family affluence scale, type of school and socioeconomic status of school's neighbourhood.<sup>d</sup> Watching television, playing videogames or using the computer for leisure purposes  $\geq 2$  h/day.<sup>e</sup> Lifestyle risk behaviours considered: exceeding screen time recommendations ( $\geq 2$  h/day), skipping breakfast at least once a week, not following physical activity recommendations (<1 h/day) and not sleeping the recommended amount of time (<8 h/day).

study is that it has been performed in a representative sample of in-school adolescents in an urban European context. Moreover, weight status was defined from objective measures, which guarantees the validity of the dependent variable.

The high prevalence of adolescents with multiple LRB should be considered to tackle obesity. The results obtained highlight the importance of considering a multiple-behaviours approach in school-based preventive programs focused on controlling excess weight in adolescents.

#### What is known about the topic?

In general, adolescents fail to meet health-behaviour guidelines related to physical activity, sedentary behaviour, sleep time and eating habits, which have been individually associated with excess weight. However, studies analysing the association between overweight and the adoption of multiple lifestyle risk behaviours are scarce in our context.

#### What does this study add to the literature?

More than 80% of adolescents have multiple lifestyle risk behaviors when considering physical activity, screen time, breakfast and sleep time. The hazard of excess weight (including being overweight and obese) increases with a higher number of lifestyle risk behaviors adopted, being up to 56% when having the four lifestyle risk behaviors. Findings indicate the need of a multiple-behaviors approach in school-based prevention programs addressed at reducing adolescent excess weight.

#### Editor in charge

María Teresa Ruiz-Cantero.

#### Authorship contributions

X. Contiente participated in the concept and design of the work, data analysis and interpretation and drafted the manuscript. A. Pérez and M.J. López contributed to the design of the survey, participated in the concept and design of the work, helped to interpret data and critically revised the manuscript. A. Espelt and C. Ariza participated in the concept and design of the work, helped to interpret data and critically revised the manuscript. All authors approved the final manuscript as submitted.

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#### Conflicts of interest

None.

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