

Global proportion of disordered eating in children and adolescents: a systematic review and meta-analysis of 63,181 individuals from 16 countries

Disordered eating in children and adolescents

José Francisco López-Gil ¹, PhD; Antonio García-Hermoso ², PhD; Lee Smith ³, PhD; Joseph Firth ^{4,5}, PhD; Mike Trott ^{3,6}, PhD; Arthur Eumann Mesas ^{1,7}, PhD; Estela Jiménez-López ¹, PhD; Héctor Gutiérrez-Espinoza ⁸, PhD; Pedro J. Tárraga-López ⁹, PhD; Desirée Victoria-Montesinos ¹⁰, PhD

¹ Health and Social Research Center, Universidad de Castilla-La Mancha, Cuenca, Spain.

² Navarrabiomed, Hospital Universitario de Navarra (HUN), Universidad Pública de Navarra (UPNA), IdiSNA, Pamplona, Navarra, Spain.

³ Centre for Health, Performance and Wellbeing, Anglia Ruskin University, Cambridge, United Kingdom.

⁴ Division of Psychology and Mental Health, University of Manchester, Manchester Academic Health Science Centre, Manchester, United Kingdom.

⁵ Greater Manchester Mental Health NHS Foundation Trust, Manchester Academic Health Science Centre, Manchester, United Kingdom.

⁶ Centre for Public Health, Queen's University, Belfast, United Kingdom.

⁷ Postgraduate Program in Public Health, Universidade Estadual de Londrina, Londrina, Brazil.

⁸ Escuela de Fisioterapia, Universidad de las Américas, Quito, 170504, Ecuador

⁹ Faculty of Nursing, Universidad de Castilla-La Mancha, Albacete, Spain

¹⁰ Faculty of Health Sciences, San Antonio Catholic University of Murcia, Murcia, Spain.

Corresponding author

* José Francisco López-Gil, PhD.

✉ ¹ Health and Social Research Center, Universidad de Castilla-La Mancha, Cuenca, Spain. +34645627375. 📧 josefranciscolopezgil@gmail.com

Word count: 3185.

Key points

Question: What is the global proportion of disordered eating in children and adolescents?

Findings: Approximately two out of ten children and adolescents showed disordered eating. Proportion was further elevated among girls, older adolescents, and those with higher body mass index.

Meaning: Identifying the magnitude of disordered eating and its distribution in at-risk populations is crucial for planning and executing actions aimed at preventing, detecting, and dealing with them.

Abstract

Importance: The 5-item Sick, Control, One, Fat, Food (SCOFF) questionnaire is the most widely used screening measure for eating disorders. However, no previous systematic review and meta-analysis determined the proportion of disordered eating among children and adolescents.

Objective: The aim of the present study was to establish the proportion among children and adolescents of disordered eating as assessed with the SCOFF tool.

Data sources: Four databases were systematically searched (PubMed, Scopus, Web of Science, and the Cochrane Library) with date limits from January 1999 to November 2022.

Study selection: Studies were required to meet the following criteria: (a) participants: studies of community samples of children and adolescents aged 6 to 18 years; and (b) outcome: disordered eating assessed by the SCOFF questionnaire. The exclusion criteria included: (a) studies conducted with young people who had a diagnosis of physical or mental disorders; (b) studies that were published before 1999 because the SCOFF questionnaire was designed in that year; (c) studies in which data were collected during coronavirus disease-2019 (COVID-19) because they could introduce selection bias; (d) studies based on data from the same surveys/studies to avoid duplication; and (e) systematic reviews and/or meta-analyses and qualitative and case studies

Data extraction and synthesis: A systematic review and meta-analysis was performed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement.

Main Outcome and Measures: Proportion of disordered eating among children and adolescents assessed with the SCOFF tool.

Results: Thirty-two studies were included in this systematic review and meta-analysis. The overall proportion of children and adolescents with disordered eating was 22.36% (95% CI: 18.84% to 26.09%; $p < 0.001$; $n = 63,181$) ($I^2 = 98.58\%$). Girls were significantly more likely to report disordered eating (30.03%, 95% CI: 25.61% to 34.65%; $n = 27,548$) than boys (16.98%, 95% CI: 13.46% to 20.81%; $n = 26,170$) ($p < 0.001$). Disordered eating became more elevated with increasing age ($B = 0.03$, 95% CI: 0.00 to 0.06; $p = 0.049$) and BMI ($B = 0.03$, 95% CI: 0.01 to 0.05; $p < 0.001$).

Conclusions and relevance: The available evidence from 32 studies comprising large samples from 16 countries showed that approximately two out of ten children and adolescents showed disordered eating according to the SCOFF tool. Proportion of disordered eating was further elevated among girls, as well as with increasing age and BMI. These high figures are worrisome from a public health perspective and highlight the need to implement strategies for preventing eating disorders.

Ratings of the quality of the evidence: 1 (systematic review and meta-analysis).

1. Introduction

Eating disorders are psychiatric disorders characterized by abnormal eating or weight control behaviors, which can lead to serious health problems¹. These disorders include anorexia nervosa, bulimia nervosa, binge eating disorder, and eating disorder not otherwise specified^{2,3}. They are defined according to individual signs and symptoms and with degrees of severity detailed in the Diagnostic and Statistical Manual of Mental Disorders-version 5 (DSM-5)², as well as in the World Health Organization International Statistical Classification of Diseases and Related Health Problems-11th revision (ICD-11)³. Similarly, they are recognized within the mental disorders included in the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) 2019⁴, and are currently a public health concern in most mid- and high-income countries, because their prevalence in young people has markedly increased over the past 50 years¹. Furthermore, eating disorders are among the most life-threatening of all mental health conditions⁵, and accounted for 17,361.5 years of life lost (between 1990 and 2019) and caused 318.3 deaths worldwide in 2019⁴.

The etiology of eating disorders is very complex and, similar to other psychiatric disorders such as depression and anxiety, arise from the intersection of many risk factors⁶. Although the prevalence varies according to study populations and definitions used⁷, it is recognized that eating disorders are common in adolescents and even more common in young adults⁸. Based on the DSM-5, the prevalence of eating disorders in children/adolescents (aged 11–19 years) has been stated to be between 1.2% (boys) and 5.7% (girls), with increasing incidence over recent decades⁷. Considering that mid-to-late adolescence is a peak period of eating disorders and their symptoms, knowing and understanding the proportion of disordered eating among youths is a crucial issue⁹.

Because some children/adolescents with eating disorders may hide the core symptoms of the illness and delay seeking specialized care due to feelings of shame or stigmatization¹⁰, it is reasonable to consider that eating disorders are underdiagnosed and undertreated¹¹. In addition to diagnosed eating disorders, parents, guardians and health care providers should be aware of symptoms of disordered eating, which include behaviors such as weight-loss dieting, binge eating, self-induced vomiting, excessive exercise, and the use of laxatives or diuretics (although not to the level to warrant a clinical diagnosis of an eating disorder)¹². Although these symptoms predict outcomes related to eating disorders and obesity in adolescents five years later¹³, it is important to distinguish disordered eating from eating disorders¹⁴. The term disordered eating is often used to describe and identify some of the different eating behaviors that do not necessarily meet the diagnostic criteria for an eating disorder and therefore cannot be classified as eating disorders *per se*¹⁵. Notwithstanding, although their impact on health is often minimized, disordered eating should be closely evaluated because they can evolve into eating disorders¹².

The Sick, Control, One, Fat, Food (SCOFF) questionnaire, developed in 1999 by Morgan et al.¹⁶, is the most widely used screening measure for eating disorders¹⁷. It consists of five questions with dichotomic answers options (i.e., yes or no)¹⁶: a) “Do you make yourself Sick because you feel uncomfortably full?”; b) “Do you worry you have lost Control over how much you eat?”; c) “Have you recently lost more than One stone in a 3 month period?”; d) “Do you believe yourself to be Fat when others say you are too thin?”; e) “Would you say that Food dominates your life?”. A positive screen is provided when a participant answers “yes” to two or more questions¹⁶, which denotes a suspicion of an existing eating disorder (i.e., disordered eating)¹⁷. Previous systematic reviews have examined the SCOFF questionnaire as a screening tool in primary care setting^{17,18}. For

instance, a recent systematic review with metanalysis including 25 validation studies found that the validity of the cut-off point ≥ 2 on the SCOFF questionnaire was high across samples with a pooled sensitivity of 86.0% and specificity of 83.0%. Another recent systematic review for populations and settings relevant to primary care in the US found that a cut-off point ≥ 2 on the SCOFF questionnaire had a pooled sensitivity of 84% and pooled specificity of 80% among adults¹⁸. Among young people, previous studies have found that the cut-off point ≥ 2 on the SCOFF questionnaire provided a sensitivity ranging from 64.1% to 81.9%, and a specificity ranging from 77.7% to 87.2%^{19–22}.

Despite the above, thus far, no previous systematic review and meta-analysis determined the proportion of disordered eating among children and adolescents. From an epidemiological perspective, identifying the magnitude of disordered eating and their distribution in at-risk populations is crucial for planning and executing actions aimed at preventing, detecting, and dealing with them²³. Therefore, the aim of the present study was to establish the proportion among children and adolescents of disordered eating as assessed with the SCOFF tool, one of the most widely used methods to study disordered eating in this population⁸.

2. Methods

This systematic review and meta-analysis was registered in the International Prospective Register of Systematic Reviews (PROSPERO) (Registration number: CRD42022350837) and conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement²⁴.

2.1. Eligibility criteria

Studies were required to meet the following criteria: (a) participants: studies of community samples of children and adolescents aged 6 to 18 years; and (b) outcome: disordered eating assessed by the SCOFF questionnaire. Searching was not restricted to articles in published any language peer-reviewed journals. For studies that included children/adolescents and adults, the manuscripts were reviewed and, if reported, the child/adolescent samples were included.

The exclusion criteria included: (a) studies conducted with young people who had a diagnosis of physical or mental disorders; (b) studies that were published before 1999 because the SCOFF questionnaire was designed in that year¹⁶; (c) studies in which data were collected during coronavirus disease-2019 (COVID-19) because they could introduce selection bias; (d) studies based on data from the same surveys/studies to avoid duplication; and (e) systematic reviews and/or meta-analyses and qualitative and case studies.

2.2. Information sources and search strategy

Two researchers (JFL-G and DV-M) systematically searched PubMed, Scopus, Web of Science, and the Cochrane Library with date limits from January 1999 to November 2022. Based on the participants, outcome, and study criteria, studies were identified using all possible combinations of the following groups of search terms: (a) “child*” OR “adolescen*” OR “youth*” OR “teen*” OR “young*”; (b) “Sick, Control, One, Fat, Food” OR “SCOFF”. The complete search strategy for each database is shown in **Table eS1**. In addition, the list of references of the studies included in this review and in a previous systematic review¹⁷ was thoroughly reviewed to ensure that no eligible studies were missed.

2.3. Selection process

After identifying eligible studies, Mendeley (Version for Windows 10; Elsevier, Amsterdam, Netherlands) was used to remove duplicate studies. Two members of the research team (JFL-G and DV-M) conducted the selection process independently and screened every title and abstract to identify potentially relevant articles to be reviewed in the full-text phase. A third researcher (AG-H) participated to resolve any discrepancies.

2.5. Data items

The proportion of participants with disordered eating (i.e., cut-off point ≥ 2 on the SCOFF questionnaire) was extracted by one researcher (DV-M). Another researcher (JFL-G) checked the data for accuracy. In case of a discrepancy between these two researchers, a third researcher (AG-H) reviewed the information.

2.6. Risk of bias assessment

Information on the authors, affiliations, date, and source of each study included in this review was hidden to avoid bias in the assessment of the methodological quality of the articles. Two researchers (DV-M and JFL-G) independently assessed the risk of study bias of the included studies. This assessment was performed using a specific tool by Hoy et al. for prevalence studies²⁵. The tool consists of ten items that address both the external and internal validity of prevalence studies. Each item can be classified as “yes (low risk)” or “no (high risk)”, which equals zero and one point, respectively. The overall risk of study bias is deemed to be at “low risk of bias”, “moderate risk of bias” or “high risk of bias” if the points scored are 0–3, 4–6 or 7–9, respectively.

2.7. Outcome measures

Proportion of disordered eating was computed based on the raw numerators (i.e., participants who scored ≥ 2 on SCOFF questionnaire) and denominators (i.e., total sample) found among the studies.

2.8. Synthesis methods

Using RStudio software (version 2022.07.2+576; R Group for Statistical Computing, Vienna, Austria) with the *meta* package²⁶, a meta-analysis of single proportions (i.e., *metaprop*) was pooled by applying a random-effects model that displayed the results as forest plots using the inverse variance method. The exact or Clopper-Pearson method was used to establish 95% confidence intervals (95% CIs) for proportion from the selected individual studies²⁷, and a Freeman-Tukey double arcsine transformation was used to normalize the results before calculating the pooled proportion²⁸. A continuity correction of 0.5 was used both to calculate individual study results with confidence limits and to conduct meta-analysis.

Heterogeneity between the included studies was determined by the I^2 statistic and its p value. Small-study effects and publication bias were examined using the Doi plot and the Luis Furuya-Kanamori (LFK) index²⁹. No asymmetry, minor asymmetry, or major asymmetry were considered with values of < -2 , between -2 and -1 , and > -1 , respectively²⁹.

Sub-group analyses were conducted by sex. Furthermore, random-effects meta-regression analyses using the method of moments were estimated to independently assess whether disordered eating differed by age mean or body mass index (BMI) (both as continuous variables).

3. Results

3.1. Study selection

A total of 628 records were identified through database searches (**Figure 1**). After screening for duplicates, gray literature, and other reasons, 302 records remained. Finally, 97 records were obtained for full-text review. Of those studies, 67 were excluded for several reasons (**eTable 2**). Two studies were included via other methods (i.e., citation searching). Finally, 32 studies were included in this systematic review, and all studies were included in the meta-analysis.

3.2. Study characteristics

The main characteristics of the 32 included studies are summarized in **Table 1**. Twenty-six of the studies were cross-sectional^{19,20,30–53}, four were longitudinal^{54–57}, one was a quasi-experimental study⁵⁸, and one was a randomized clinical trial⁵⁹. A total of 63,181 participants (51.8% of girls) aged 7–18 years were included in this systematic review and meta-analysis.

According to sex, 22 studies reported the overall proportion of children and adolescents with disordered eating in both girls and boys, and two studies included only one sex (i.e., only girls^{36,53}). The remaining eight studies did not report proportion segmented by sex. In terms of geographical regions, 16 different countries were identified, including 21 studies in Europe^{19,20,30,33–35,37–44,46,47,49–51,56,57}, five in Asia^{31,48,53,55,58}, four in North America^{36,45,52,54}, one in South America⁵⁹, and one in Africa³². All the studies were conducted with participants from only one country.

3.3. Risk of study bias

All studies were deemed to be at low risk of bias, presenting scores ranging between zero and two points (with the exception of the study by Hicks et al.³⁶ which presented three

points). The main sources of bias were related to the representativeness of the analyzed sample^{19,20,30–33,36,38,41,42,44,45,52,53,56,58,59}. A summary of the risk of bias scoring is shown in **eTable 3**.

3.4. Results of syntheses

3.4.1. Disordered eating

Figure 2 shows that the overall proportion of children and adolescents with disordered eating was 22.36% (95% CI: 18.84% to 26.09%; $p < 0.001$; $n = 63,181$) ($I^2 = 98.58\%$). The LFK index for the Doi plot showed no asymmetry, indicating no risk of publication bias (LFK index = -0.58) (**eFigure 1**).

Figure 3 depicts the subgroup analysis according to sex. Girls were significantly more likely to report disordered eating (30.03%, 95% CI: 25.61% to 34.65%; $n = 27,548$) than boys (16.98%, 95% CI: 13.46% to 20.81%; $n = 26,170$) ($p < 0.001$).

The random-effects meta-regression models between proportion of disordered eating and age mean or BMI are shown in **Figure 4**. Disordered eating became more elevated with increasing age and BMI ($B = 0.03$, 95% CI: 0.00 to 0.06; $p = 0.049$) (**Figure 4A**), and BMI ($B = 0.03$, 95% CI: 0.01 to 0.05; $p < 0.001$) (**Figure 4B**).

4. Discussion

To our knowledge, this is the first meta-analysis that has comprehensively examined the overall proportion of children and adolescents with disordered eating in terms of sex, age mean, and BMI. The main findings of this study are as follows: (a) a total of 14,856 of 63,181 (i.e., 22.36%) children and adolescents from 16 countries showed disordered eating; (b) the proportion of children and adolescents with disordered eating was significantly higher in girls than in boys; and (c) the proportion of disordered eating among children and adolescents was positively associated with age mean and BMI. These

findings can inform intervention priorities for disordered eating as a global health initiative to prevent possible health problems among young people⁶⁰, particularly in girls and young people with higher BMI.

Our findings indicate that more than one in five children and adolescents presented disordered eating. It is noteworthy that disordered eating and eating disorders are not similar because not all children and adolescents who reported disordered eating behaviors will necessarily be diagnosed with an eating disorder¹⁵. However, disordered eating in childhood/adolescence can predict outcomes related to eating disorders in early adulthood¹³. For this reason, this high proportion found is worrisome and call for urgent action to try to address this situation. In 2019, 14 million people experienced eating disorders including almost three million children and adolescents⁶¹. The behaviors related to eating disorders may lead to greater risk or damage to health, significant distress, or significant impairment of functioning⁶⁰. Indeed, eating disorders are among the most life-threatening psychiatric problems, and people with these conditions die 10–20 years younger than the general population⁵.

Our findings also indicated that the proportion of children and adolescents with disordered eating was higher in girls than in boys. Although sex differences in disordered eating seem to be relatively minor in adolescence⁶², it is well-known that these disorders are more prevalent among girls⁶³. Conventionally, studies have focused principally on the female sex, but currently this is not considered as a girl-specific matter. The reasons for sex disagreement in the prevalence are not well known⁶². It has been pointed out that disordered eating are frequently unobserved among boys⁶⁴. Boys are presumed to underreport the problem because of the societal perception that these disorders mostly affect girls⁶⁵ and because disordered eating have usually been thought by the general population to be exclusive to girls/women⁶⁴. Additionally, it has been noted that the

current diagnostic criteria of eating disorder² fail to detect disordered eating behaviors more commonly observed in boys than in girls, such as intensely engaging in muscle mass and weight gain with the goal of improving body image satisfaction⁶⁴.

On the other hand, the proportion of young people with disordered eating increased with increasing age. This finding is in line with the scientific literature^{66–68}. The age at onset of eating disorders has classically been described in adolescence⁶⁸. Adolescence represents a critical period for the onset of eating disorders⁶⁶. Similarly, Swanson et al.⁶⁷ found that the median of some eating disorders (e.g., anorexia nervosa, bulimia nervosa, binge eating disorder) ranged from 12.3 to 12.6 years in a US nationally representative sample including 10,123 adolescents. As the analyzed sample in the present systematic review and meta-analysis ranged from 7 to 18 years old, and only three studies included only children (i.e., aged 7–10 years), it seems to corroborate these ages at onset.

Importantly, we found that proportion of children and adolescents with disordered eating became more evaluated with increasing BMI. In this sense, the proportion of disordered eating is higher in young people with excess weight than in their counterparts with normal weight^{31,69,70}. Young people who have excess weight may follow disordered eating behaviors while attempting to lose body weight⁷¹. Therefore, it has been described that young people with excess weight is the population that appears to experience symptoms of disordered eating most frequently (e.g., unsupervised weight loss dieting may lead to eating disorder risk⁷²). Although most adolescents who develop an eating disorder do not report prior excess weight problems, some adolescents could misinterpret what eating healthy consists of and engage in unhealthy behaviors (e.g., skipping meals to generate a caloric deficit), which could then lead to development of an eating disorder⁷³.

The WHO's Comprehensive Mental Health Action Plan 2013–2030 recognizes the essential role of mental health in achieving health for all people, establishing some objectives/priorities⁶⁰. For instance, among others, this plan tries to strengthen information systems, evidence, and research for mental health. In this sense, our systematic review and meta-analysis contributes to this aim by providing epidemiological evidence on the current situation of disordered eating that, if undetected and untreated, can lead to eating disorders with their harmful consequences for the individual, the family and society. Similarly, the high proportion of disordered eating found in our review reinforce the importance of screening eating disorders in primary care setting. This is in line with the recommendations by the American Academy of Pediatrics⁷⁴ and the American Academy of Child and Adolescent Psychiatry⁷⁵, which advice screening young people through longitudinal height and weight monitoring and looking for symptoms of disordered eating. In this sense, the SCOFF questionnaire is simple, memorable, easy for applying and scoring¹⁶, which may be considered the first approach to identify the need for a more detailed and specialized evaluation²⁰. However, positive results should be followed by further questioning, prior to an automatic referral to mental health professionals⁷⁶.

The present study has certain limitations that must be acknowledged. First, only studies that analyzed disordered eating using the SCOFF questionnaire were included. This decision is justified by the intention of homogenizing the proportion of global proportion of children and adolescents with disordered eating. In this sense, the SCOFF questionnaire is the most widely used screening tool for eating disorders, has been adapted and validated for its use in several languages, seems to be highly effective as a screening tool, and has been extensively used to raise the suspicion level of an eating disorder. Second, because of the cross-sectional nature of most of the included studies, a

causal relationship cannot be established. Third, due to the inclusion of binge eating disorder and other specified eating disorders in the DSM-5, there is not enough evidence to support the use of SCOFF in primary care and community-based settings for screening all the range of eating disorders. However, a meta-analysis by Kutz et al.¹⁷ concluded that the SCOFF is a useful and simple screening tool for the most prevalent eating disorders (i.e., bulimia nervosa, anorexia nervosa). Fourth, we included studies based on self-report questionnaires to assess disordered eating, and consequently, both social desirability and recall bias could influence the findings.

To conclude, the available evidence from 32 studies comprising large samples from 16 countries showed that approximately two out of ten children and adolescents showed disordered eating according to the SCOFF tool. Proportion of disordered eating was further elevated among girls, as well as with increasing age and BMI. This high proportion is worrisome from a public health perspective and highlight the need to implement strategies for preventing eating disorders⁶⁰.

Acknowledgements

JFL-G is a Margarita Salas Fellow (Universidad de Castilla-La Mancha – 2021-MS-20563). AG-H is a Miguel Servet Fellow (Instituto de Salud Carlos III – CP18/0150). JFL-G had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Funding

No funding.

References

1. Treasure J, Duarte TA, Schmidt U. Eating disorders. *The Lancet*.

2020;395(10227):899-911. doi:10.1016/S0140-6736(20)30059-3

2. American Psychiatric Association, ed. *Diagnostic and Statistical Manual of Mental Disorders: DSM-5-TR*. Fifth edition, text revision. American Psychiatric Association Publishing; 2022.
3. World Health Organization. *International Statistical Classification of Diseases and Related Health Problems (ICD)*.; 2022.
<https://www.who.int/standards/classifications/classification-of-diseases>
4. GBD 2019 Mental Disorders Collaborators. Global, regional, and national burden of 12 mental disorders in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet Psychiatry*. 2022;9(2):137-150. doi:10.1016/S2215-0366(21)00395-3
5. Chesney E, Goodwin GM, Fazel S. Risks of all-cause and suicide mortality in mental disorders: a meta-review. *World Psychiatry*. 2014;13(2):153-160. doi:10.1002/wps.20128
6. Culbert KM, Racine SE, Klump KL. Research Review: What we have learned about the causes of eating disorders - a synthesis of sociocultural, psychological, and biological research. *J Child Psychol Psychiatry*. 2015;56(11):1141-1164. doi:10.1111/jcpp.12441
7. Smink FRE, van Hoeken D, Hoek HW. Epidemiology of Eating Disorders: Incidence, Prevalence and Mortality Rates. *Curr Psychiatry Rep*. 2012;14(4):406-414. doi:10.1007/s11920-012-0282-y
8. Galmiche M, Déchelotte P, Lambert G, Tavalacci MP. Prevalence of eating disorders over the 2000–2018 period: a systematic literature review. *Am J Clin Nutr*. 2019;109(5):1402-1413. doi:10.1093/ajcn/nqy342
9. Stice E, Marti CN, Rohde P. Prevalence, incidence, impairment, and course of the

proposed DSM-5 eating disorder diagnoses in an 8-year prospective community study of young women. *J Abnorm Psychol.* 2013;122(2):445-457. doi:10.1037/a0030679

10. Forrest LN, Smith AR, Swanson SA. Characteristics of seeking treatment among U.S. adolescents with eating disorders: Forrest et al. *Int J Eat Disord.* 2017;50(7):826-833. doi:10.1002/eat.22702

11. Attia E, Guarda AS. Prevention and Early Identification of Eating Disorders. *JAMA.* 2022;327(11):1029. doi:10.1001/jama.2022.2458

12. Toni G, Berioli M, Cerquiglini L, et al. Eating Disorders and Disordered Eating Symptoms in Adolescents with Type 1 Diabetes. *Nutrients.* 2017;9(8):906. doi:10.3390/nu9080906

13. Neumark-Sztainer D, Wall M, Guo J, Story M, Haines J, Eisenberg M. Obesity, Disordered Eating, and Eating Disorders in a Longitudinal Study of Adolescents: How Do Dieters Fare 5 Years Later? *J Am Diet Assoc.* 2006;106(4):559-568. doi:10.1016/j.jada.2006.01.003

14. Quick VM, Byrd-Bredbenner C, Neumark-Sztainer D. Chronic Illness and Disordered Eating: A Discussion of the Literature. *Adv Nutr.* 2013;4(3):277-286. doi:10.3945/an.112.003608

15. Pennesi JL, Wade TD. A systematic review of the existing models of disordered eating: Do they inform the development of effective interventions? *Clin Psychol Rev.* 2016;43:175-192. doi:10.1016/j.cpr.2015.12.004

16. Morgan JF, Reid F, Lacey JH. The SCOFF questionnaire: assessment of a new screening tool for eating disorders. *BMJ.* 1999;319(7223):1467-1468. doi:10.1136/bmj.319.7223.1467

17. Kutz AM, Marsh AG, Gunderson CG, Maguen S, Masheb RM. Eating Disorder Screening: a Systematic Review and Meta-analysis of Diagnostic Test Characteristics of

- the SCOFF. *J Gen Intern Med*. 2020;35(3):885-893. doi:10.1007/s11606-019-05478-6
18. Feltner C, Peat C, Reddy S, et al. *Screening for Eating Disorders in Adolescents and Adults: An Evidence Review for the U.S. Preventive Services Task Force*. Agency for Healthcare Research and Quality (US); 2022.
19. Berger U, Wick K, Hölling H, et al. [Screening of disordered eating in 12-Year-old girls and boys: psychometric analysis of the German versions of SCOFF and EAT-26]. *Psychother Psychosom Med Psychol*. 2011;61(7):311-318. doi:10.1055/s-0031-1271786
20. Muro-Sans P, Amador-Campos JA, Morgan JF. The SCOFF-c: Psychometric properties of the Catalan version in a Spanish adolescent sample. *J Psychosom Res*. 2008;64(1):81-86. doi:10.1016/j.jpsychores.2007.06.011
21. Rueda Jaimes GE, Díaz Martínez LA, Ortiz Barajas DP, Pinzón Plata C, Rodríguez Martínez J, Cadena Afanador LP. [Validation of the SCOFF questionnaire for screening the eating behaviour disorders of adolescents in school]. *Aten Primaria*. 2005;35(2):89-94. doi:10.1157/13071915
22. Caamaño F. Validation of SCOFF questionnaire among pre-teenagers. *BJM*. Published online 2022.
23. Hoek HW. Review of the worldwide epidemiology of eating disorders. *Curr Opin Psychiatry*. 2016;29(6):336-339. doi:10.1097/YCO.0000000000000282
24. Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ*. Published online March 29, 2021:n71. doi:10.1136/bmj.n71
25. Hoy D, Brooks P, Woolf A, et al. Assessing risk of bias in prevalence studies: modification of an existing tool and evidence of interrater agreement. *J Clin Epidemiol*. 2012;65(9):934-939. doi:10.1016/j.jclinepi.2011.11.014

26. Schwarzer G, Carpenter JR, Rücker G. *Meta-Analysis with R*. Springer International Publishing; 2015.
27. Newcombe RG. Two-sided confidence intervals for the single proportion: comparison of seven methods. *Stat Med*. 1998;17(8):857-872. doi:10.1002/(SICI)1097-0258(19980430)17:8<857::AID-SIM777>3.0.CO;2-E
28. Barendregt JJ, Doi SA, Lee YY, Norman RE, Vos T. Meta-analysis of prevalence. *J Epidemiol Community Health*. 2013;67(11):974-978. doi:10.1136/jech-2013-203104
29. Furuya-Kanamori L, Barendregt JJ, Doi SAR. A new improved graphical and quantitative method for detecting bias in meta-analysis. *Int J Evid Based Healthc*. 2018;16(4):195-203. doi:10.1097/XEB.0000000000000141
30. Adelantado-Renau M, Beltran-Valls MR, Toledo-Bonifás M, Bou-Sospedra C, Pastor M^a C, Moliner-Urdiales D. The risk of eating disorders and academic performance in adolescents: DADOS study. *Nutr Hosp*. 2018;35(5):1201-1207. doi:10.20960/nh.1778
31. Feng T, Abebe DS. Eating behaviour disorders among adolescents in a middle school in Dongfanghong, China. *J Eat Disord*. 2017;5(1):47. doi:10.1186/s40337-017-0175-x
32. Ghafouri KJ, Qadhi AH, Ghaith MM, Azhar WF, Azzeh FS, Habibullah MM. Eating disorders amongst adolescents in Makkah: Effects of stress and smoking. *Med Sci*. 2021;25(110):767-775.
33. Gmeiner MS, Warschburger P. Simply too much: the extent to which weight bias internalization results in a higher risk of eating disorders and psychosocial problems. *Eat Weight Disord*. 2022;27(1):317-324. doi:10.1007/s40519-021-01170-z
34. Grüttner M. Eating Disorders in Female High School Students: Educational and Migration Background, School-Related Stress and Performance-Orientated Classes [Essstörungen bei Schülerinnen: Bildungs- und Migrationshintergrund,

- leistungsorientiertes Klassenklima und leistungsbezogener Schulstress]. *Gesundheitswesen Suppl.* 2018;80:S5-S11. doi:10.1055/s-0042-113602
35. Herpertz-Dahlmann B, Wille N, Hölling H, Vloet TD, Ravens-Sieberer U. Disordered eating behaviour and attitudes, associated psychopathology and health-related quality of life: results of the BELLA study. *Eur Child Adolesc Psychiatry.* 2008;17 Suppl 1:82-91. doi:10.1007/s00787-008-1009-9
 36. Hicks TM, Lee JY, Nguyen T, La Via M, Roberts MW. Knowledge and practice of eating disorders among a group of adolescent dental patients. *J Clin Pediatr Dent.* 2013;38(1):39-43. doi:10.17796/jcpd.38.1.p764642162107355
 37. Horváth Z, Román N, Elekes Z, Griffiths MD, Demetrovics Z, Urbán R. Alcohol consumption and risk for feeding and eating disorders in adolescence: The mediating role of drinking motives. *Addict Behav.* 2020;107:106431. doi:10.1016/j.addbeh.2020.106431
 38. Jáuregui Lobera I, Romero Candau J, Montaña González MT, Morales Millán MT, Vargas Sánchez N, León Lozano P. [Analysis of eating attitudes in a sample of adolescents from Sevilla]. *Med Clin (Barc).* 2009;132(3):83-88. doi:10.1016/j.medcli.2008.07.001
 39. Lommi S, Viljakainen HT, Weiderpass E, de Oliveira Figueiredo RA. Children's Eating Attitudes Test (ChEAT): a validation study in Finnish children. *Eat Weight Disord.* 2020;25(4):961-971. doi:10.1007/s40519-019-00712-w
 40. López-Gil JF, García-Hermoso A, Smith L, et al. Physical fitness and disordered eating among adolescents: Results from the EHDLA study. *Appetite.* 2022;178:106272. doi:10.1016/j.appet.2022.106272
 41. Monteagudo M, Rodríguez-Blanco T, Pueyo MJ, et al. Gender differences in negative mood states in secondary school students: health survey in Catalonia (Spain). *Gac Sanit.* 2013;27(1):32-39. doi:10.1016/j.gaceta.2012.01.009

42. Philipp J, Zeiler M, Waldherr K, et al. The Mental Health in Austrian Teenagers (MHAT)-Study: preliminary results from a pilot study. *Neuropsychiatr Klin Diagn Ther Rehabil Organ Ges Österreichischer Nervenärzte Psychiater*. 2014;28(4):198-207. doi:10.1007/s40211-014-0131-9
43. Pustivšek S, Hadžić V, Dervišević E, Carruthers J. Risk for eating disorders and body composition among adolescent female and male athletes and non-athlete controls. *Int J Adolesc Med Health*. 2020;32(4). doi:10.1515/ijamh-2017-0190
44. Esteche Querol S, Fernández Alvira JM, Mesana Graffe MI, Nova Rebato E, Marcos Sánchez A, Moreno Aznar LA. Nutrient intake in Spanish adolescents SCOFF high-scorers: the AVENA study. *Eat Weight Disord*. 2016;21(4):589-596. doi:10.1007/s40519-016-0282-8
45. Read AK. The Implementation and Evaluation of the SCOFF (Sick, Control, One Stone, Fat, Food) Eating Disorder Screening Tool for Children and Adolescents. *Pediatr Nurs*. 2021;47(3):124-132.
46. Šablatúrová N, Gottfried J, Blinka L, Ševčíková A, Husarova D. Eating disorders symptoms and excessive internet use in adolescents: the role of internalising and externalising problems. *J Eat Disord*. 2021;9(1):152. doi:10.1186/s40337-021-00506-5
47. Štefanová E, Bakalár P, Baška T. Eating-Disordered Behavior in Adolescents: Associations with Body Image, Body Composition and Physical Activity. *Int J Environ Res Public Health*. 2020;17(18):6665. doi:10.3390/ijerph17186665
48. Watson HJ, Hamer RM, Thornton LM, et al. Prevalence of screening-detected eating disorders in Chinese females and exploratory associations with dietary practices. *Eur Eat Disord Rev*. 2015;23(1):68-76. doi:10.1002/erv.2334
49. Zeiler M, Waldherr K, Philipp J, et al. Prevalence of Eating Disorder Risk and Associations with Health-related Quality of Life: Results from a Large School-based

Population Screening. *Eur Eat Disord Rev.* 2016;24(1):9-18. doi:10.1002/erv.2368

50. Cohrdes C, Göbel K, Schlack R, Hölling H. Symptoms of eating disorders in children and adolescents: frequencies and risk factors: Results from KiGGS Wave 2 and trends [Essstörungssymptome bei Kindern und Jugendlichen: Häufigkeiten und Risikofaktoren: Ergebnisse aus KiGGS Welle 2 und Trends]. *Bundesgesundheitsblatt - Gesundheitsforschung - Gesundheitsschutz.* 2019;62(10):1195-1204. doi:10.1007/s00103-019-03005-w

51. Nolan E, Bunting L, McCartan C, et al. Prevalence of probable eating disorders and associated risk factors: An analysis of the Northern Ireland Youth Wellbeing Survey using the SCOFF. *Br J Clin Psychol.* Published online October 27, 2022:bjc.12401. doi:10.1111/bjc.12401

52. Bean GJ. An Item Response Theory Analysis of the SCOFF Questionnaire in a High School Population. *J Evid-Based Soc Work.* 2019;16(4):404-422. doi:10.1080/26408066.2019.1617212

53. Rungta N, Kudpi R. Evaluation of Eating Disorders Using “SCOFF Questionnaire” Among Young Female Cohorts and Its Dental Implications – An Exploratory Study. *J Orofac Sci.* 2019;11(1):27. doi:10.4103/jofs.jofs_145_18

54. Breton É, Dufour R, Côté SM, et al. Developmental trajectories of eating disorder symptoms: A longitudinal study from early adolescence to young adulthood. *J Eat Disord.* 2022;10(1):84. doi:10.1186/s40337-022-00603-z

55. Chia M, Lee M. Body weight satisfaction and disordered eating among youth who are active in sport in Singapore. *Pedagog Psychol Med-Biol Probl Phys Train Sports.* 2015;19(4):51-58. doi:10.15561/18189172.2015.0409

56. Esteban-Gonzalo L, Veiga OL, Gómez-Martínez S, et al. Length of residence and risk of eating disorders in immigrant adolescents living in madrid. The AFINOS study.

Nutr Hosp. 2014;29(5):1047-1053. doi:10.3305/nh.2014.29.5.7387

57. Giel KE, Zipfel S, Schweizer R, et al. Eating disorder pathology in adolescents participating in a lifestyle intervention for obesity: associations with weight change, general psychopathology and health-related quality of life. *Obes Facts.* 2013;6(4):307-316. doi:10.1159/000354534

58. Lee GY, Park EJ, Kim YR, et al. Feasibility and acceptability of a prevention program for eating disorders (Me, You and Us) adapted for young adolescents in Korea. *Eat Weight Disord EWD.* 2018;23(5):673-683. doi:10.1007/s40519-017-0436-3

59. Galvão PP, Valente JY, Cogo-Moreira H, Mari JJ, Sanchez ZM. Bullying as a Risk Factor for Eating Disorder Behaviors Among Students: Secondary Analysis for a Cluster Randomized Controlled Trial. *Child Psychiatry Hum Dev.* Published online March 2022. doi:10.1007/s10578-022-01343-6

60. World Health Organization. *Mental Disorders.*; 2022. <https://www.who.int/news-room/fact-sheets/detail/mental-disorders>

61. Institute for Health Metrics and Evaluation. Global Health Data Exchange (GHDx). Published online 2022. <https://vizhub.healthdata.org/gbd-results/>

62. Hautala LA, Junnila J, Helenius H, et al. Towards understanding gender differences in disordered eating among adolescents. *J Clin Nurs.* 2008;17(13):1803-1813. doi:10.1111/j.1365-2702.2007.02143.x

63. Ammann S, Berchtold A, Barrense-Dias Y, Akre C, Surís JC. Disordered Eating: The Young Male Side. *Behav Med.* 2018;44(4):289-296. doi:10.1080/08964289.2017.1341383

64. Anderson CB, Bulik CM. Gender differences in compensatory behaviors, weight and shape salience, and drive for thinness. *Eat Behav.* 2004;5(1):1-11. doi:10.1016/j.eatbeh.2003.07.001

65. Franco KSN, Tamburrino MB, Carroll BT, Bernal GAA. Eating attitudes in college males. *Int J Eat Disord.* 1988;7(2):285-288. doi:10.1002/1098-108X(198803)7:2<285::AID-EAT2260070214>3.0.CO;2-Z
66. Herpertz-Dahlmann B. Adolescent Eating Disorders. *Child Adolesc Psychiatr Clin N Am.* 2015;24(1):177-196. doi:10.1016/j.chc.2014.08.003
67. Swanson SA, Crow SJ, Le Grange D, Swendsen J, Merikangas KR. Prevalence and Correlates of Eating Disorders in Adolescents: Results From the National Comorbidity Survey Replication Adolescent Supplement. *Arch Gen Psychiatry.* 2011;68(7):714. doi:10.1001/archgenpsychiatry.2011.22
68. Volpe U, Tortorella A, Manchia M, Monteleone AM, Albert U, Monteleone P. Eating disorders: What age at onset? *Psychiatry Res.* 2016;238:225-227. doi:10.1016/j.psychres.2016.02.048
69. D'Anna G, Lazzeretti M, Castellini G, et al. Risk of eating disorders in a representative sample of Italian adolescents: prevalence and association with self-reported interpersonal factors. *Eat Weight Disord - Stud Anorex Bulim Obes.* 2022;27(2):701-708. doi:10.1007/s40519-021-01214-4
70. Gutiérrez T, Espinoza P, Penelo E, et al. Association of biological, psychological and lifestyle risk factors for eating disturbances in adolescents. *J Health Psychol.* 2015;20(6):839-849. doi:10.1177/1359105315577302
71. Golden NH, Schneider M, Wood C, et al. Preventing Obesity and Eating Disorders in Adolescents. *Pediatrics.* 2016;138(3):e20161649. doi:10.1542/peds.2016-1649
72. Jebeile H, Lister NB, Baur LA, Garnett SP, Paxton SJ. Eating disorder risk in adolescents with obesity. *Obes Rev.* 2021;22(5). doi:10.1111/obr.13173
73. Lebow J, Sim LA, Kransdorf LN. Prevalence of a History of Overweight and Obesity in Adolescents With Restrictive Eating Disorders. *J Adolesc Health.*

2015;56(1):19-24. doi:10.1016/j.jadohealth.2014.06.005

74. Hornberger LL, Lane M, Breuner CC, et al. Identification and Management of Eating Disorders in Children and Adolescents. *Pediatrics*. 2021;147(1):e2020040279. doi:10.1542/peds.2020-040279

75. Lock J, La Via MC. Practice Parameter for the Assessment and Treatment of Children and Adolescents With Eating Disorders. *J Am Acad Child Adolesc Psychiatry*. 2015;54(5):412-425. doi:10.1016/j.jaac.2015.01.018

76. Luck AJ, MorganLuck JF, Reid F, et al. The SCOFF questionnaire and clinical interview for eating disorders in general practice: comparative study. *BMJ*. 2002;325(7367):755-756. doi:10.1136/bmj.325.7367.755

Table 1. Characteristics of the studies included (N=32).

Reference	Year	Study design	Total (n)	Girls (%)	Age (mean)	Age (range)	BMI (kg/m ²)
Adelantado-Renau et al. ³⁰	2018	Cross-sectional	261	47.1	13.9	14–18	20.3
Bean et al. ⁵²	2019	Cross-sectional	3356	52.6	NA	14–18	NA
Berger et al. ¹⁹	2011	Cross-sectional	807	52.7	12.0	12	NA
Breton et al. ⁵⁴	2022	Longitudinal	1336	52.2	12.0	12	NA
Chia et al. ⁵⁵	2015	Longitudinal	137	40.1	12.7	12–13	NA
Cohrdes et al. ⁵⁰	2019	Cross-sectional	13232	50.3	NA	11–17	NA
Esteban-Gonzalo et al. ⁵⁶	2014	Longitudinal	2077	50.6	14.7	13–17	NA
Estecha-Querol et al. ⁴⁴	2016	Cross-sectional	235	62.1	14.9	13–18	21.6
Feng et al. ³¹	2017	Cross-sectional	389	48.8	15.1	12–18	NA
Galvão et al. ⁵⁹	2022	Cluster randomized controlled trial	5208	49.9	13.3	12–17	NA
Ghafouri et al. ³²	2021	Cross-sectional	471	84.7	17.3	15–18	22.0
Giel et al. ⁵⁷	2013	Longitudinal	41	48.8	13.7	12–13	31.3
Gmeiner et al. ³³	2021	Cross-sectional	1061	52.1	11.0	9–13	NA
Grüttner ³⁴	2016	Cross-sectional	1778	49.8	12.0	12–13	NA
Herpertz-Dahlmann et al. ³⁵	2009	Cross-sectional	1843	48.7	14.6	11–17	NA
Hicks et al. ³⁶	2013	Cross-sectional	126	0	13.9	12–17	NA
Horváth et al. ³⁷	2020	Cross-sectional	5205	50.8	16.6	15–18	21.7
Jáuregui-Lobera et al. ³⁸	2009	Cross-sectional	318	52.8	14.4	12–18	20.6
Lee et al. ⁵⁸	2017	Quasi-experimental	169	50.9	12.3	11–12	19.6
Lommi et al. ³⁹	2020	Cross-sectional	339	54.6	11.9	10–15	NA
López-Gil et al. ⁴⁰	2022	Cross-sectional	855	54.6	14.0	12–17	22.8
Monteagudo et al. ⁴¹	2013	Cross-sectional	9340	50.2	15.0	14–18	NA
Muro-Sans et al. ²⁰	2008	Cross-sectional	954	49.8	13.6	11–17	NA
Nolan et al. ^{51 a}	2022	Cross-sectional	1291	48.8	NA	11–19*	NA
Philipp et al. ⁴²	2014	Cross-sectional	408	58.3	NA	10–18	NA
Pustivšek et al. ⁴³	2019	Cross-sectional	583	46.8	16.0	15–17	26.5

Read ⁴⁵	2021	Cross-sectional	125	53.6	15.9	7–18	NA
Rungta & Kudpi ⁵³	2019	Cross-sectional	200	100	13.5	14–17	17.7
Šabláturová et al. ⁴⁶	2021	Cross-sectional	6867	50.1	13.5	11–16	NA
Štefanová et al. ⁴⁷	2020	Cross-sectional	780	44.1	14.4	11–15	19.9
Watson et al. ⁴⁸	2015	Cross-sectional	259	100	12.3	12–17	19.0
Zeiler et al. ⁴⁹	2015	Cross-sectional	3610	55.3	14.5	10–18	NA

BMI, body mass index. NA, not available. * Only the sample between 11 and 16 years of age (N=811) was included.

Figure legends

Figure 1. PRISMA 2020 flow chart for systematic reviews that included database searches.

Figure 2. Meta-analysis of proportion of disordered eating among children and adolescents. ^a Data from KiGGS Baseline, 2003–2006; ^b Data from KiGGS Wave 2, 2014–2017. CI, confident intervals.

Figure 3. Meta-analysis of proportion of disordered eating among children and adolescents by sex. ^a Data from KiGGS Baseline, 2003–2006; ^b Data from KiGGS Wave 2, 2014–2017. CI, confident intervals.

Figure 4. Meta-regression analyses by age mean and body mass index. A: meta-regression analysis by age mean. B: meta-regression analysis by body mass index.