



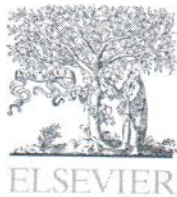
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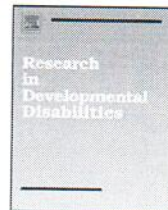
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Adolescent idiopathic scoliosis and eating disorders: Is there a relation? Results of a cross-sectional study

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ABSTRACT

A recent study suggests a correlation between idiopathic scoliosis in adolescence and eating disorders. However, this does not correspond with our clinical experience in the same population. The aim of this study was to verify the correlation between scoliosis and eating disorders in adolescence. A cross-sectional study was designed including 187 consecutive adolescent girls with a diagnosis of idiopathic scoliosis (mean Cobb angle 26°, range 11–73°, age 15.2 ± 2.5; 24% juveniles, 76% adolescent type) and 93 schoolgirls as controls (age 14.9 ± 1.0). All of the participants answered the Italian validated questionnaire EAT-26 about eating habits in order to identify any eating disorders. Body mass index (BMI) was calculated for all participants and compared to reference data. Statistical Analysis: chi-square test, Student's *t*-test, Pearson's correlation coefficient. Only 3 (1.6%; 95% CI –0.2–3.4%) participants in the scoliosis group showed EAT-26 scores suggestive for eating disorders versus 7 (7.5%; 95% CI 2.2–12.9%) in the school population ($p < 0.05$). The BMI was slightly lower ($p < 0.05$) for scoliosis patients (19 ± 0.2) than for school girls (21 ± 0.3). EAT-26 is recognized among the most valid questionnaires for eating disorders and has been widely applied in various countries. By applying this questionnaire, a lower incidence of eating disorders in female scoliosis patients was found than in the general population (using both our own controls and Italian reference values). This contrasts with some expert opinions and a recent study performed in Italy. The low BMI already reported in the literature as being typical of scoliosis participants is confirmed by our data.

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1. Introduction

Idiopathic scoliosis (IS) is a three-dimensional spinal deformity consisting of a lateral curvature, reduction of the sagittal profile and axial vertebral rotation of an unknown cause Negrini et al., 2012a). Severe forms of scoliosis can affect the quality of life because of the esthetic impact (Donaldson et al., 2007; Negrini et al., 2006), the risk of progression and the higher risk of low back pain (Weinstein, 1986; Weinstein et al., 2003). The pathology itself affects self-image, but the treatment,

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2.3. Protocol

All of the participants answered the Italian validated questionnaire EAT-26 about eating habits in order to identify eating disorders (Saporetti, Sancini, Bassoli, Castelli, & Pellai, 2004).

The EAT-26 is a validated questionnaire used in many studies and many countries (Garner, Olmsted, Bohr, & Garfinkel, 1982). It consists of 26 questions about eating attitudes and gives a score from 0 to 78, with 20 points being considered the cut-off value for a risk of eating disorders. Participants were divided on the basis of EAT-26 scores into two groups: "Risk" (≥ 20) and "Non-Risk" (< 20).

BMI was calculated for all participants and compared to reference data. Moreover, a cut-off of 17.5 was used to dichotomize data, since values lower than this are considered suggestive of anorexia (Smith et al., 2002).

2.4. Statistical analysis

Dichotomized data were analyzed with a chi-square test. A Student's *t*-test was used to compare continuous data. α was set at 0.05. A Pearson's correlation coefficient was calculated to evaluate the correlation of the Cobb angle and BMI.

3. Result

3.1. EAT-26

Only 3 (1.6%; 95% CI $-0.2/3.4\%$) participants in the scoliosis group showed EAT-26 scores suggestive for eating disorders (≥ 20) versus 7 (7.5%; 95% CI 2.2/12.9%) in the school population; this difference was statistically significant ($p < 0.05$).

Due to the extremely low rate of eating disorders in the study group it was not possible to correlate this with the severity of scoliosis.

3.2. BMI

The BMI was slightly lower ($p < 0.05$) for scoliosis patients (19 ± 0.2) than for schoolgirls (21 ± 0.3). Considering a cut-off of 17.5, a significantly higher prevalence of low BMI was found in the scoliosis group than in the controls (19% vs. 8%, $p < 0.05$). This study tried to correlate BMI and the severity of scoliosis using the Cobb Angle value, but no correlation was found ($r = -0.015$).

4. Discussion

Due to their low BMI, many adolescents with idiopathic scoliosis have been frequently considered to be affected by an eating disorder, most commonly anorexia. The data of this study is in contrast with this idea, showing a surprisingly low rate of eating disorders in the study population with respect to the healthy control population and Italian reference values obtained with the same questionnaire (Saporetti et al., 2004). This was a surprising finding due to previously published data (Alborghetti et al., 2008; Smith et al., 2002). In our experience, we have rarely considered any of our patients to be affected by eating disorders, but a rate lower than that of the general population was not imagined. It is possible that scoliosis treatments in a specialized setting can somehow protect patients from the risk of eating disorders during adolescence, but caution must be taken when interpreting data. It can be reasonably suggested that scoliosis is not correlated with eating disorders, but nothing more can be said without further investigation and larger sample sizes. The current study design would not allow for this kind of interpretation as it was only a cross-sectional study.

Previous studies found contrasting results, with a higher prevalence of eating disorders in the scoliosis group (Alborghetti et al., 2008; Smith et al., 2002). This difference could be the result of the tools used when screening patients in different studies. Alborghetti et al. (2008) used a questionnaire, while Smith et al. (2002) based their data principally on BMI measures. Conversely, this study used a combination of the EAT-26 questionnaire and BMI values.

The EAT-26 is recognized among the most valid questionnaires for eating disorders and has been widely applied in various countries (Garner et al., 1982). Despite this not being a diagnostic tool it is normally used for identifying participants at risk of eating disorders. Moreover, it was used in both the study and the control group, making the comparison reliable.

With regards to BMI, as already demonstrated, scoliosis patients generally have lower values. This is consistent with most of the data in the literature, although Smith found a higher rate of pathological BMI values (Alborghetti et al., 2008; Smith et al., 2002). Considering a cut-off of 17.5, the AIS Group showed more participants with a BMI considered suggestive of anorexia. This is in sharp contrast with the results of the questionnaire, and suggests that a low BMI in AIS could be somehow connected with the etiology or pathogenesis of scoliosis, rather than being a sign of an eating disorder. If this was the case, corresponding results should have been seen between the questionnaire and BMI, which is not the case. Some authors correlated the low BMI of AIS patients to hormonal dysfunction related to its etiology: recent studies have shown that Leptin may play a significant role in the pathogenesis of AIS, and, since this hormone is present at lower levels in individuals with scoliosis with respect to the general population, this could explain the typical thinness of girls affected by AIS (Burwell et al., 2009; Grivas et al., 2009). A lower level of Leptin in AIS has the effect of both reducing the fat mass and altering bone formation (Qiu et al., 2007). Other studies have tried to correlate low BMI to inappropriate or insufficient nourishment,

possibly suggesting a role for low levels of bone density, but this is still under debate (Dede et al., 2011; Kono et al., 2011; Smith et al., 2002; Szalay et al., 2008). Anorexia or a low body weight can cause, in addition to a reduction in fat mass, a reduced bone density in the spine and in the thorax (25% lower than reference values) (Mazess, Barden, & Ohlrich, 1990). In contrast, the reduction at the limb level is lower (below 5%). These values are comparable to those of elderly women and can lead to bone degeneration, fractures, and developmental complications. However, the mean BMI in this AIS sample was not pathological, even though it was significantly lower. Previous papers have reported more than 25% of the AIS sample participants to have BMI values lower than 17.5 (Alborghetti et al., 2008; Smith et al., 2002).

Another interesting point to highlight is that no correlation between the severity of the curve and BMI was found, suggesting that the role of a low BMI in the genesis of scoliosis is questionable.

The main strengths of this study are the use of both a validated and reliable questionnaire and the comparison of results with BMI, as it is the first study, to our knowledge, to use this methodology. A previous paper used both a questionnaire and BMI, but did not report the data on BMI. With the exception of an inverse correlation between the severity of scoliosis and BMI, the group of Alborghetti et al. (2008) stated that this correlation exists as the result of an r value of -0.50 ; however, this is a quite a weak correlation.

A further strength of the current study is that the population was larger than those of previous studies (Alborghetti et al., 2008; Smith et al., 2002, 2008).

The limitations include the lack of interview with an expert to confirm the diagnosis and the possible self-selection bias of patients due to the study setting. With regards to the effect of an interview on participants screened by the questionnaire, this would eventually reduce the number of positive participants, so the extremely low rate of eating disorders would not change. Moreover, the questionnaire used is reliable and should rule out the participants at risk even without the confirmation of a specialist. Nevertheless, it is known that a self-administered questionnaire requires the collaboration of the patient. In future studies a clinical interview with an expert could be required for the lowest BMI patients, independent of the test results. This could increase the sensitivity of a diagnosis of eating disorders.

With regards to the selection bias, it must be said that the setting of this study is quite particular, as it is a private institution totally devoted to conservative scoliosis treatment. The team involved is highly specialized, working in strict collaboration with both MDs and Physiotherapists, with a deep involvement of both patients and their families according to current guidelines (Negrini et al., 2009) and using the best available tools for the follow-up (Don et al., 2012). In this context, psychological aspects are addressed by this team, which has been clearly demonstrated by the high rates of compliance to exercise and brace treatments (Donzelli, Zaina, & Negrini, 2012; Tavernaro et al., 2012). Another aspect to consider is that it is possible that AIS patients focus so much of their attention on the scoliosis and its treatment that they do not focus on their weight at all. It is well known that eating disorders, particularly anorexia, can represent an effort to control the body and needs like hunger (Pellizzari, 2010). In early adolescence, when scoliosis progresses rapidly, the body goes through a rapid growth phase and secondary sexual characteristics appear. In girls with scoliosis it is possible that the enemy is not the transforming body, but the disease, or even the brace therapy. Moreover, scoliosis itself requires parents to be attentive and to take care of the patients, which could also be another explanation for the results of this study, due to the key role of the parents, particularly mothers, in the pathogenesis of anorexia (Selvini Palazzolo, Cirillo, Sorrentino, & Selvini, 1998).

It is possible that the scoliosis, or eventually the brace, is the battlefield of adolescence that is substituted for the most typical one, food. Another possibility is that the self-image of these patients is disturbed because of the deformity, meaning that they do not pay much attention to their weight.

It could be interesting to determine whether other female adolescent patients with chronic diseases have the same reduced incidence of anorexia, as some of the psychological mechanisms proposed here could presumably be generalized to other clinical situations.

Of course, these are only hypotheses, but further large-scale studies could help with understanding more about this field. However, it could be found that the attention paid to the psychological approach aimed at scoliosis management could help to manage other psychological problems, like eating disorders. As our center is so specialized, we have a self-selected population referred to us, making it conceivable that our population is not totally representative of the general Italian population of girls affected by AIS. Nevertheless, our patients come from all around the country and are quite heterogeneous with regard to culture, scholarship, job conditions, and economic retribution. What could be different are some of the features connected to the parental figures, such as their role, their relationship with their daughters, and the attention given to the scoliosis treatment, all of which could have an influence on our findings and could reduce its applicability. However, if this selection effect was found to be true, it could demonstrate that the social environment, the family and the treatment team can positively influence a trend toward eating disorders.

5. Conclusion

Eating disorders are commonly considered to be a feature of scoliosis patients (Smith et al., 2002). Our data rejects this supposition and contrasts with previous studies. Despite the low BMI, AIS patients showed a lower prevalence of eating disorders.

EAT-26 is recognized as being among the most valid questionnaires for eating disorders and has been widely applied in various countries. By applying this questionnaire, we found a lower incidence of eating disorders in female scoliosis patients than in the general population (both our own controls and Italian reference values). This contrasts with some expert opinions

and a recent study performed in Italy (Alborghetti et al., 2008). The low BMI already reported in the literature as being typical of scoliosis participants is confirmed by our data. However, even if patients with a lower BMI are more frequent in AIS (Smith et al., 2002), this cannot be considered as a sign of an eating disorder per se, since much data has shown that there are hormonal alterations in AIS that can explain this low BMI and cause scoliosis.

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Conflict of interest

The authors have no conflicts of interest to disclose.

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