

# Anxiety and depression levels in prepubertal obese children: a case-control study

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**Introduction:** Childhood obesity has become a worldwide epidemic in Western and in developing countries and has been accompanied by many serious and severe comorbidities, such as diabetes, hypertension, sleep apnea syndrome, depression, dyslipidemia, impaired glucose homeostasis, steatohepatitis, and intracranial hypertension, as well as medical concerns unique to youth, such as accelerated pubertal and skeletal development and orthopedic disorders. To date, no specific studies about the psychological assessment in pediatric obesity are present. Therefore, the aim of this study was to evaluate the putative relationship between psychological troubles and obesity in a sample of school-aged children.

**Materials and methods:** The study population consists of 148 obese subjects (body mass index [BMI] >95th percentile) (69 males, mean age 8.9±1.23 years) consecutively referred from clinical pediatricians to the Child and Adolescent Neuropsychiatry department at the Second University of Naples. In all subjects, weight, height, and BMI z-score were evaluated. In order to assess the anxiety levels and the presence of depressive symptoms, the Children Depression Inventory (CDI) and the Italian Self-Administered Psychiatric Scales for Children and Adolescents (SAFA) were administered. The control group consisted of 273 healthy children (129 males and 144 females) (mean age 9.1±1.8 years), enrolled in schools within the Campania region of Italy.

**Results:** No significant differences between the two study groups were found for age (8.9±1.23 years in the obese sample and 9.1±1.8 years in the control group) ( $P=0.228$ ) or sex (ratio male/female: 69/79 in the obese group versus 129/144 in the control group) ( $P=0.983$ ). Obviously, significant difference was found for the BMI z-score (2.46±0.31 in the obese group vs 0.73±0.51 in the control group) ( $P<0.001$ ). The obese subjects showed significant higher level of depressive symptoms (CDI total score) (16.82±7.73 vs 8.2±2.9) ( $P<0.001$ ) and anxiety (SAFA – Anxiety [SAFA-A]) scale score (58.71±11.84 vs 27.75±11.5) ( $P<0.001$ ) compared with the control group. Moreover, the Pearson's correlation analysis showed a significantly positive relationship between the BMI z-score and both the CDI ( $r=0.677$ ;  $P<0.001$ ) and SAFA-A scores ( $r=0.591$ ;  $P<0.001$ ).

**Conclusion:** Our findings highlighted the importance of assessing the presence of internalizing problems, such as anxiety and depression, in the common management of childhood obesity.

**Keywords:** childhood obesity, internalizing problems, SAFA, CDI

## Introduction

Childhood obesity has become a worldwide epidemic in Western and in developing countries<sup>1,2</sup> and has been accompanied by many serious and severe comorbidities, such as diabetes,<sup>3</sup> hypertension,<sup>4,5</sup> sleep apnea syndrome,<sup>6,7</sup> depression,<sup>8</sup> metabolic alterations, intracranial hypertension,<sup>9,10</sup> and precocious puberty.<sup>11,12</sup> The psychiatric aspects related to obesity in pediatric age are still poorly studied, although depressive symptoms seem to be relevant in obese subjects.<sup>13–15</sup>

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In fact, obesity may be identified as a multifactorial disease, and in recent years many studies attempted to also identify the putative psychological link between obesity (and/or overweight) development and parental relationship of obese subjects.<sup>16–23</sup>

Despite the extensive literature about the role of genetic and metabolic comorbidities,<sup>24–34</sup> reports about the role of psychological factors in obese children are still scant, probably due to the difficulty of recognizing the psychiatric symptoms in children.<sup>35–39</sup> On the other hand, body size seems to be the strongest predictor for the development of depressive symptoms, with a curvilinear relationship shown by Cortese et al in 2009.<sup>40</sup> Researchers found that body mass index (BMI) could be associated with the externalizing problems, such as attention-deficit hyperactivity disorder (ADHD) symptoms also influencing the treatment therapeutic outcome.<sup>41–43</sup> In this perspective, the link between obesity and psychiatric symptoms appears to be intriguing and still unclarified.

To the best of our knowledge, no specific studies about self-evaluation of internalizing problems in pediatric obese subjects are present in clinical literature. Therefore, the aim of the present study was to evaluate the putative relationship between psychological troubles and obesity, in a sample of school-aged children.

## Materials and methods

The study population consisted of 148 obese subjects (BMI >95th percentile) (69 males and 79 females, with mean age 8.9±1.23 years) consecutively referred by clinical pediatricians to the Child and Adolescent Neuropsychiatry department at the Second University of Naples. In all subjects, weight, height, and BMI z-score were evaluated.

In order to assess the anxiety levels and the presence of depressive symptoms, the Children Depression Inventory (CDI)<sup>44</sup> and the Italian Self-Administered Psychiatric Scales for Children and Adolescents (SAFA)<sup>45</sup> were administered.

The exclusion criteria were: allergies, endocrine problems (ie, diabetes), genetic syndromes (such as Prader–Willi syndrome, Down syndrome, Sturge–Weber syndrome, neurofibromatosis),<sup>46,47</sup> preterm birth,<sup>48,49</sup> neurological (ie, epilepsy, headache), or psychiatric symptoms (ADHD, depression, behavioral problems, etc.), mental retardation (intelligence quotient [IQ] ≤70), previous rehabilitative treatment,<sup>50</sup> borderline intellectual functioning (IQ ranging from 71 to 84),<sup>51,52</sup> referred sleep disorders,<sup>8,53–59</sup> primary nocturnal enuresis,<sup>60–62</sup> or anticonvulsant<sup>63,64</sup> or psychoactive drugs administration.

The control group consisted of 273 healthy children (129 males and 144 females, with mean age 9.1±1.8 years) enrolled in schools within the Campania region of Italy.

All subjects were recruited from the same urban area and were of Caucasian origin and middle socioeconomic status (class 2 or class 3, corresponding to 28,000–55,000 euros/year to 55,000–75,000 euros/year, respectively, according to the current Italian economic legislation parameters as previously reported).<sup>65–70</sup>

Informed consent was obtained from all parents. The investigation was carried out in accordance with the principles of the Declaration of Helsinki.<sup>71</sup> The Departmental Ethics Committee at the Second University of Naples approved the study.

## Screening for depressive symptoms

All children filled out the Italian version of the CDI,<sup>72</sup> to screen for the presence of depressive symptoms. The CDI is widely used to assess depressive symptomatology in children and adolescents aged 8–17 years, providing good internal consistency (Cronbach's  $\alpha$  =0.80). The scale is composed of 27 Likert-like items scored from 0 to 2, with higher scores reflecting more important depressive symptomatology. According to the Italian validation criteria, a score of 19 is considered suggestive of depressive symptoms.<sup>73</sup> In our study, the five CDI subscale scores (negative mood, interpersonal problems, ineffectiveness, anhedonia, and negative self-esteem)<sup>74,75</sup> were not considered because of lack of normative data for the Italian version of the test.<sup>73</sup>

## Anxiety assessment

All subjects filled out the SAFA – Anxiety (SAFA-A) scale,<sup>76</sup> a self-administered questionnaire providing an emotional profile in children. Specifically, in 2012, the SAFA-A scale was validated for the Italian pediatric population by Naciovich et al.<sup>76</sup>

The SAFA-A scale was created to assess internalizing problems and comprises a specific subscale for 8- to 10-year-old children (SAFA A/e), for 11- to 13-year-old children (SAFA A/m), and for 14- to 18-year-olds (SAFA A/s).<sup>77</sup>

The SAFA A/e scale consists of 42 items (40 negative and two positive affirmations) grouped into four subscales: Generalized Anxiety (ten items); Social Anxiety (ten items); Separation-Loss Anxiety (ten items); and School-Related Anxiety (ten items).<sup>77</sup> The scale is characterized by good reliability in healthy subjects (Cronbach's  $\alpha$  =0.857).<sup>77</sup>

## Statistical analysis

In order to compare the characteristics (age, sex, and BMI *z*-score) and the CDI and SAFA-A tests results between obese children and controls, the chi-square test and unpaired *t*-test, where appropriate, were applied. Then, to explore the relationship between the BMI *z*-score and the CDI and SAFA-A scales, Pearson's correlation test was applied. For all statistical analysis, *P*-values <0.05 were considered significant.

All data were coded and analyzed using the commercially available STATISTICA 6.0 package for Windows (StatSoft, Inc., Tulsa, OK, USA).

## Results

No significant differences between the two study groups were found for age ( $8.9 \pm 1.23$  years in the obese sample and  $9.1 \pm 1.8$  years in the control group) ( $P=0.228$ ) or sex (ratio male/female: 69/79 in the obese group versus 129/144 in the control group) ( $P=0.983$ ). Obviously, significant difference was found for the BMI *z*-score ( $2.46 \pm 0.31$  in the obese group versus  $0.73 \pm 0.51$  in the control group) ( $P < 0.001$ ).

The obese subjects showed significant higher level of depressive symptoms (CDI total score) ( $16.82 \pm 7.73$  vs  $8.2 \pm 2.9$ ) ( $P < 0.001$ ) and in the SAFA-A total scale score ( $58.71 \pm 11.84$  vs  $27.75 \pm 11.5$ ) ( $P < 0.001$ ) compared with the control group. In the obese group, no significant differences were found between males and females in depression ( $17.19 \pm 8.05$  vs  $15.96 \pm 7.84$ ;  $P=0.349$ ) and anxiety ( $56.11 \pm 13.01$  vs  $59.02 \pm 15.36$ ) ( $P=0.219$ ) levels.

Moreover, the Pearson's correlation analysis showed a significantly positive relationship between the BMI *z*-score and both the CDI ( $r=0.677$ ;  $P < 0.001$ ) and SAFA-A scores ( $r=0.591$ ;  $P < 0.001$ ).

## Discussion

The main finding of the present study is the higher presence of anxiety and depression levels in a population of obese prepubertal subjects.

The presence of high rate of internalizing symptoms, such as anxiety and depression, among obese children could also be supported by some neurobiological evidence.<sup>78</sup> Pervanidou et al reported that the imbalance in hypothalamic-pituitary-adrenal axis was involved in anxiety disorders, depression, and obesity.<sup>78</sup> Moreover, cortisol level alterations may also be found in obese children, in linear correlation with the degree of psychological/emotional distress.<sup>78</sup>

On the other hand, many authors have identified a putative link between obesity and internalizing difficulties,<sup>79</sup> poorer

quality of life,<sup>80</sup> more profound social issues,<sup>81</sup> and increased behavioral problems.<sup>82,83</sup> In this picture, obese children seem to be more depressed,<sup>84</sup> hopeless,<sup>85</sup> and suicidal,<sup>85</sup> as well as to have lower self-esteem and lower life satisfaction<sup>86</sup> compared with healthy controls, although the findings are not conclusive.

In fact, studies have generally focused on large community-based samples or small clinic-based samples, but in large community samples, the number of children who are obese is often limited, while in clinic-based studies, the sample sizes tend to be small, masking the considerable psychological variability among obese individuals.<sup>87,88</sup>

In this light, critical for treatment of these youth is the identification and/or treatment of psychological conditions, which otherwise could prevent successful treatment in a pediatric weight management clinic and may even lead to continued rapid, abnormal weight gain.<sup>89</sup>

On the other hand, overweight and depression are two pressing issues among school-aged children, which have negative impacts on their growth and development, school performance, and family relationships, and which are an important precursor to psychopathology,<sup>90</sup> and in this light, our findings about the significant relationship between depressive symptoms and obesity may be interpreted.

The effective mechanisms that may explain the relationship between symptoms of depression and obesity remain unclear, although some hypotheses may be proposed. One possibility is that symptoms of depression promote excess weight gain during adolescence via reduced physical activity and consequently, lower energy expenditure. From a cognitive-behavioral theoretical framework, elevated symptoms of depression develop and are maintained as a result of a negative view of the self, one's experiences, and the future.<sup>91</sup> In particular, it has been evidenced that obese subjects showed higher levels of anhedonia as prompting behavioral withdrawal from physical exercise, which further exacerbates depressed mood.<sup>92</sup> In support of this hypothesis, a number of cross-sectional studies have found an inverse association between adolescents' symptoms of depression and self-reported physical activity, exercise, or sports participation.<sup>93-97</sup> In contrast, in a large sample of young adolescent girls, depressive symptoms were not significantly associated with physical activity as assessed by accelerometer, an ambulatory device used to objectively monitor moderate-to-vigorous physical activity.<sup>98</sup> Longitudinal data indicate that increases in adolescents' depressive symptoms are associated with decreases in self-reported leisure-time physical activity.<sup>99</sup>

Although it seems obvious that obese children and adolescents would likely be at higher risk for psychological problems, the mediating factors in the relationship between psychological problems and obesity are still not well established. Obesity is a complex disorder with an equally complex etiology and is thus associated with complex behaviors and psychological outcomes that make it difficult to study in children.<sup>100–109</sup>

Limitations of the present study can be identified in the small number of obese children recruited and in the use of self-administered psychological tools. Notwithstanding these limitations, our study could suggest the psychological screening for internalizing problems as mandatory among obese children.

In conclusion, our findings highlighted the importance of assessing the presence of internalizing problems, such as anxiety and depression, in the common management of childhood obesity.

## Disclosure

The authors report no conflicts of interest in this work.

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