


# Psychosocial health of adolescents in relation to underweight, overweight/obese status: the EU NET ADB survey

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**Background:** Both deviations from normal weight, namely, underweight and overweight/obese status, have been inversely associated with psychosocial health in adolescents. This study aimed to examine the relationship between psychosocial health and body mass index (BMI) among adolescents in five European countries, while assessing the effect of sociodemographic variables. **Methods:** A cross-sectional school-based study of adolescents aged 14–17.9 years was conducted in the framework of the European Network for Adolescent Addictive Behavior survey. Self-reported questionnaires from Greece, Iceland, the Netherlands, Romania and Spain were used for the current analysis. Associations between Youth Self-Report (YSR) scales and BMI status were investigated by multiple logistic regression analysis. The effect of sociodemographic variables was also measured. **Results:** The sample consisted of 7005 adolescents aged 14–17.9 years. Borderline/clinical scores on some YSR scales were independently associated with overweight/obesity, specifically total problems (OR = 1.52, 95% CI: 1.18–1.96), internalizing (OR = 1.48, 95% CI: 1.16–1.91), externalizing (OR = 1.36, 95% CI: 1.10–1.68), social (OR = 1.67, 95% CI: 1.19–2.35) and thought problems (OR = 1.62, 95% CI: 1.20–2.20). Among subscales, overweight/obesity specifically correlated with anxiety/depression (OR = 1.83, 95% CI: 1.33–2.51), withdrawal/depression (OR = 1.58, 95% CI: 1.02–2.48) and rule-breaking behavior (OR = 1.55, 95% CI: 1.15–2.08). Underweight was associated with problems on activities (OR = 1.31, 95% CI: 1.01–1.68) and withdrawal/depression (OR = 1.95, 95% CI: 1.27–3.01). **Conclusions:** Lower levels of psychosocial health are associated with both deviations from normal weight. These findings suggest the need for health policies that target health habits and lifestyle, as well as positive attitudes towards the body image, with respect to the different psychosocial characteristics of each body weight status category.

## Introduction

Adolescence consists of rapid physical and psychosocial transitions; during this developmental stage, adolescents feel the emerging need to build their own personal identity and positive self-image.<sup>1</sup> Psychosocial health in adolescence is a challenging notion, because of numerous effects superimposed to the already existing stress of the transition context.<sup>1</sup> Well-being is the combination of healthy and successful functioning in physical, psychological and behavioral level, positive social relationships with family, peers, social institutions and school, with a social ecology that allows the adolescent to feel a sense of security.<sup>2</sup>

Body image is a very important component of self-image in adolescence,<sup>3</sup> and its main concern pertains to body weight.<sup>3–5</sup> Prior research has shown how crucial body image perception and satisfaction can be in psychosocial health among adolescents.<sup>3,4,6–8</sup> A large number of studies<sup>9–14</sup> have underlined the psychological vulnerability of adolescents who exceed normal weight, while others

have pointed out the vulnerability of underweight adolescents, especially when underweight is related either to undernutrition<sup>10,15,16</sup> in low-income countries or to eating disorders<sup>17–19</sup> or to pressure for fitting in the existing ‘thinness ideal’, in high-income countries.<sup>3,8,17</sup>

Overweight and obese adolescents have received a great attention from modern research because of the impact of excessive weight in many aspects of psychosocial health. Obesity is an alarming public health issue globally; recent findings<sup>20</sup> have shown that, in year 2016, 124 million children and adolescents worldwide were obese. Interestingly enough, compared with obese adolescents, there is limited knowledge about underweight adolescents who have not been as thoroughly investigated in empirical research.<sup>21</sup> Based on empirical findings on a worldwide scale,<sup>22</sup> prevalence of underweight ranges from 5% to ~12% in adolescence, while ages 15–19 years are the most affected.<sup>20</sup>

The present study aims at investigating the relationship between psychosocial health in adolescents and their body mass index (BMI)

status, namely overweight/obesity or underweight vs. normal weight, in the context of the European Network for Adolescent Addictive Behavior (EU NET ADB) survey.

## Methods

### Participants and procedure

The EU NET ADB study is a cross-sectional school-based study which was conducted in seven European countries (Germany, Greece, Iceland, the Netherlands, Poland, Romania and Spain), which differ in matter of socioeconomic and cultural characteristics. The study took place between October 2011 and May 2012 and its methodological protocol was approved by the Ethical Committees of each country, thus leading to a common research protocol.

Each country used the official national lists as sampling frames, stratified by region and population density, to draw a random clustered probability sample. The sample unit was the school class. In case of non-school-based educational systems, the current school structure was used to form clusters, in a similar sampling process. In case there was no national list, classes were selected with probability proportional to size. The aim of obtaining a target number of 2000 adolescents per country was achieved after sampling ~100 9th and 10th grade classes. All students who had a written permission form from their parents or legal guardians and who were present at school in the day of data collection were eligible to participate. Parents and participants were ensured for the confidentiality and anonymity of the information given, to avoid reporting bias. Moreover, students were informed that their participation was voluntary. The detailed methodology of the project can be found in EU NET ADB project report.<sup>23</sup>

The questionnaire used in the study had gone through the processes of cognitive interviewing and pilot testing before administration. In total, 85% of the registered students actually completed the questionnaire, therefore 13 708 adolescents; the remaining 15% were not included due to various reasons (such as absence from school at that day, lack of parental consent, no filling in the questionnaire). The process of completing the questionnaire was supervised by trained research assistants. In the current analysis, participants were excluded if their age was <14 or >18 years ( $n = 112$ ), if they had not reported their age or their gender ( $n = 256$ ), if calculation of their BMI was impossible because of not reported height or weight ( $n = 2488$ ). Moreover, the Youth Self-Report (YSR) data were not available for Germany ( $n = 2410$ ) and Poland ( $n = 1437$ ) for administrative reasons, leaving a total of 7005 adolescents for this analysis. Regarding Romania ( $n = 1646$ ), only data about total scales, namely total competencies, total problems, total internalizing and total externalizing problems, were available.

## Measures

### Sociodemographic variables

The sociodemographic variables investigated for associations with the BMI status were age, gender, parental education of parents—which was considered as a proxy measure for the socioeconomic status (low/middle vs. high), parental marital status (married/living together vs. separated/divorced/single-parent family), school performance based on last year's grades (1–14.9 vs. 15–20) and country.

### Psychosocial health

Psychosocial health was the independent variable of the study. It was measured using the YSR questionnaire for ages 11–18, which is widely used and translated in >100 languages, due to its excellent psychometric properties.<sup>24</sup> It is part of the Achenbach System of Empirical Based Assessment and is used in clinical and school settings, to assess adolescents' emotional and behavioral problems and their competencies as well.<sup>24</sup> Adolescents report their own

functioning by rating how true each of the 112 items is for them, in the present time or within the previous 6 months (0 = absent, 1 = occurs sometimes and 2 = occurs often). Scale and subscale scores are organized in two groups: (i) competence scales (activities, social competence, academic performance and total competence) and (ii) empirically based syndrome scales (anxious/depressed, withdrawn/depressed, somatic complaints, social problems, thought problems, attention problems, rule-breaking/delinquent behavior and aggressive behavior). These syndrome subscales are clustered into the internalizing problems scale (subscales: anxious/depressed, withdrawn/depressed and somatic complaints), externalizing problems scale (subscales: rule-breaking (delinquent) behavior and aggressive behavior), social problems, thought problems, attention problems and total problems scale.<sup>24</sup> In the analysis, adolescents' scores were categorized as either borderline/clinical or normal.

### Body mass index

The students were asked to report their weight and height through the following questions: 'Your weight is . . . kilos' and 'Your height is . . . cm', respectively. BMI status (category) was the dependent variable of the study. For the categories BMI, the sex- and age-specific BMI cut-off values for adolescents, as proposed by Cole *et al.*<sup>25</sup> were used, thus leading to the categorization of each participant as underweight, normal, overweight or obese. BMI was calculated as weight (kg)/[height (m)]<sup>2</sup>.

### Statistical analysis

Categorical variables were presented with relative and absolute frequencies. For the comparison of proportions, chi-square tests were used. Multiple logistic regression analysis was used to explore the association of underweight status or overweight status with YSR scales after adjusting for sociodemographics. Each scale was examined separately in the regression models, adjusting for country, gender, age, highest educational level of the parents, school grades last year and family status, because model diagnostics with two or more scales together in the models indicated that the regression estimates were highly collinear. Adjusted odds ratios are presented from the results of the logistic regression analyses. All *P* values reported are two-tailed. All statistical tests and confidence intervals were corrected for the complex sample design with countries as strata and classes as clusters. Analyses were conducted using SPSS statistical software (version 22.0).

## Results

The sample consisted of 7005 adolescents aged 14–18 years (table 1). In total, 58.7% ( $n = 4112$ ) were younger than 16 years and 41.3% ( $n = 2893$ ) older than 16 years old. In total, 50.1% of the sample were girls ( $n = 3507$ ) and 49.9% boys ( $n = 3498$ ). Participants were drawn from five European countries: Greece ( $n = 1629$ , 23.3%), Spain ( $n = 1492$ , 21.3%), Romania ( $n = 1646$ , 23.5%), the Netherlands ( $n = 844$ , 12.0%) and Iceland ( $n = 1394$ , 19.9%). The educational level of parents was high in 63.5% ( $n = 3941$ ) of participants and low/middle in 36.5% ( $n = 2262$ ). 81.8% of parents ( $n = 5635$ ) were married or living together. Concerning BMI status, 10.0% of adolescents were underweight ( $n = 697$ ), 77.8% had normal BMI status ( $n = 5450$ ), 10.7% were overweight ( $n = 747$ ) and 1.6% were obese ( $n = 111$ ).

Proportions of adolescents being on borderline or clinical range in YSR scales are shown in table 2. In total, 5.9% ( $n = 405$ ) of participants were borderline and 8.0% ( $n = 548$ ) clinical concerning internalizing problems, while the respective proportions were 8.4% ( $n = 578$ ) and 9.6% ( $n = 660$ ) for externalizing problems. Total problems score was borderline in 5.2% ( $n = 353$ ) and clinical in 6.3% ( $n = 428$ ) of the sample.

Univariate analysis for the association of BMI status with YSR scales (table 3) showed significant associations for the following scales: total competences ( $P=0.007$ ), total problems ( $P<0.001$ ), social problems ( $P<0.001$ ), thought problems ( $P<0.001$ ), internalizing problems ( $P=0.001$ ) and their subscales, namely, anxiety/depression ( $P<0.001$ ), withdrawal/depression ( $P=0.001$ ), somatic complaints ( $P=0.042$ ), externalizing problems ( $P<0.001$ ) and their subscales, namely, rule breaking (delinquent) behavior ( $P<0.001$ ) and aggressive behavior ( $P<0.001$ ).

Concerning the results of multiple logistic regression analyses examining the association of BMI status with the YSR subscales (table 4), after adjusting for age, gender, country, grades, parental educational level and parental family status, underweight status was associated with problems on activities (OR = 1.31, 95% CI: 1.01–1.68) and withdrawal/depression subscale (OR = 1.95, 95% CI:

1.27–3.01). On the other hand, overweight/obesity was significantly associated with total problems (OR = 1.52, 95% CI: 1.18–1.96), total internalizing problems (adjusted OR = 1.48, 95% CI: 1.16–1.91), total externalizing problems (OR = 1.36, 95% CI: 1.10–1.68), social (OR = 1.67, 95% CI: 1.19–2.35) and thought problems (OR = 1.62, 95% CI: 1.20–2.20). Among subscales, overweight/obesity specifically correlated with anxiety/depression (OR = 1.83, 95% CI: 1.33–2.51), withdrawal/depression (OR = 1.58, 95% CI: 1.02–2.48) among internalizing problems, and, among externalizing problems, rule-breaking behavior (OR = 1.55, 95% CI: 1.15–2.08).

Regarding associations implicating the covariates that were examined in multivariate models with respect to total internalizing and externalizing problems (Supplementary tables S1 and S2), males were less likely to be underweight (OR = 0.37), but more likely to be overweight or obese (OR = 2.52; OR = 2.57), when compared with females. Adolescents aged from 16 to 17.9 years were more likely to be underweight (OR = 1.47; OR = 1.48) when compared with those aged <16 years. Also, adolescents with lower grades were more likely to be overweight/obese (OR = 1.49; OR = 1.51). Participants from Spain were more likely to be underweight but less likely to be overweight/obese, when compared with those from Greece; participants from Iceland were less likely to be overweight/obese vs. those from Greece.

**Table 1** Sample characteristics ( $n=7005$ )

	<i>n</i>	%
Gender		
Female	3507	50.1
Male	3498	49.9
Age		
14–15.9	4112	58.7
16–17.9	2893	41.3
Country		
Greece	1629	23.3
Spain	1492	21.3
Romania	1646	23.5
The Netherlands	844	12.0
Iceland	1394	19.9
Parental education		
Low/middle	2262	36.5
High	3941	63.5
Grades		
15–20	3271	50.0
1–14.9	3271	50.0
Parents married/living together	5635	81.8
Adolescent body mass index categories		
Underweight	697	10.0
Normal	5450	77.8
Overweight	747	10.7
Obese	111	1.6

## Discussion

This study's uniqueness lies on the large sample of adolescents among five European countries and the associations between psychosocial health of this population with both underweight and overweight/obese status. Results from previous studies have stressed the inverse association of psychosocial health with overweight/obesity in adolescent populations.<sup>9,11–13,26</sup> Additionally, other researchers<sup>4,7,9</sup> have revealed the associations of low body image satisfaction in adolescents with problems, including withdrawn, anxiety and depression, social problems and somatic complaints, which is consistent with the fact that body image dissatisfaction affects mostly those adolescents who exceed normal weight.<sup>7</sup>

Overweight/obese adolescents were more likely to experience internalizing problems. This finding has deeper implications regarding the subjective perception of one's body, as it has been found that the domination of the 'thinness model' in many countries affects the way adolescents perceive themselves.<sup>3,8</sup> Interestingly, however, some researchers have concluded that being satisfied with overweight status is associated with similar levels of psychosocial health as with the

**Table 2** Proportion of adolescents being on borderline or clinical range in YSR scales

	Normal, <i>n</i> (%)	Borderline, <i>n</i> (%)	Clinical, <i>n</i> (%)
Competences			
Competences (total)	3779 (57.1)	994 (15)	1842 (27.8)
Activities <sup>a</sup>	3468 (67.6)	711 (13.9)	951 (18.5)
Social <sup>a</sup>	4575 (89.5)	328 (6.4)	211 (4.1)
Problems, overall			
Total problems (score)	6066 (88.6)	353 (5.2)	428 (6.3)
Internalizing problems			
Internalizing problems (total)	5894 (86.1)	405 (5.9)	548 (8.0)
Anxious/depressed <sup>a</sup>	4758 (91.4)	233 (4.5)	215 (4.1)
Withdrawn/depressed <sup>a</sup>	4632 (94.5)	152 (3.1)	118 (2.4)
Somatic complaints <sup>a</sup>	4627 (89)	308 (5.9)	264 (5.1)
Externalizing problems			
Externalizing problems (total)	5611 (81.9)	578 (8.4)	660 (9.6)
Rule-breaking (delinquent) behavior <sup>a</sup>	4708 (90.4)	276 (5.3)	223 (4.3)
Aggressive behavior <sup>a</sup>	4776 (91.7)	236 (4.5)	195 (3.7)
Other problems			
Social problems <sup>a</sup>	4818 (92.5)	208 (4.0)	180 (3.5)
Thought problems <sup>a</sup>	4721 (90.7)	185 (3.6)	299 (5.7)
Attention problems <sup>a</sup>	4652 (89.3)	303 (5.8)	252 (4.8)

a: No available data for Romania.

**Table 3** Associations of BMI status with YSR scales

	Underweight, n (%)	Normal, n (%)	Overweight/obese, n (%)	p <sup>a</sup>
Competences				
Competences (total)				0.007
Normal	386 (58.8)	2985 (57.7)	408 (51.9)	
Borderline/clinical	270 (41.2)	2188 (42.3)	378 (48.1)	
Activities <sup>b</sup>				0.156
Normal	296 (66.8)	2750 (68.2)	422 (64.4)	
Borderline/clinical	147 (33.2)	1282 (31.8)	233 (35.6)	
Social <sup>b</sup>				0.174
Normal	379 (87.5)	3612 (89.9)	584 (88.1)	
Borderline/clinical	54 (12.5)	406 (10.1)	79 (11.9)	
Problems, overall				<0.001
Total problems				
Normal	618 (90.6)	4758 (89.2)	690 (83.1)	
Borderline/clinical	64 (9.4)	577 (10.8)	140 (16.9)	
Internalizing problems				0.001
Internalizing problems				
Normal	584 (85.6)	4630 (86.8)	680 (81.9)	
Borderline/clinical	98 (14.4)	705 (13.2)	150 (18.1)	
Anxious/depressed <sup>b</sup>				<0.001
Normal	393 (88.7)	3770 (92.3)	595 (87.6)	
Borderline/clinical	50 (11.3)	314 (7.7)	84 (12.4)	
Withdrawn/depressed <sup>b</sup>				0.001
Normal	391 (92.9)	3656 (95.1)	585 (91.7)	
Borderline/clinical	30 (7.1)	187 (4.9)	53 (8.3)	
Somatic complaints <sup>b</sup>				0.042
Normal	396 (89.4)	3645 (89.4)	586 (86.2)	
Borderline/clinical	47 (10.6)	431 (10.6)	94 (13.8)	
Externalizing problems				<0.001
Externalizing problems (total)				
Normal	569 (83.4)	4409 (82.6)	633 (76.3)	
Borderline/clinical	113 (16.6)	928 (17.4)	197 (23.7)	
Rule-breaking (delinquent) behavior <sup>b</sup>				<0.001
Normal	413 (93.2)	3710 (90.8)	585 (86.2)	
Borderline/clinical	30 (6.8)	375 (9.2)	94 (13.8)	
Aggressive behavior <sup>b</sup>				0.001
Normal	415 (93.7)	3762 (92.1)	599 (88.2)	
Borderline/clinical	28 (6.3)	323 (7.9)	80 (11.8)	
Other problems				<0.001
Social problems <sup>b</sup>				
Normal	402 (90.7)	3810 (93.3)	606 (89.1)	
Borderline/clinical	41 (9.3)	273 (6.7)	74 (10.9)	
Thought problems <sup>b</sup>				<0.001
Normal	402 (90.7)	3735 (91.5)	584 (85.9)	
Borderline/clinical	41 (9.3)	347 (8.5)	96 (14.1)	
Attention problems <sup>b</sup>				0.377
Normal	387 (87.4)	3656 (89.5)	609 (89.7)	
Borderline/clinical	56 (12.6)	429 (10.5)	70 (10.3)	

a: Pearson's chi-squared test.

b: Not available for Romania.

normal status.<sup>7</sup> At any case, our finding agrees with previous research showing that overweight/obese adolescents had more internalizing problems than their normal weight peers.<sup>11,13,26</sup> Meta-analysis on overweight/obese adolescents has shown that they reported more anxiety and depression symptoms than the normal weight group, similarly to our findings herein.<sup>12</sup> Other researchers, in line with our results pertaining to externalizing problems, have concluded that overweight/obese adolescents are more likely to score high in the rule-breaking subscale<sup>13,27</sup> and aggressive behavior subscale than normal weight adolescents.<sup>28</sup>

Participants with borderline/clinical scores in withdrawal/depression and activities subscales were more likely to be underweight than normal weight. Despite the fact that relevant evidence from population-based, large cohorts is limited, some suggestions might be in accordance with this finding, such as evidence that dieting and weight control behaviors correlate strongly with anxiety, depression and low self-esteem.<sup>3,8,18,19,29</sup> Specifically, weight control behaviors have been significantly associated with anxiety and depression in

adolescents.<sup>29</sup> A secondary explanation may entail the fact that underweight status is caused from poor health conditions,<sup>10,12</sup> reflecting also the limited opportunities for such adolescents to participate in activities. Contrary to our results, other researchers from the USA<sup>11</sup> and Australia<sup>14</sup> have suggested that, after evaluating various BMI statuses, only the overweight/obese population was found to be at risk for poorer psychosocial health scores.

Consistent to previous research,<sup>21,27</sup> boys were more likely to be overweight/obese and less likely to be underweight than girls. This could be partly attributed to the fact that girls feel the social pressure to adhere to the existing ideal of beauty and thinness: girls have been found to worry more about their appearance,<sup>30</sup> to feel more dissatisfied with their body image<sup>7</sup> and to adopt more weight control behaviors than boys. Furthermore, they evaluate themselves as heavier than they really are<sup>36</sup> and have greater risk of experiencing some less or more severe form of eating disorder.<sup>17,19</sup> Other researchers have shown that girls are more likely to make efforts to lose weight, while boys tend to attempt gaining weight<sup>4</sup>; among males higher



**Table 4** Results from multiple logistic regression analysis for the association of BMI status with YSR scales (borderline/clinical vs. normal)

	Underweight vs. normal, OR (95% CI) <sup>a</sup>	Overweight/obese vs. normal, OR (95% CI) <sup>a</sup>
Competences		
Competences (total)	1.17 (0.97–1.40)	0.98 (0.81–1.18)
Activities <sup>b</sup>	1.31 (1.01–1.68)	0.91 (0.75–1.11)
Social <sup>b</sup>	1.35 (0.95–1.91)	1.07 (0.76–1.51)
Problems, overall		
Total problems (score)	0.97 (0.69–1.35)	1.52 (1.18–1.96)
Internalizing problems		
Internalizing problems (total)	1.18 (0.89–1.57)	1.48 (1.16–1.91)
Anxious/depressed <sup>b</sup>	1.32 (0.88–1.99)	1.83 (1.33–2.51)
Withdrawn/depressed <sup>b</sup>	1.95 (1.27–3.01)	1.58 (1.01–2.48)
Somatic complaints <sup>b</sup>	0.84 (0.57–1.23)	1.34 (0.98–1.85)
Externalizing problems		
Externalizing problems (total)	0.96 (0.73–1.25)	1.36 (1.10–1.68)
Rule-breaking (delinquent) behavior <sup>b</sup>	0.79 (0.51–1.21)	1.55 (1.15–2.08)
Aggressive behavior <sup>b</sup>	1.01 (0.67–1.52)	1.20 (0.87–1.65)
Other problems		
Social problems <sup>b</sup>	1.49 (0.96–2.32)	1.67 (1.19–2.35)
Thought problems <sup>b</sup>	1.01 (0.67–1.52)	1.62 (1.20–2.20)
Attention problems <sup>b</sup>	1.21 (0.84–1.76)	1.28 (0.94–1.75)

a: Odds ratio (95% confidence interval) adjusted for age, gender, country, grades, parental educational level and parental family status.

b: Data from Romania were not available for this analysis.

BMI might sometimes be linked with a significant muscle development and not overweight/obesity per se.<sup>31</sup>

Older adolescents aged 16–17.9 years were more likely to be underweight than younger ones. In accordance to this, it has been shown that the prevalence of overweight/obesity diminishes through the stages of adolescence and that older adolescents spend more time over their physical appearance<sup>30</sup>; on the other hand, weight control behaviors, dieting and hard exercise in the adolescent population have been found to occur more frequently in the age of 17 years,<sup>17</sup> whereas eating disorders tend to occur more often in older adolescents.<sup>17</sup>

Moreover, consistent with previous findings<sup>32,33</sup> is the result that adolescents with lower grades were more likely to be overweight/obese. Another significant result showed that Greek adolescents were more likely to be overweight/obese than adolescents from Spain and Iceland, whereas Spanish adolescents were also more likely to be underweight than their Greek peers. The high rate of adolescent obesity in Greece has been documented also by other available data, including the recent data of the WHO European Childhood Obesity Surveillance Initiative.<sup>34</sup> A large Greek study on adolescent population<sup>27</sup> conducted in 2014, during the economic crisis, showed that the prevalence of adolescent obesity grew, while it had flattened in high-income countries at the same time.<sup>35</sup> Such a cross-cultural discussion could take into account cultural differences concerning policies and interventions around healthy lifestyle, possible stigmatization of overweight/obese people, accessibility of adolescents to sports, activities and health system and the current physical appearance model of each country. Further commenting on covariates, no significant correlations were found between BMI status and neither educational level of parents nor family status variable.

The most important strength of this study is the comparison of underweight and overweight/obese adolescents with normal weight ones, from a large sample of five European countries. Random sampling and anonymity of self-reporting limited the risk for selection and reporting biases. Furthermore, results concerning the underweight population can incite efforts for further investigation, since for the latter evidence is more limited than for overweight/

obese adolescents. Clinical and borderline categories were merged in the analyses, in an attempt to depict also milder effects in psychosocial health of adolescents at the population level.

On the other hand, the limitations could be summarized in the risk for self-reported bias or social desirability bias, although self-reported BMI has been found to be rather reliable for the investigation of associations in similar studies.<sup>36</sup> However, an underestimation of the prevalence of overweight has been documented on the basis of self-reported data, with bias varying by sex and weight status, leading to one-fourth to one-half of overweight missed in individual studies.<sup>37</sup> Another limitation pertains to the interpretation of underweight in our sample; there was no evaluation by a clinical team to establish the diagnosis of actual anorexia nervosa or bulimia nervosa in these cases, therefore, the extent of such conditions underlying our findings cannot be estimated. Also, given that this study has been performed in the early 2010s, further, longitudinal comparative studies are needed. At any case, it should be kept in mind that the perception of under/overweight could impact as much on mental health as the actual BMI<sup>38</sup>; future studies could therefore also include body image perception questionnaires. Finally, the cross-sectional nature of the present study excludes the possibility to establish cause and effect associations between different variables.

## Conclusions

The results of this study stress the need for strengthening public health policies about both deviations from normal weight in adolescents. Furthermore, this study highlights the importance of policies promoting positive attitudes towards body image in adolescents. Finally, it underlines the necessity of collecting more data regarding the causes of underweight status on the population level, to accomplish a better understanding of the way it associates with psychosocial health.

## Supplementary data

Supplementary data are available at *EURPUB* online.

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*Conflicts of interest:* None declared.

## Key points

- Adolescent overweight/obesity is associated with internalizing problems, such as anxiety/depression and withdrawal/depression, as well as externalizing problems (rule-breaking behavior), social and thought problems.
- Underweight is associated with problems in activities and withdrawal/depression.
- Public health policies are needed to promote psychosocial health in overweight, obese and underweight adolescents, taking into account their distinct features.

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