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REVIEW

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Associations between social media, adolescent mental health, and diet: A systematic review

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Summary

Social media use is integral to many adolescents' lives. It brings benefits but can also have detrimental effects on both physical and mental health. We conducted a systematic review examining associations between social media use, adolescent mental health (including body image, self-esteem, stress, interpersonal relationships and loneliness, anxiety, and depressive symptoms), and dietary outcomes. Quantitative studies published between 2019 and 2023 investigating both mental health and diet were searched in 11 databases. The risk of bias was appraised using ROBINS-E. Data were narratively synthesized by type of association, PROGRESS-Plus health equity characteristics, and related to social media influencers. Twenty-one studies were included, of which only one focused on influencers. Sex/gender was the only equity characteristic assessed ($n = 8$), with mixed results. The findings suggest significant positive correlations between social media use and both depressive and disordered eating symptoms, body dissatisfaction, and anxiety. Four studies identified body image, self-esteem, or anxiety as moderators acting between social media exposure and dietary outcomes. Policy interventions mitigating the impact of social media on adolescents—particularly body image and disordered eating—are needed, alongside follow-up studies on causal pathways, the role of influencers, equity impacts, dietary intake, and the best measurement tools to use.

KEYWORDS
adolescent, diet, mental health, social media

1 | INTRODUCTION

Social media use is an integral part of many adolescents' lives. According to 2017–2019 data from a European Union (EU) Kids Online survey, the time that 9–16-year-olds spend on the internet has doubled since 2010 to reach on average 167 min a day.[1] The 15–16-year-olds spent about twice as much time online than the 9–11-year-olds. Daily,

Abbreviations: CI, confidence interval; CO-CREATE, "Confronting obesity: Co-creating policy with youth"; DE, disordered eating; OECD, Organisation for Economic Co-operation and Development; OR, odds ratio; SE, standard error; UK, United Kingdom.

54% of the children surveyed visited social networking sites such as Snapchat, Facebook, and Instagram, particularly the 12–16-year-olds, and 44% played video games, especially the 12–14-year-olds and boys. In the United States in 2022, 95% of 13–17-year-olds had access to a smartphone and visited social media, and 35% reported using social media "almost constantly."[2]

While social media brings new opportunities, including for information sharing and social connection, it can also have detrimental effects on both physical and mental health. Advertisements and marketing promoting commodities harmful to health such as ultra-processed foods, tobacco, alcohol, and gambling are omnipresent[3–7] and enhanced via home delivery platforms (e.g., Just Eat and Deliveroo).[8,9] Furthermore, the line between actual social media content and marketing is blurred when shared by influencers and peers, making it more difficult for young people to recognize when marketing is occurring.[10] In 2018, more than US$ 500 million was spent by advertisers on influencer marketing.[11] According to 2021 UK data,[12] just under half of 10–15-year-olds search engine users can correctly identify adverts on Google searches, about half know that not all sites can be trusted, and two-thirds recognize that vloggers (video bloggers) and influencers can be sponsored to promote products or brands. While recognition of marketing is essential for activating cognitive defenses against its harmful influence,[13] the unique developmental stage of adolescence—including increased susceptibility to risk taking, establishment of social identities, and desire for acceptance from peers—makes this age group particularly vulnerable to advertisers' messaging despite their advanced cognitive development relative to younger children.[14–16]

Additionally, when on social media, adolescents can experience bullying, sexual harassment, exclusion, hate messages, exposure to inappropriate content such as self-harm strategies, and sleep problems, which can lead to stress, low mood, depression, injury, and even death.[1,17] Exposure to marketing and harmful content can also be further exacerbated by peers' interactions and the use of real-time personalized algorithms that rely on extensive collections of personal data such as emotions, responses, preferences, behavior, and location.[8] By the time a young person reaches 13 years, an estimated 72 million data points have been collected from them, equivalent to 12,000 pieces of data for each hour spent online.[18] This practice can enable organizations to target particularly vulnerable groups and individuals,[8] as vividly illustrated by a 2017 newspaper article in Australia, which reported that Facebook had informed advertisers that it monitored 1.9 million high schoolers in real time, including their mood and when they felt "overwhelmed," "anxious," or like "a failure."[9] Thus, poor adolescent mental health can be both an outcome of social media and a factor that marketers can use to further promote unhealthy commodities.

1.1 | Adolescents' views of what drives obesity

This systematic review is part of a larger project entitled *Confronting obesity: Co-creating policy with youth* (CO-CREATE, www.co-create.eu),[19] a European Commission-funded research project that aims to identify, together with adolescents, factors causing obesity in adolescence and potential solutions using a complex systems perspective. An initial CO-CREATE research activity consisted of conducting systems mapping workshops with 16–18-year-olds in the Netherlands, Norway, Poland, Portugal, South Africa, and the UK to visually capture their views about the drivers of adolescent obesity.[20,21] Social media, and in particular influencers and celebrities, was consistently reported as negatively impacting mental health—specifically body image, self-esteem, stress, personal relationships and loneliness, anxiety, and depressive symptoms, which in turn encouraged excessive and compulsive dietary intakes and reduced motivation to exercise and eat healthily. Similar concerns have been raised by WHO and EU Kids Online surveys.[1,8]

1.2 | The findings of the literature to date

This systematic review focused on the role of social media use in adolescent mental health and diet. To our knowledge, no review has directly investigated the potential causal pathways suggested above in an adolescent population. However, a mixed-methods systematic review by Rounsefell et al.[22] covering the years 2005 up to July 2019 assessed the relationships between social media, body image, and eating behaviors in young adults (18–30 years old), and as such serves as a starting point for our study. Rounsefell et al. also included disordered eating (DE) symptoms such as anorexia and bulimia, given that social media is seen to trigger or worsen them. They found a positive association between photo-based social media and body dissatisfaction, dieting/restricting food, compulsive overeating, and choosing healthy foods.

In order to examine the hypotheses formulated by adolescents in CO-CREATE and inform potential policy actions, the present systematic review aimed to synthesize the literature on the associations between social media use and both adolescent mental health (specifically body image, self-esteem, stress, interpersonal relationships/loneliness, anxiety, and depressive symptoms) and diet. We also sought to investigate associations specific to social media influencers and celebrities and by health equity characteristics (e.g., gender, age, education, and income). The hypotheses generated by the adolescents are also further investigated in this journal supplement in a simulation model by Aguiar et al.[23] exploring the dynamics between mental wellbeing, energy balance-related behaviors, and obesity prevalence, as well as in a systematic review by Nwosu et al.[24] investigating the role of mental health in weight gain and energy balance-related behaviors.

2 | METHODS

This study is reported following the PRISMA 2020 checklist (Table S1).[25] The protocol was registered on PROSPERO (CRD42023399929). However, deviating slightly from the initial protocol, this systematic review focused only on quantitative evidence, mental health and diet, and social media.

2.1 | Eligibility criteria

This systematic review included quantitative studies, both published and from grey literature, on social media and both adolescent mental health and diet. At least one of the latter two outcomes had to be measured in direct relation to social media use, while the other could also be measured in relation to the first outcome. There was no geographical restriction. Evidence syntheses, case reports, conference abstracts, books, protocols, commentaries, working papers, and preprints were excluded. Given how quickly social media evolves and Rounsefell et al.'s systematic review,[22] only sources published from 2019 onwards were considered. Participants were adolescents, defined as 10–19 years of age according to WHO's definition.[26] Studies focusing on those aged 18+, university students, and population groups with a mean or median age higher than 19 years were excluded. Any use, exposure, or experience with publicly accessible social media platforms that allow people to interact with others from any type of device was eligible. This included chat functions (e.g., WhatsApp), games (e.g., Fortnite), and social networks (e.g., Facebook, Instagram, and TikTok). Influencers and celebrities were defined as people with a large number of social media followers.

Mental health outcomes encompassed body image, self-esteem, stress, interpersonal relationships and loneliness, anxiety, and depressive symptoms. These are part of mental "well-being," which encapsulates both positive and negative self-rated measures such as emotions and the feeling of having control over one's own life.[27,28] They are also aligned with WHO's definition of mental health: "an integral component of health and well-being and {…} more than the absence of mental disorder."[29] General well-being, life satisfaction, self-harm, suicide, as well as psychological, neurological, and substance use disorders were excluded. Emotional eating as well as DE (e.g., anorexia and bulimia) were automatically considered as they include a mental health component. Other dietary outcomes included food consumption patterns and appetite measured with questionnaires, diaries, and direct measurements, as well as views, experiences, and motivations to eat analyzed quantitatively.

2.2 | Literature search and screening strategies

Studies were identified as part of a wider literature search strategy on social media and adolescent diet, physical activity, and obesity in 11 bibliographic databases in January 2023: OvidSP Medline ALL, OvidSP Embase Classic+Embase, EBSCOhost CINAHL Complete, OvidSP Global Health, WHO Global Index Medicus, OvidSP PsycInfo, Scopus, as well as on the Web of Science: Citation Index Expanded, Social Sciences Citation Index, Arts & Humanities Citation Index, and Emerging Sources Citation Index. The strategy was developed by three information specialists and refined with the project team around the following concepts: adolescents AND social media AND (obesity OR diet OR physical activity), with inspiration for the search terms taken from another evidence synthesis.[30] The full search strategy is presented in Tables S2–S9. Note that it was conducted with a cut-off date of 2012, but only studies published from 2019 onwards were eligible. The reference lists of the included studies were checked. Two articles that we were unable to retrieve were obtained directly from the authors.

The removal of duplicates, screening, and data extraction were managed using the software EPPI-Reviewer Web. Titles and abstracts were screened against the eligibility criteria by two independent reviewers (LB, KCM, CK, FÖ, and AA) using the priority screening feature.[31] This feature analyzes a sample of records previously screened manually (in this case, about 4100 or 38% of titles and abstracts) and puts the remaining in order from most to least likely to meet the eligibility criteria. As in other systematic reviews, screening of titles and abstracts ceased after meeting a threshold of included records, using a conservative "fewer than one in 75" rather than one in 50.[32] All eligible full texts were screened by two independent reviewers (KCM, LB, and CK). Disagreements were resolved by a third reviewer.

2.3 | Data extraction

Data were extracted in a standardized form on EPPI-Reviewer Web (a priori tested by LB, KCM, and CK) by one reviewer and checked by another (KCM and LB). This included general study characteristics; social media characteristics loosely based on the CLICK framework,[8] that is, type(s) of devices, type of "exposure" measured (such as time, type of interactions, topics, format of content [e.g., advertising, chats, and pictures], and experience of protective features); influencers and celebrities characteristics (e.g., job, celebrity status, and type of content they share); study methods including design, aim, and data collection; results with any type of effect size and precision estimate provided, including for adverse outcomes; and presence of health inequalities using the PROGRESS-Plus framework.[33] Statistical significance was established at $p < 0.05$ unless specified otherwise in the studies. PROGRESS-Plus stands for Place, Race, Occupation, Gender, Religion and culture, Education, Socioeconomic status at the individual level, and Social capital. In this review, the "Plus" included age, disability, and sexual orientation. School grade was used as a proxy for age.

2.4 | Risk of bias appraisal

The risk of bias of each study and outcome was assessed using ROBINS-E.[34] Each of the seven domains of the tool (confounding, measurement of exposure, selection of participants, post-exposure interventions, missing data, measurement of outcomes, and selective reporting of results) and the study and outcome overall were rated as having a "low," "some concerns," "high," or "very high" risk of

bias, as per ROBINS-E guidance. The appraisal was conducted by two reviewers independently (KCM and LB) in Excel.

2.5 | Data synthesis

Given the high level of heterogeneity in the outcomes and metrics used, the data were synthesized narratively by type of association between social media use and the six mental health outcomes, DE, and other dietary outcomes, as well as between mental health and dietary outcomes. DE symptoms included those (a) mainly involving a component of compulsive overeating (e.g., binge eating, bulimia, and night eating disorder); (b) focused on weight loss and control (e.g., anorexia, fasting, purging, and inappropriate weight loss strategies); (c) aggregating the aforementioned categories; and (d) on other symptoms. For each association, including by PROGRESS-Plus characteristics and for results specific to influencers and celebrities, evidence was determined as being overall: significant (when results from a majority of studies and participants were significant), little (for results based on only one or two studies or fewer than 1000 participants in total), mixed (when results were mainly contradictory), or absent (when results were mainly non-significant), as well as mainly relying on studies with a high or very high risk of bias or not. This information was also presented visually. Heterogeneity was examined by investigating results by type of social media metric, country, study design, and risk of bias.

3 | RESULTS

As illustrated in Figure 1, the literature searches yielded 43,219 records. After removing duplicates and records published before 2019, 12,289 were eligible for title and abstract screening. Priority screening was stopped after verifying 6008 (49%) of them, and of these, 225 met the inclusion criteria and had their full text verified, leading to 21 studies[35–55] being included. In parallel, four additional full texts were retrieved by screening reference lists, all of which were excluded, including one[56] for being in Turkish. The excluded full texts are listed in Table S10, along with their reasons for exclusion.

3.1 | Study characteristics

Twelve countries were documented, including Australia ($n = 4$), Türkiye ($n = 3$), Canada ($n = 2$), China ($n = 2$), the Republic of Korea ($n = 2$), and the United Kingdom (UK) ($n = 2$), as well as Indonesia, Italy, Japan, Norway, Spain, and the Philippines ($n = 1$ each). All were in English, except for one[40] in Spanish. One was a cohort study,[46] 18 employed a single timepoint cross-sectional design, and two[41,50] only provided eligible data at a single point in time (explained in Table S11). Most recruited participants were from secondary schools ($n = 18$). The number of participants ranged from 62 to 244,250, and their ages ranged from 10 to 19 years, with studies mainly focusing on adolescents aged 12 or more. The proportion of females ranged

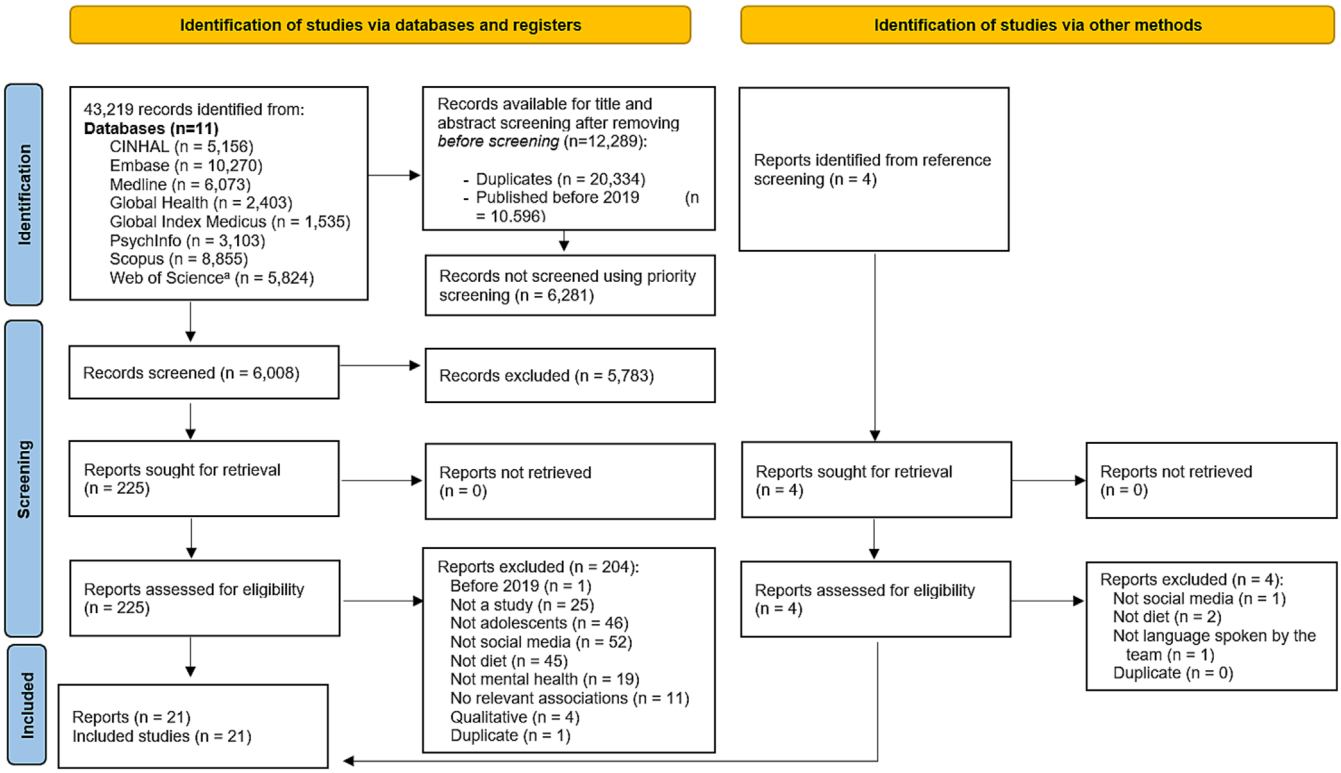

FIGURE 1 Study selection process. a: includes Science Citation Index Expanded, Social Sciences Citation Index, Arts & Humanities Citation Index, and Emerging Sources Citation Index. Chart template from Page et al.[25]

from 43.5% to 100%, with four studies looking at females exclusively. All studies collected self-reported data using questionnaires, including one[35] that also involved semi-structured interviews analyzed quantitatively. Seven studies assessed data collected as part of a national survey or a wider study. Data were collected between 2008 and 2022, although dates were not reported in five studies. Two studies[40,51] did not report having ethical approval. The study characteristics are detailed in Table S11.

Social media use was assessed in different ways, with several studies focusing on multiple components (Table 1). Thirteen studies examined time spent on social media (typically in hours/day). Seven assessed users' experiences on social media, such as the perceived impact of influencers, response to receiving "likes," and engaging in appearance-based comparison. Six examined the type of platform used (e.g., TikTok, Snapchat, and Facebook). Five focused on excessive or disordered use, mainly employing the Social Media Disorder Scale.[57] Four studies each focused on the most common use of a smartphone (including social media), type of activities or interactions (e.g., selfie taking/posting, influencer engagement, and general posting), and type of content. Finally, one study looked at the number of accounts that adolescents follow, and another compared participants who own at least one social media account to those who do not own any.

The six mental health outcomes were assessed using a wide variety of measuring tools (Table 2). Body image was evaluated in half of the studies ($n = 11$), followed by depressive symptoms ($n = 9$), anxiety ($n = 5$), self-esteem ($n = 3$), interpersonal relationships/loneliness ($n = 2$), and stress ($n = 1$). Regarding dietary outcomes, most studies focused on DE ($n = 13$), while the remaining looked at food consumption frequencies/patterns ($n = 3$), emotional eating ($n = 3$), respecting hunger and satiety cues ($n = 1$), and food choices, nutrient consumption, and nutritional knowledge ($n = 1$).

3.2 | Risk of bias of studies

The risk of bias ratings by ROBINS-E domain and for each study overall are presented in Table S12. One study and one outcome in another study were assessed as having a very high risk of bias. Eleven were rated as high-risk, and the remaining eight had some concerns. Among the seven domains, high and very high risks of bias were due to D1: lack of inclusion of relevant confounders such as age and gender ($n = 9$); D2: vague measurement of social media exposure or potential differential social desirability bias in the method used between the groups ($n = 2$); D3: unclear recruitment procedures or exposure being potentially related to the latter ($n = 3$); D5: non-reporting or lack of clarity around the handling of missing data ($n = 10$); and D6: vague measurement of outcomes or potential differential social desirability bias between the groups ($n = 1$). One study did not report outcomes relating to depression and anxiety (D7).[47] As most studies were cross-sectional, the risk of bias due to post-exposure interventions was generally found to be low (D4).

At least one author from each study was affiliated with a university, and at least one author from five studies was affiliated with a hospital research center. Nine studies outlined their funding source, four reported not having funding, and six did not disclose this information. Lastly, 16 studies declared having no conflicts of interest, two declared conflicts related to past funding, and four did not include a conflict-of-interest statement.

TABLE 1 Type of social media exposures measured in the studies.

SM exposure	Measurements	*N* studies
Time spent on social media in general	Minutes/hours per day/week/month	$n = 13$[35,36,39,41–46,48,49,54,55]
Experiences	Influencer impact, beliefs about nutritional knowledge gained on social media, receiving "likes" on posts, online sexual objectification, appearance-based social comparison, followers, privacy settings, Social Media Affinity Scale	$n = 7$[37–39,48,53–55]
Platform(s) used	Use (yes/no), time or frequency of use of TikTok, Snapchat, Facebook, Twitter, Instagram, Tumblr and so forth	$n = 6$[37,42,49,52,54,55]
Excessive/disordered use of social media	Social Media Disorder Scale and its validated Turkish version, the Social Media Addiction Scale; personal conflicts due to social media use	$n = 5$[37,43,50,51,55]
Most common smartphone uses	Main uses of smartphone including chatting, social networking or other purposes (reported by use type or measured in time), and main activity after class between social media and other activities	$n = 4$[36,42,43,45]
Type of activities or interactions	Photo-related activity, influencer-related activity, posting activity	$n = 4$[37,39,47,54]
Type of content followed/exposed to	Food/beverage, nutrition, makeup/beauty, entertainment, content related to being thin, and so forth (posted by peers and/or influencers)	$n = 4$[35,37]
Number of accounts followed	Total number of accounts followed	$n = 1$[35]
Using social media or not	Having at least one social media account versus having none	$n = 1$[40]

TABLE 2 Tools employed for assessing mental health and DE outcomes.

Outcomes (*n* tools in *n* = studies)	Tools
Body image (14 tools in *n* = 11 studies)	Body Esteem Scale for Adolescents and Adults (*n* = 2) Body Appreciation Scale (*n* = 1) Body Change Inventory (*n* = 1) Body Image Scale (*n* = 1) Body Shape Questionnaire (*n* = 2) Eating Disorder Examination Questionnaire (*n* = 1) Objectified Body Consciousness Scale (*n* = 1) Physical Appearance Comparison Scale-Revised (*n* = 1) Social Appearance Anxiety Scale (*n* = 1) Sociocultural Attitudes Towards Appearance Questionnaire (versions 3 and 4) (*n* = 3) Upward Physical Appearance Comparison Scale (*n* = 1) Questionnaire designed specifically for the study (*n* = 1) Questionnaire for the study via a structured interview (*n* = 1)
Anxiety (five tools in *n* = 5 studies)	Depression Anxiety Stress Scale (*n* = 1) K10 Psychological Distress Scale (*n* = 1) Revised Children's Anxiety and Depression Scale (*n* = 1) Spence Children's Anxiety Scale (*n* = 1) Youth Self-report 11–18 Questionnaire (*n* = 1)
Depressive symptoms (eight tools in *n* = 9 studies)	Center for Epidemiologic Studies Depression Scale-revised version for adolescents (*n* = 1) Depression Self-rating Scale for Children (*n* = 1) Hopkins Symptom Checklist (*n* = 1) K10 Psychological Distress Scale (*n* = 1) Revised Children's Anxiety and Depression Scale (*n* = 1) Short Mood and Feelings Questionnaire (*n* = 2) Youth Self-report 11–18 Questionnaire (*n* = 1) Questionnaire designed specifically for the study (*n* = 1)
Self-esteem (two tools in *n* = 3 studies)	Rosenberg Self-Esteem Scale (*n* = 2) Single-Item Self Esteem Scale (*n* = 1)
Stress (one tool in *n* = 1 study)	Questionnaire designed specifically for the study (*n* = 1)
Interpersonal relationships (two tools in *n* = 2 studies)	Friends and Family Interview (*n* = 1) Questionnaire designed specifically for the study (*n* = 1)
DE symptoms (12 tools in *n* = 13 studies)	Binge Eating Scale (*n* = 1) Bulimic Investigatory Test (*n* = 1) Children's Eating Attitude Test (*n* = 1) Developmental and Well-being Assessment (*n* = 1) Dutch Eating Behavior Questionnaire (*n* = 1) Eating Attitudes Test-26 (n = 4) Eating Disorder Examination Questionnaire (EDEQ, *n* = 2) Orthorexia Nervosa Scale (*n* = 1) Project EAT (*n* = 1) Sick, Control, One stone, Fat, Food Questionnaire (*n* = 1) Questionnaire using items from EDEQ, Night Eating Questionnaire and additional questions (*n* = 1) Questionnaire designed specifically for the study (*n* = 1)
Other dietary outcomes (six tools in *n* = 8 studies)	Emotional Eating Scale for Children and Adolescents (*n* = 3) Food consumption patterns with questionnaires designed for each study (*n* = 3) Intuitive Eating Scale (i.e., respecting hunger and satiety cues) (*n* = 1) Food choices, nutrient consumption, and nutritional knowledge with a questionnaire for the study via a structured interview (*n* = 1)

Abbreviation: DE, disordered eating.

3.3 | Results by type of associations

The results are presented below and in detail in Table S13 by type of association. No study reported adverse effects. Funnel plots for assessing publication bias could not be conducted because there were fewer than 10 studies in each category of association.

3.3.1 | Social media use and mental health

Fourteen studies assessed associations between social media exposure and mental health: nine on body image, five on depressive symptoms, three on anxiety, two on self-esteem, one on stress, and none on interpersonal relationships or loneliness. The findings are

summarized in Figure 2, indicating for each association whether it is statistically significant overall (plain line) or not (dotted line), along with the number of studies (k), total participants (n), and risk of bias (red lines represent findings mainly influenced by studies with a high or very high risk of bias). The associations that rely on stronger evidence (≥3 studies and ≥1000 participants) are shown in bold.

Body image

There is evidence from eight studies, representing a total of 5469 adolescents and with a high risk of bias overall, for a significantly positive link between social media use and body dissatisfaction. In a ninth study by Kwon et al. ($n = 53{,}133$, high risk of bias), there was no statistical difference in body image for using a smartphone mainly for chatting/messaging/emailing or for social networking compared with for searching information.[45]

Four studies reported that body image worsened with time spent on social media: Hosokawa et al. ($n = 161$ females, high risk, odds ratio (OR) [95% confidence interval; CI] = 1.34 [1.09–1.66], $p < 0.01$)[42]; Caner et al. ($n = 1{,}363$, $r = 0.334$, $p < 0.001$; high risk)[37]; McAndrew ($n = 238$ females, some concerns) for preferred social media platforms ($r = -0.13$, $p = 0.039$) and Instagram (e.g., BESAA: $r = -0.18$, $p = 0.006$) but not Facebook[49]; and Luo et al. ($n = 1152$ females, some concerns) who reported that time spent on QQ negatively affects both body image ($r = -0.18$, $p < 0.001$) and conceptualization of beauty ($r = -0.20$, $p < 0.001$) but that only conceptualization of beauty was negatively related with online interpersonal sexual objectification ($r = -0.12$, $p < 0.01$).[48] By contrast, in Fardouly et al.'s study ($n = 528$, some concerns), time spent on social media were not identified as unique predictors for body image in their final model[39]; and Yurtdaş-Depboylu et al. ($n = 1232$, some concerns) did not find a difference in body image between spending ≥7 h per day and <1 h ($p < 0.001$) on social media.[55]

Seven studies measured other social media metrics. Tadena et al. ($n = 114$, high risk) reported that body dissatisfaction increases with social media affinity (i.e., people's interest in social media; $\beta = 0.17$, $p = 0.041$),[53] Yurtdaş-Depboylu et al. with social media addition ($\beta = 0.268$, $p < .001$) and frequency of reading nutrition-related posts (mixed results),[55] and Caner et al. for social media addiction in relation with social appearance anxiety ($\beta = 14.952$, $p < 0.001$).[37] McAndrew reported that body dissatisfaction increases with frequency of checking Instagram (BESAA: $r = -0.14$, $p = 0.034$) and for using photo-based social media in general.[49] The final models by Rodgers et al. ($n = 681$, high risk) suggests that using several social media platforms regularly is related to internalization of a social media ideal ($\beta = 0.15$, $p < 0.001$) (as well as with internalization of a muscular ideal in males; $\beta = 0.25$, $p < 0.001$), which affects different aspects of body image ($p < 0.001$ for all).[52] Fardouly et al. reported that making more appearance comparisons on social media (comparison frequency, $\beta = -0.41$, standard error [SE] = 0.06, $p < 0.001$) and perceiving others as more attractive than oneself (comparison direction, $\beta = -0.25$, SE = 0.06, $p < 0.001$) were uniquely predictive of body (dis)satisfaction; but not controlling one's own appearance (appearance investment), posting selfies or receiving likes.[39] Hosokawa et al. reported a significant association for following accounts promoting thinness (3.82, 1.05–13.89 adjusted, $p < 0.05$) but not by social media platform.[42]

Self-esteem

There is mixed evidence with a high risk of bias from two Canadian studies for an association between time spent on social media and low self-esteem. The first study ($n = 238$ females, some concerns)[49] found no significant association ($\beta = 0.15$, $p = 0.059$). The second study (high risk of bias) followed a cohort of 3801 adolescents over a 5-year period.[46] It found a significant correlation both during the years of exposure to social media and the subsequent years ($p < 0.001$ for all).

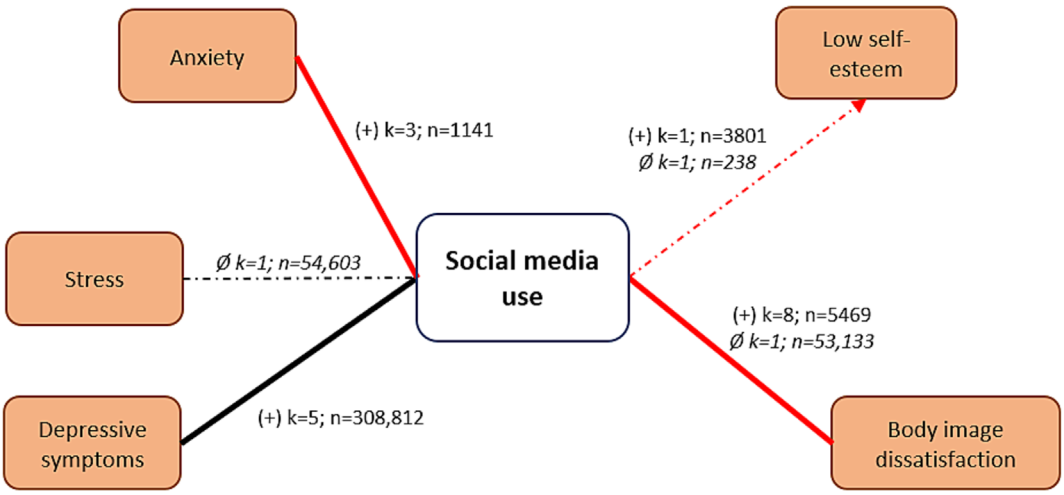

FIGURE 2 Associations between social media use and mental health outcomes. **Lines:** plain: evidence overall statistically significantly positive; dotted: evidence overall not statistically significant or mixed; bold: stronger evidence (≥3 studies and ≥1000 participants); red: large influence of studies with a high or very high risk of bias. **Other symbols:** (+): statistically significant positive association; *Ø and italic:* not statistically significant; k: number of studies; n: total number of participants. No association was reported for interpersonal relationships.

Stress

There is no evidence from one study ($n = 54,603$, some concerns) that using a smartphone for social media and chatting compared with education purposes affects stress.[43]

Depressive symptoms

Five studies, representing a total of 308,812 participants and some concerns of bias, reported significant positive correlations between some metric of social media use and depressive symptoms. This included time spent on social media in three studies: Hoare et al.[41] ($n = 9369$, high risk, B = 0.62, 95% CI = 0.49–0.75); Kleppang et al.[44] using a threshold of 3 h/day ($n = 244,250$, some concerns; males: adjusted OR [95% CI] = 0.65 [0.62–0.68], $p < 0.001$; females: 0.70 [0.68–0.73], $p < 0.001$); and Fardouly et al.[39] ($n = 528$, some concerns) though for YouTube only and not as a unique predictor in their final model.

Regarding other social media metrics, Muzi et al. reported a significantly positive correlation for social media disorders during the COVID-19 pandemic ($n = 62$, high risk, $r = 0.21$, $p < 0.05$),[50] Kim & Han's study ($n = 54,603$, some concerns) for using a smartphone for social media and chatting versus education purposes (adjusted OR [95% CI] = 1.17 [1.08–1.27]),[43] and Fardouly et al. concluded that making more appearance comparisons (comparison frequency, $\beta = 0.33$, SE = 0.07, $p < 0.001$) and controlling their own appearance (i.e., appearance investment, for instance by modifying pictures or taking several pictures to select the most attractive one, $\beta = 0.16$, SE = 0.07, $p < 0.021$) were uniquely predictive of depressive symptoms, but not perceiving others as more attractive than oneself (comparison direction), posting selfies or receiving likes.[39]

Anxiety

Three studies representing 1141 participants reported significant positive associations between anxiety and at least some social media metrics, with a high risk of bias overall. This includes Muzi et al. during the COVID-19 pandemic for social media disorders ($n = 62$; high risk, $r = 0.24$, $p < 0.05$).[50] Ding and Xu ($n = 551$, some concerns) concluded that anxiety acts as a mediator between making social comparisons on social media and emotional eating ($\beta = 0.546$, $t = 10.549$, $p < 0.01$).[38] Fardouly et al. ($n = 528$, some concerns) reported that making more appearance comparisons (comparison frequency, $\beta = 0.29$, SE = 0.07, $p < 0.001$) and perceiving others on social media as more attractive than oneself (comparison direction, $\beta = 0.18$, SE = 0.07, $p < 0.01$) were uniquely predictive of higher social anxiety, which in turn was related with higher DE scores ($r = 0.29$, $p < 0.001$), but not controlling one's own appearance, posting selfies, receiving likes, time or using specific platforms.[39]

3.3.2 | Social media and disordered eating symptoms

Ten studies reported associations between social media and DE symptoms: five on compulsive overeating, four on weight loss or control, six on DE in general, and three on other manifestations. The findings are summarized in Figure 3 (in blue).

Compulsive overeating

There is evidence from five studies, all with a high risk of bias, for a significant positive relationship between social media exposure and compulsive overeating. Four ($n = 9,068$) reported positive results for at least some metrics, and one ($n = 709$) reported no significant relationship.

On the one hand, the cohort study by Livet et al. ($n = 3801$) reported a significant positive effect between time spent on social media and binge eating (including in the subsequent year).[46] Muzi et al. ($n = 62$) showed a significant correlation between social media addiction and binge eating during the COVID-19 pandemic ($r = 0.23$, $p < 0.05$).[50] Lonergan et al. ($n = 4290$) reported greater odds of night eating syndrome and bulimia symptoms with four selfie-related behaviors (ORs ranging from 1.01 to 1.22, $p < 0.05$) whereas binge eating was only significantly associated with photo investment (i.e., effort in choosing a selfie and monitoring likes and comments, OR [95% CI] = 1.04 [0.02–0.060]) and investment in others' selfies (1.07 [0.01–0.13]).[47] In Wilksch et al.'s study ($n = 996$), Tumblr users had a greater likelihood of having binge eating symptoms (males: OR [95% CI] = 0.21 [0.06–0.82]; females: 0.44 [0.20–0.93]) but not Facebook, Instagram and Snapchat users.[54] On the other hand, Frieiro et al. ($n = 709$) found no significant association between having a social networking account and bulimia symptoms.[40]

Weight loss or control

Four studies representing 59,047 participants, all with a high risk of bias, suggest significant positive associations between social media exposure and at least some weight loss or control behaviors. In the study by Kwon et al. ($n = 53,133$), females—but not males—who used a smartphone mainly for chatting/messaging/emailing or for social networking had greater odds of attempting to lose weight (OR [95% CI] = 1.34 [1.19–1.51] and 1.20 [1.07–1.36], respectively) and of employing inappropriate weight loss strategies (1.57 [1.25–1.99] and 1.37 [1.08–1.73], respectively) than those mainly searching information.[45] Frieiro et al. ($n = 709$) reported a borderline significant correlation suggesting that people without a social network profile control less their dietary intake (M = 17.55 ± 5.64) than those with a profile (M = 16.06 ± 5.71, $p = 0.047$), but no significant association for dieting behaviors.[40] Lonergan et al. ($n = 4209$) reported greater odds of having anorexia for avoiding of posting selfies (OR [95% CI] = 1.24 [0.03–0.40], $p < 0.01$), photo investment (1.03 [0.02–0.05], $p < 0.001$) and photo manipulation (1.04 [0.01–0.07], $p < 0.01$), but not investment in other's selfies.[47] Purging was only associated with photo investment (1.02 [0.01–0.03], $p < 0.001$) and photo manipulation (1.06 [0.03–0.08], $p < 0.001$). In the study by Wilksch et al. ($n = 996$), using Facebook, Instagram, Snapchat, and Tumblr (males only) was correlated with skipping meals; using all four platforms with doing strict exercise in females only; Snapchat (females) and Tumblr (males) with eating little food; Snapchat with using a strict meal plan (females only); and none with vomiting.[54]

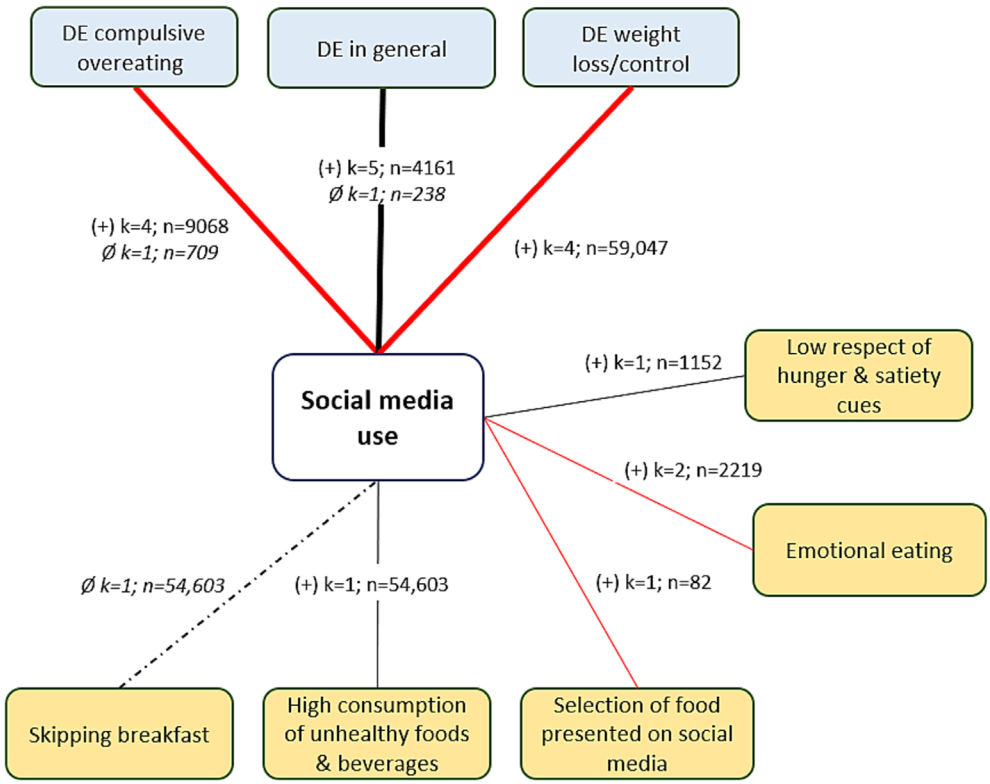

FIGURE 3 Associations between social media use and dietary outcomes. **Lines:** plain: evidence overall statistically significantly positive; dotted: evidence overall not statistically significant or mixed; bold: stronger evidence (≥3 studies and ≥1,000 participants); red: large influence of studies with a high or very high risk of bias. **Other symbols:** (+): statistically significant positive association; Ø *and italic:* not statistically significant; k: number of studies; n: total number of participants. No association was reported for consumption of healthy foods.

DE in general

Associations from six studies ($n = 4399$, four with some concerns) were overall significantly positive for DE in general. Nolan et al. ($n = 1291$) focused on social media use disorder (adjusted OR [95% CI] = 2.95 [1.50–5.79]),[51] and Tadena et al. ($n = 114$, high risk) on social media affinity ($\beta = 0.33$, $p < 0.001$). Yurtdaş-Depboylu et al. ($n = 1232$) reported a significant positive relationship between DE and social media addiction (OR [95% CI] = 1.07 [1.04–1.10]) and reporting to always or often read nutrition-related posts (6.77 [3.84–11.94]) but not for spending ≥7 h per day on social media.[55] Fardouly et al. ($n = 528$) reported that making more appearance comparisons on social media ($\beta = 0.26$, SE = 0.08, $p < 0.01$) and perceiving others as more attractive than oneself ($\beta = 0.18$, SE = 0.05, $p < 0.01$) were uniquely predictive of DE.[39] McAndrew ($n = 238$ females) observed significant associations for time spent and frequency of checking on Instagram, time spent on preferred platforms, but not Facebook nor photo-based social media use in general in their final model ($\beta = 0.15$, $p = 0.059$).[49] Wilksch et al. ($n = 996$, high risk) also reported higher general DE scores with time spent on Instagram but in females only (OR [95% CI] = 0.11 [0.01–0.34]), and not for Snapchat.[54] Females were also more likely to have DE symptoms when posting photos of themself or friends taken by someone else on Instagram (0.12 [0.01–0.83]) or memes/quotes on Snapchat (0.12 [0.05–0.84]), whereas for males this was for posting pictures of possessions on Instagram (0.15 [0.03–0.68]) and selfies on Snapchat (0.23 [0.18–0.90]).

Other DE manifestations

There is limited or no evidence from three studies for other DE symptoms (not shown in the figures). Yurtdaş-Depboylu et al. ($n = 1232$, some concerns) noted a statistically positive correlation for orthorexia for adolescents reporting to always or often read nutrition-related posts (OR [95% CI] = 5.49 [3.39–8.88]) but neither for social media addiction nor by time spent on social media.[55] Friero et al. ($n = 709$, some concerns) reported a statistically positive association between being preoccupied with food and having a social media account.[40] Lonegan et al. ($n = 4,209$, high risk) found that having an undefined food and eating disorder was linked with avoiding posting selfies, photo investment, and investment in others' selfies ($p < 0.001$), but not photo manipulation.[47]

3.3.3 | Social media and other dietary outcomes

There is limited evidence from five studies for associations linking social media use and dietary outcomes other than DE. Few studies measured dietary intake. The findings are summarized in Figure 3 (in yellow).

In Türkiye, two studies with a high risk of bias by Caner and colleagues found a significant positive correlation with emotional eating. In the first study ($n = 856$), this was for using the internet mainly for social media (mean score ± SD: 54.2 ± 18.3, $p < 0.001$), chatting (54.4 ± 20.2, $p < 0.001$), or playing games (58.8 ± 18.7, $p < 0.001$)

compared with using it to do homework.[36] The second study ($n = 1{,}363$) suggests that emotional eating increases with time spent on social media ($r = 0.058$, $p < 0.001$) but not with social media addiction, picture and video sharing, or using specific platforms.[37]

Adiba et al. ($n = 81$ females, very high risk) concluded that adolescents who spent 2.25 h or more per access on social media had 3.35 times greater chances of selecting food presented on social media ($R^2 = 0.16$, controlled for body image) compared with fewer hours. Neither the frequency of social media use nor the number of accounts owned influenced that outcome.[35]

Kim and Han's study ($n = 54{,}603$, some concerns) reported greater odds of eating fast food ≥3 times/week in participants who use their smartphone for social media and chatting compared with education purposes (adjusted OR [95% CI] = 1.37 [1.25–1.50]), but not skipping breakfast ≥5 times/week.[43]

In the study by Luo et al. ($n = 1152$ females, some concerns), participants were less likely to respect their hunger and satiety cues when spending more time on QQ ($r = -0.35$, $p < 0.001$).[48] Experiencing online interpersonal sexual objectification was related to reduced respect of hunger and satiety cues ($r = -0.135$, $p < 0.05$).

3.3.4 | Mental health and dietary outcomes

Figure 4 presents the associations linking mental health and dietary outcomes, along with a summary of the results presented above. To keep the figure simple, only the results that are overall statistically positive across studies are presented unless they are part of a potential pathway of effect. The latter includes the four indirect relationships listed below that were identified in models between social media use and diet and that involve a mental health variable acting as a moderator. The first one involves a clear direction of effect (shown with arrows), as suggested in a cohort study. The remaining do not (no arrow) because they are based on cross-sectional data.

- Social media →Low self-esteem →Binge eating[46];
- Social media—Body image—Dietary restraint[52];
- Experiencing online interpersonal sexual objectification on social media—Conceptualization of beauty (—Body image)—Respecting hunger and satiety cues[48];
- Social media—Anxiety—Emotional eating.[38]

In Livet et al.'s 5-year cohort study ($n = 3801$, high risk), self-esteem mediated the relationship between binge eating and time on social media ($p < 0.001$ for all time points).[46] Rodgers et al.'s final models ($n = 681$, high risk) suggest that regularly using several social media platforms is associated with internalizing a social media ideal. The latter is then associated with dietary restraint directly (females only) or indirectly via body dissatisfaction or muscle building behaviors (both females and males) (all $p < 0.001$).[52] In the model by Luo et al. ($n = 1152$, some concerns), experiencing online interpersonal sexual objectification influenced respect for hunger and satiety cues directly

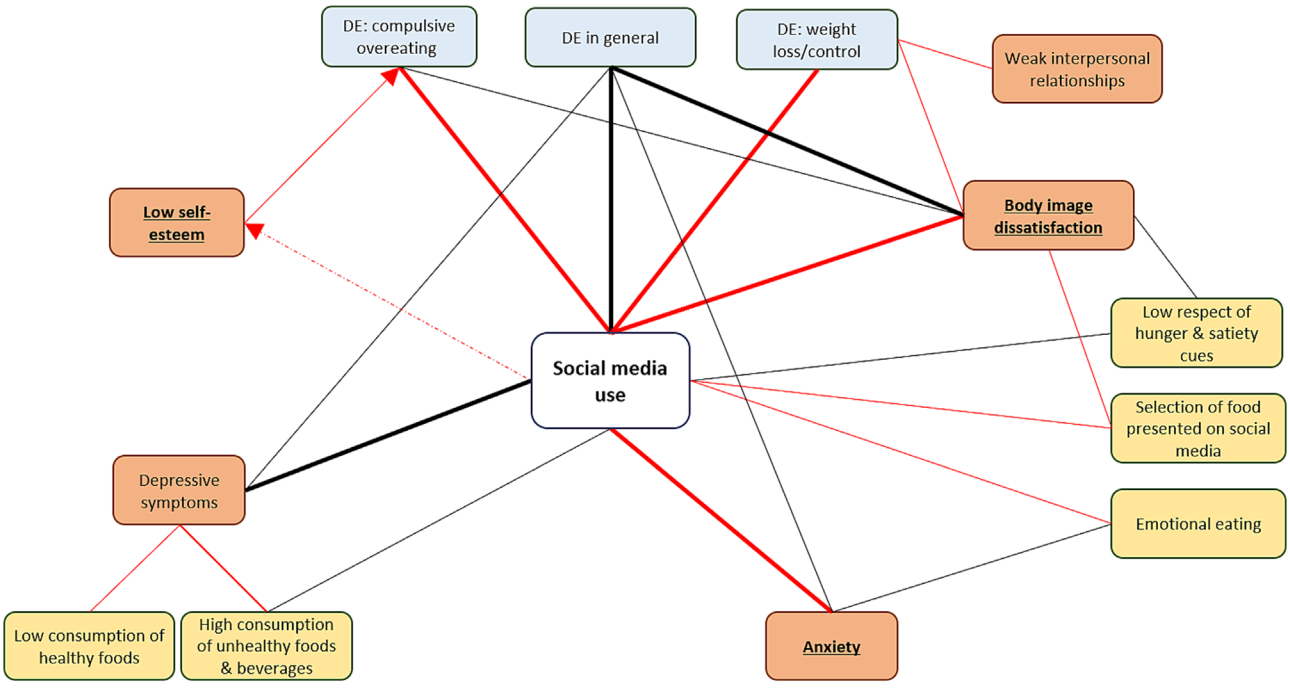

FIGURE 4 Associations between social media use and mental health (orange), disordered eating (DE) (blue) and other dietary outcomes (yellow). This figure only presents the associations that are overall statistically positive across studies unless they are part of a potential pathway of effect. None involved stress or breakfast consumption. **Lines:** plain: evidence overall statistically significantly positive; dotted: evidence overall not statistically significant or mixed; bold: stronger evidence (≥3 studies and ≥1000 participants); red: large influence of studies with a high or very high risk of bias; arrow: direction of effect suggested in a cohort study.

and indirectly via either the conceptualization of beauty alone or the conceptualization of beauty, which in turn influenced body satisfaction.[48] Ding and Xu ($n = 551$, some concerns) found that anxiety acts as a mediator between making social comparisons on social media and emotional eating ($\beta = 0.546$, $t = 10.549$, $p < 0.01$). These social comparisons were influenced by perceived sociocultural pressure to adopt certain appearances ($\beta = -0.083$, $t = -2.5096$, $p < 0.05$).[38]

Additional statistically significant relationships were reported between body dissatisfaction and general DE (five studies, $n = 2{,}273$ and some concerns overall, one with a particularly small effect size)[39,42,49,53,55] and bulimia (one study, $n = 161$, some concerns).[42] Two studies (total $n = 1819$, both with some concerns) found a statistically significant correlation between general DE and both depressive symptoms and anxiety (measured jointly in one study).[39,51] In McAndrew's final model ($n = 238$, some concerns), the association between self-esteem and general DE was not significant.[49] Kleppang et al.[44] ($n = 244{,}250$, some concerns) and Hoare et al.[41] ($n = 9369$, high risk) reported more depressive symptoms among low consumers of fruit and high consumers of soft drinks (although in females only in Kleppang et al.'s study), contradictory results for vegetables, and more depressive symptoms among low consumers of fish and whole-grain bread, and high consumers of sweets, salty snacks, diet and energy drinks (measured by Kleppang et al. only). In Adiba et al.'s study ($n = 82$, very high risk), adolescents who selected food presented on social media were more likely to have a positive body image ($p = 0.040$) and to consume more energy ($p = 0.03$) and protein ($p = 0.02$), but not carbohydrate, and fat. There was also no statistical difference by nutrition knowledge and peer influence.[35] In Caner et al.'s study ($n = 1363$, high risk), there was no significant association between body image and emotional eating.[37] Frieiro et al. ($n = 709$, high risk) found a significant decreasing risk of bulimia, dietary intake control, and dieting as the perceived quality of family relationships increased, but not for preoccupation with food.[40] By contrast, Muzi et al. ($n = 62$, very high risk) did not find a relationship between binge eating and four types of attachment with family and peers.[50]

3.4 | Exploration of heterogeneity in the findings

The findings did not vary by study design (the results from the cohort study are generally aligned with those of cross-sectional studies), by country (associations with stronger evidence include all countries except Indonesia), or by risk of bias (the figures show no trend between significant and inconclusive results). The findings also do not appear to be influenced by the various metrics used to assess social media exposure. For example, while associations between time spent on social media and both body dissatisfaction and depressive symptoms are all significantly positive, they are mixed for self-esteem,[46,49] DE in general,[39,49,54,55] and when three outcomes or more are evaluated.[39,49,55] In the four studies that have examined several social media platforms, experiences, or activities, results vary not only by type of exposure but also by outcome and gender.[37,39,47,54] However, all four studies that have employed social media disorder scales report significant associations across different outcomes except for emotional eating.[37,50,51,55]

3.5 | Results specific to social media influencers and celebrities

The only study that reported findings specific to social media influencers or celebrities is the one by Caner et al. in Türkiye ($n = 1383$, high risk).[37] In this study, 51.7% of adolescents reported actively following influencers, 27.1% said they followed four or more, and 67.7% admitted being influenced by social media influencers. Funny posts (44.2%) were the most frequent type of influencer content followed, followed by digital games (19.9%), makeup/personal care (21.8%), exercise (7.8%), and nutrition/diet (6.3%). Participants reporting actively following influencers, being influenced by them, and following four influencers or more (compared with zero or one) had higher social appearance anxiety and social media addiction scores ($p < 0.001$) but not emotional eating. Following nutrition/diet or makeup/personal care content was associated with higher social appearance anxiety. Following makeup/personal care content was also associated with higher social media addiction, and following nutrition/diet content was associated with higher emotional eating.

3.6 | Results by equity characteristics

Out of the 11 equity dimensions considered in this study, the associations of interest were only measured by sex/gender, and this in only eight studies. No information was found by place, race/ethnicity, occupation, religion/culture, education, socioeconomic status, social capital, age, disability, and sexual orientation. None of the studies reporting results by sex/gender focused on self-esteem or interpersonal relationships.

There is mixed evidence from three studies for associations between social media use and body dissatisfaction: Kwon et al. in Korea (high risk) found no association for females nor males[45]; Rodgers et al. (high risk) reported significant positive associations in both gender groups in Australia ($p < 0.001$ for all)[52]; and Fardouly's et al. in Australia again (some concerns) among females only ($\beta = -0.485$, $SE = 0.207$, $p = 0.019$, using body satisfaction).[39] There is also mixed evidence from three studies (all with some concerns) between social media exposure and depressive symptoms: Kleppang et al. reported a significant positive correlation in both females (OR [95% CI] = 0.70 [0.68–0.73], $p < 0.001$) and males (0.65 [0.62–0.68], $p < 0.001$)[44]; Kim and Han in males only (1.20 [1.06–1.35]),[43] and Fardouly et al. in females only (appearance comparisons: $\beta = 0.371$, $SE = 0.148$, $p = 0.012$).[39]

There is evidence from three Australian studies with some concerns (total $n = 5967$) that social media is associated with several DE symptoms in both sex/gender groups directly or indirectly.[47,52,54] There is limited evidence from one study with some concerns each that: (a) females who perceive more social pressure on their

appearance experience greater emotional eating (M − 1 SD = 0.089, 95% CI = 0.008–0.1884, borderline significant), but not males (no value reported)[38]; (b) both females and males who use their smartphone for social media compared with education functions are more likely to skip breakfast ≥5 times/week (males: OR [95% CI] = 1.15 [1.02–1.29]; females: 1.22 [1.05–1.41]) and to eat fast food ≥3 times/week (males: 1.37 [1.21–1.55]; females: 1.44 [1.23–1.70], adjusted for several factors)[43]; (c) anxiety is related with emotional eating in both females ($\beta = 0.559$, $t = 10.564$, $p < 0.01$), and males ($\beta = 0.564$, $t = 7.649$, $p < 0.01$)[38]; (d) depressive symptoms are related in both males and females with a low consumption of fruit, whole-grain bread and fish, and a high consumption of vegetables, snacks and sugary, diet and energy drinks, except for fruit and sugary drinks in males.[44] There is no evidence from one study with some concerns that social media use is associated with stress in either females (OR [95% CI] = 0.95 [0.86–1.06]) or males (0.92 [0.84–1.01]).[43]

4 | DISCUSSION

We conducted a systematic review of the literature on the associations between social media exposure and both adolescent mental health and diet. Overall, there is evidence of significant associations between social media use and both depressive and general DE symptoms, as well as between body dissatisfaction and DE in general. There is also evidence of associations with a high risk of bias between social media use and body dissatisfaction, anxiety, compulsive overeating, and weight loss/control behaviors. High risks of bias were mainly attributed to a lack of information relating to missing data handling and a lack of control for relevant confounders. Evidence is limited, mixed, or absent for self-esteem, stress, interpersonal relationships, and all other dietary outcomes. Body image, self-esteem, and anxiety have been identified as potential mediators between social media use and dietary outcomes (including binge eating, DE in general, respecting hunger and satiety cues, and emotional eating).

Evidence by gender/sex group was mainly limited to one or two studies for each association, except for social media exposure and both body image and depressive symptoms, where it was mixed. However, there is evidence from three Australian studies that social media is associated with several DE symptoms in both sex/gender groups, directly or indirectly. To inform decisions for different population sub-groups, primary studies should consider health equity more systematically and beyond sex/gender.

The single study on social media influencers suggests that actively following influencers and following nutrition/diet or makeup/personal care content is associated with social appearance anxiety and emotional eating. Considering the importance given to influencers and celebrities by adolescents in the CO-CREATE systems maps, the considerable sums spent on influencer marketing, and public perceptions of influencers and celebrities,[11,20,21,37,58,59] there is an urgent need to investigate this topic more extensively and in different contexts.

4.1 | Results in relation to other studies

Our findings resonate with those of two other evidence syntheses. Rounsefell et al.'s systematic review previously mentioned on social media, body image, and eating behaviors among 18–30-year-olds found a positive association between exposure to image-related content and body dissatisfaction, dieting/restricting food, overeating, and choosing healthy foods (although our review lacks evidence on the latter).[22] The authors also reported that social media promoted a culture of physical appearance, comparison, and competition. A scoping review covering the years 2016 to July 2021 and analyzing data on 10–24-year-olds all together suggests that social media contributes to body dissatisfaction and DE symptoms. Although not focusing on other mental health outcomes, the authors also documented negative associations with mood, anxiety, and depressive symptoms. The review highlights the role of social comparison, thin/fit ideal internalization, and self-objectification as mediators, as well as exposure to popular hashtags (especially #Fitspiration and #Thinspiration), pro-eating disorder content, platforms primarily using images or videos, and photo investment.[60]

Our findings are also supported by the simulation-based study by Aguiar et al.[23] and the systematic review of longitudinal studies by Nwosu et al.[24] on adolescents presented in this supplement. Aguiar et al.'s model suggests that socio-cultural norms related to body image (including those promoted by social media influencers) generate vicious cycles or a series of reinforcing feedback loops involving self-stigmatization and body dissatisfaction.[23] In turn, these lead to lower self-esteem, higher psychosocial stress, negative mental wellbeing, and unhealthy dietary and physical activity behaviors that can increase adolescent obesity. Reducing pressure on body image was found to have the potential to halt this cycle. Thus, interventions promoting positive body image and/or reducing exposure to content enforcing body dissatisfaction, such as on social media, might be promising for improving adolescent mental health, diet, and physical activity and preventing obesity. Nwosu et al.'s findings suggest that poor mental health in adolescents, including anxiety, body dissatisfaction, and depressive symptoms, can encourage both unhealthy diets and inactive lifestyle patterns, which in turn can increase the risk of weight gain later in adolescence.[24]

4.2 | Measuring relevant social media features

This review highlights the wide diversity of metrics used to assess media exposure, which makes it challenging to compare results. Of the 21 included studies in this review, 13 looked at self-reported time spent on social media, while several also looked at the type of platform(s) accessed, most common smartphone uses, number of accounts followed/used, and excessive/disordered use. While these assess the magnitude of social media exposure, they do not provide much insight into what exactly adolescents see or do on social media or how it might affect them. Only a third of the studies measured social media experiences (including appearance comparison),

and four each examined exposures to specific types of content and/or the types of activities or interactions adolescents were engaging in (including taking/posting selfies and following influencer accounts). None looked at exposure to advertising or marketing content.

Studies that evaluated types of experiences, content, or activities suggest significantly positive links with body dissatisfaction, DE, depressive symptoms, anxiety, and emotional eating.[35,37,39,42,47,54,55] Identifying the features that are the most informative based on consultations with adolescents and research evidence would help make both research and policy recommendations more useful and efficient. The CLICK framework by the WHO Regional Office for Europe also outlines a guide for the evaluation of actual social media exposure (focused on digital marketing of ultra-processed foods) through a focus on its specific features and recommends screen captures as the best way to document them.[8,61] However, to date only a small number of published studies have done so as per the CLICK methodology.[62,63]

4.3 | Review strengths, limitations, and future research

As far as we are aware, this is the first systematic review that aimed to investigate associations between social media exposure and both adolescent mental health and diet, which were hypotheses voiced by adolescents themselves.[20,21] However, no young people were involved in the systematic review itself. Data could not be pooled together in a meta-analysis because of the high level of heterogeneity in both the outcomes and the tools used, but were synthesized narratively by category of association and summarized visually. The heterogeneity was particularly striking for body image (documented in 11 studies using 14 different tools) and DE (assessed in 13 studies using 12 different tools). While there is no one-size-fits-all tool for either outcome, this makes comparisons difficult. It was not possible to assess associations by age as most studies analyzed a wide range of ages together, and only two focused on 13-year-olds and younger (where reported). This reinforces the need for primary studies to consider various equity or population characteristics. The reviewed literature represents a predominance of high-income countries. No study focused on Africa or either Central or South America, highlighting the need for studies investigating populations in low- and middle-income countries. Given that not all titles and abstracts were screened using the priority screening tool in EPPI-Reviewer Web, some relevant full texts might have been missed. Nevertheless, none of the records identified as potentially relevant when screening the reference lists of the included studies were found among the unscreened records.

Because most of the findings rely on cross-sectional data, they can show the presence of correlations but not causations. More longitudinal studies are therefore needed; yet, this should not stop decision-makers from taking action now. According to a 2023 U.S. Surgeon Advisory statement, there is insufficient evidence to conclude that social media is safe for children and adolescents, particularly for their mental health.[17] Furthermore, waiting for more evidence on causation linkages and more studies with large effect sizes ignores the effects of social media on the wider system. As explained by Haidt,[64] "[social media] transforms social life for everyone, even for those who don't use social media." This reduces the size of differential effects between users and non-users. For example, beauty norms are shaped and shared between communities online and offline. Moreover, as the majority of adolescents now use social media, not engaging with it can also lead to social isolation, anxiety, and depressive symptoms. In the United States, 54% of adolescents said that quitting social media would be at least somewhat difficult.[2] Thus, while we recognize the importance of effect size in the interpretation of findings, it is provided in the manuscript and in Table S13, but we have not considered it in a subgroup analysis.

5 | CONCLUSION

Our findings call for policy interventions to mitigate the impact of social media on adolescent mental health and diet, particularly body image and DE. They also highlight the importance of involving adolescents in the formulation of research hypotheses. There is a need for follow-up studies to investigate causal pathways, dietary intake, and equity impacts on various population characteristics, including age and low- and middle-income countries, as well as for a consensus on the most valid and reliable measuring tools to use for body image and DE symptoms. Lastly, this review highlights the oversimplification of social media exposure in several of the studies and a lack of research interest in social media influencers and celebrities. As platforms become increasingly sophisticated and allow for a greater range of interactions and experiences, outlining the impact of specific content exposures and experiences, rather than only time spent on social media or disordered use, would help in developing more specific guidance for protecting the health of adolescents.

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CONFLICT OF INTEREST STATEMENT

No conflict of interest statement.

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REFERENCES

1. Smahel D, Machackova H, Mascheroni, G, et al. EU Kids Online 2020: survey results from 19 Countries. EU Kids Online; 2020. Accessed June 29, 2022. 10.21953/lse.47fdeqj01ofo
2. Vogels E, Gelles-Watnick R, Massarat N. Teens, social media and technology 2022. Pew Research Center; 2022. Accessed September 6, 2023. https://www.pewresearch.org/internet/2022/08/10/teens-social-media-and-technology-2022/
3. World Health Organization. Food marketing exposure and power and their associations with food-related attitudes, beliefs and behaviours: a narrative review, 2022. Accessed February 24, 2022. https://www.who.int/publications-detail-redirect/9789240041783
4. Grilo G, Crespi E, Cohen JE. A scoping review on disparities in exposure to advertising for e-cigarettes and heated tobacco products and implications for advancing a health equity research agenda. *Int J Equity Health*. 2021;20(1):238. doi:10.1186/s12939-021-01576-2
5. Rossi R, Nairn A, Smith J, Inskip C. "Get a £10 free bet every week!"—gambling advertising on twitter: volume, content, followers, engagement, and regulatory compliance. *J Public Policy Mark*. 2021;40(4):487-504. doi:10.1177/0743915621999674
6. Thomas SL, Bestman A, Pitt H, et al. Young people's awareness of the timing and placement of gambling advertising on traditional and social media platforms: a study of 11–16-year-olds in Australia. *Harm Reduct J*. 2018;15(1):51. doi:10.1186/s12954-018-0254-6
7. Barry AE, Padon AA, Whiteman SD, et al. Alcohol advertising on social media: examining the content of popular alcohol brands on Instagram. *Subst Use Misuse*. 2018;53(14):2413-2420. doi:10.1080/10826084.2018.1482345
8. World Health Organization. Monitoring and restricting digital marketing of unhealthy products to children and adolescents. 2018. Accessed June 21, 2022. https://www.who.int/europe/activities/monitoring-and-restricting-digital-marketing-of-unhealthy-products-to-children-and-adolescents
9. VicHealth. Under the radar: harmful industries' digital marketing to Australian children. VicHealth; 2020. 10.37309/2020.CI910
10. Tatlow-Golden M, Boyland E, Jewell J, Zalnieriute M, Handsley M, Breda J. Tackling food marketing to children in a digital world: trans-disciplinary perspectives: children's rights, evidence of impact, methodological challenges, regulatory options and policy implications for the WHO European region. World Health Organization. regional office for Europe; 2016. Accessed March 27, 2023. https://apps.who.int/iris/handle/10665/344003
11. Coates AE, Hardman CA, Halford JCG, Christiansen P, Boyland EJ. Food and beverage cues featured in YouTube videos of social media influencers popular with children: an exploratory study. *Front Psychol*. 2019;10. Accessed August 10, 2022:2142. doi:10.3389/fpsyg.2019.02142
12. Office for National Statistics. Children's online behaviour in England and Wales: year ending March 2020. Published 2021. Accessed September 8, 2022. https://www.ons.gov.uk/peoplepopulationandcommunity/crimeandjustice/bulletins/childrensonlinebehaviourinenglandandwales/yearendingmarch2020
13. Harris JL, Brownell KD, Bargh JA. The food marketing defense model: integrating psychological research to protect youth and inform public policy. *Soc Issues Policy Rev*. 2009;3(1):211-271. doi:10.1111/j.1751-2409.2009.01015.x
14. Blakemore SJ, Robbins TW. Decision-making in the adolescent brain. *Nat Neurosci*. 2012;15(9):1184-1191. doi:10.1038/nn.3177
15. Harris JL, Yokum S, Fleming-Milici F. Hooked on junk: emerging evidence on how food marketing affects adolescents' diets and long-term health. *Curr Addict Rep*. 2021;8(1):19-27. doi:10.1007/s40429-020-00346-4
16. Packer J, Croker H, Goddings AL, et al. Advertising and young people's critical reasoning abilities: systematic review and meta-analysis. *Pediatrics*. 2022;150(6):e2022057780. doi:10.1542/peds.2022-057780
17. U.S. Surgeon General's Advisory. Social media and youth mental health. 2023. Accessed September 6, 2023. https://www.hhs.gov/sites/default/files/sg-youth-mental-health-social-media-advisory.pdf
18. Stewart R. Adtech firms collecting "vast amounts" of data on kids despite online regulations. The Drum Published December 13, 2017. Accessed March 27, 2023. https://www.thedrum.com/news/2017/12/13/adtech-firms-collecting-vast-amounts-data-kids-despite-online-regulations
19. Klepp KI, Helleve A, Brinsden H, et al. Overweight and obesity prevention for and with adolescents: the "Confronting obesity: Co-creating policy with youth" (CO-CREATE) project. *Obes Rev*. 2023;24(S1):e13540. doi:10.1111/obr.13540
20. Savona N, Macauley T, Aguiar A, et al. Identifying the views of adolescents in five European countries on the drivers of obesity using group model building. *Eur J Public Health*. 2021;31(2):391-396. doi:10.1093/eurpub/ckaa251
21. Hendricks G, Savona N, Aguiar A, et al. Adolescents' perspectives on the drivers of obesity using a group model building approach: a South African perspective. *Int J Environ Res Public Health*. 2022;19(4):2160. doi:10.3390/ijerph19042160
22. Rounsefell K, Gibson S, McLean S, et al. Social media, body image and food choices in healthy young adults: a mixed methods systematic review. *Nutr Diet J Dietit Assoc Aust*. 2019;77(1):19-40. doi:10.1111/1747-0080.12581
23. Aguiar A, Önal F, Hendricks G, et al. Understanding the dynamics emerging from the interplay among poor mental wellbeing, energy balance-related behaviors, and obesity prevalence in adolescents: a simulation-based study. *Obes Rev*. 2023;e13628. doi:10.1111/obr.13628
24. Nwosu E, Makwambeni P, Herstad SH, et al. Longitudinal relationship between adolescents' mental health, energy balance-related behavior (EBRB), and anthropometric changes. *Obes Rev*. 2023;e13629. doi:10.1111/obr.13629
25. Page MJ, McKenzie J, Bossuyt P, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ*. 2021;372:n71. doi:10.1136/bmj.n71
26. World Health Organization. Adolescent health. Accessed May 31, 2022. https://www.who.int/health-topics/adolescent-health
27. Ruggeri K, Garcia-Garzon E, Maguire Á, Matz S, Huppert FA. Well-being is more than happiness and life satisfaction: a multidimensional analysis of 21 countries. *Health Qual Life Outcomes*. 2020;18(1):192. doi:10.1186/s12955-020-01423-y
28. Fismen AS, Galler M, Klepp KI, et al. Weight status and mental well-being among adolescents: the mediating role of self-perceived body weight. A cross-National Survey. *J Adolesc Health*. 2022;71(2):187-195. doi:10.1016/j.jadohealth.2022.02.010
29. World Health Organization. World mental health report: transforming mental health for all. 2022. Accessed January 23, 2023. https://www.who.int/publications-detail-redirect/9789240049338
30. Dickinson KM, Watson MS, Prichard I. Are clean eating blogs a source of healthy recipes? A comparative study of the nutrient composition of foods with and without clean eating claims. *Nutrients*. 2018;10(10):1440. doi:10.3390/nu10101440
31. EPPI-Centre. Priority screening guide. University College London; 2021.
32. Khouja C, Brunton G, Richardson M, et al. Oral anticoagulants: a systematic overview of reviews on efficacy and safety, genotyping, self-monitoring, and stakeholder experiences. *Syst Rev*. 2022;11(1):232. doi:10.1186/s13643-022-02098-w
33. O'Neill J, Tabish H, Welch V, et al. Applying an equity lens to interventions: using PROGRESS ensures consideration of socially stratifying factors to illuminate inequities in health. *J Clin Epidemiol*. 2014;67(1):56-64. doi:10.1016/j.jclinepi.2013.08.005
34. ROBINS-E Development Group, Higgins J, Morgan R, et al. Risk of bias in non-randomized studies - of exposure (ROBINS-E). Launch

version. Risk of bias tools. Published 2022. Accessed August 26, 2022. https://www.riskofbias.info/welcome/robins-e-tool

35. Adiba C, Pradigdo SF, Kartasurya MI. Association between social media exposure to food and beverages with nutrient intake of female adolescents. *Kesmas J Kesehat Masy Nas Natl Public Health J*. 2020; 15(4). doi:10.21109/kesmas.v15i4.3561
36. Caner N, Evgin D. Digital risks and adolescents: the relationships between digital game addiction, emotional eating, and aggression. *Int J Ment Health Nurs*. 2021;30(6):1599-1609. doi:10.1111/inm.12912
37. Caner N, Efe YS, Başdaş Ö. The contribution of social media addiction to adolescent LIFE: social appearance anxiety. *Curr Psychol*. 2022; 41(12):8424-8433. doi:10.1007/s12144-022-03280-y
38. Ding N, Xu Z. China adolescents comparisons on social media and emotional eating: a moderated analysis. *Child Adolesc Soc Work J*. 2023;40(1):107-117. doi:10.1007/s10560-021-00750-3
39. Fardouly J, Magson NR, Rapee RM, Johnco CJ, Oar EL. The use of social media by Australian preadolescents and its links with mental health. *J Clin Psychol*. 2020;76(7):1304-1326. doi:10.1002/jclp.22936
40. Frieiro P, González-Rodríguez R, Domínguez Alonso J. Influence of personal and family variables on eating disorders. *Rev Esp Salud Publica*. 2021;95:e202112200.
41. Hoare E, Werneck AO, Stubbs B, et al. Association of child and adolescent mental health with adolescent health behaviors in the UK millennium cohort. *JAMA Netw Open*. 2020;3(8):e2011381. doi:10.1001/jamanetworkopen.2020.11381
42. Hosokawa R, Kawabe K, Nakachi K, Soga J, Horiuchi F, Shu-ichi U. Effects of social media on body dissatisfaction in junior high school girls in Japan. *Eat Behav*. 2023;48:101685. doi:10.1016/j.eatbeh.2022.101685
43. Kim HR, Han MA. Associations between problematic smartphone use, unhealthy behaviors, and mental health status in Korean adolescents: based on data from the 13th Korea Youth Risk Behavior Survey (2017). *Psychiatry Investig*. 2020;17(12):1216-1225. doi:10.30773/pi.2020.0007
44. Kleppang AL, Haugland SH, Bakken A, Stea TH. Lifestyle habits and depressive symptoms in Norwegian adolescents: a national cross-sectional study. *BMC Public Health*. 2021;21(1):816. doi:10.1186/s12889-021-10846-1
45. Kwon S, Kim R, Lee JT, et al. Association of smartphone use with body image distortion and weight loss behaviors in Korean adolescents. *JAMA Netw Open*. 2022;5(5):e2213237. doi:10.1001/jamanetworkopen.2022.13237
46. Livet A, Boers E, Laroque F, Afzali MH, McVey G, Conrod PJ. Pathways from adolescent screen time to eating related symptoms: a multilevel longitudinal mediation analysis through self-esteem. *Psychol Health*. 2022;1-16. doi:10.1080/08870446.2022.2141239
47. Lonergan AR, Bussey K, Fardouly J, et al. Protect me from my selfie: examining the association between photo-based social media behaviors and self-reported eating disorders in adolescence. *Int J Eat Disord*. 2020;53(5):755-766. doi:10.1002/eat.23256
48. Luo Y, Niu GF, Kong FC, Chen H. Online interpersonal sexual objectification experiences and Chinese adolescent girls' intuitive eating: the role of broad conceptualization of beauty and body appreciation. *Eat Behav*. 2019;33:55-60. doi:10.1016/j.eatbeh.2019.03.004
49. McAndrew A. What do you see when you look at me? Social media, socialized gender variables, and disordered eating among adolescent girls. University of Windsor; 2020. Accessed March 16, 2023. https://core.ac.uk/download/pdf/344950329.pdf
50. Muzi S, Sansò A, Pace CS. What's happened to Italian adolescents during the COVID-19 pandemic? A preliminary study on symptoms, problematic social media usage, and attachment: relationships and differences with pre-pandemic peers. *Front Psych*. 2021;12:590543. doi:10.3389/fpsyt.2021.590543
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*. 2023;62(1):180-195. doi:10.1111/bjc.12401
52. Rodgers RF, Slater A, Gordon CS, McLean SA, Jarman HK, Paxton SJ. A biopsychosocial model of social media use and body image concerns, disordered eating, and muscle-building behaviors among adolescent girls and boys. *J Youth Adolesc*. 2020;49(2):399-409. doi:10.1007/s10964-019-01190-0
53. Tadena S, Kang SR, Kim SJ. The influence of social media affinity on eating attitudes and body dissatisfaction in Philippine adolescents. *Child Health Nurs Res*. 2020;26(1):121-129. doi:10.4094/chnr.2020.26.1.121
54. Wilksch SM, O'Shea A, Ho P, Byrne S, Wade TD. The relationship between social media use and disordered eating in young adolescents. *Int J Eat Disord*. 2020;53(1):96-106. doi:10.1002/eat.23198
55. Yurtdaş-Depboylu G, Kaner G, Özçakal S. The association between social media addiction and orthorexia nervosa, eating attitudes, and body image among adolescents. *Eat Weight Disord - Stud Anorex Bulim Obes*. 2022;27(8):3725-3735. doi:10.1007/s40519-022-01521-4
56. Acar M. Adölesanların Sosyal Medyada ve Günlük Yaşamda Fiziksel Görünüm Karşılaştırmalarının Yeme Tutum Bozukluğu Ile İlişkisi (Associations between The Physical Appearance Comparison in Social Media and Daily Life with Disordered Eating Attitudes in Adolescents). Hacettepe University; 2020. Accessed March 27, 2023. http://openaccess.hacettepe.edu.tr:8080/xmlui/handle/11655/22275
57. van den Eijnden RJJM, Lemmens JS, Valkenburg PM. The social media disorder scale. *Comput Hum Behav*. 2016;61:478-487. doi:10.1016/j.chb.2016.03.038
58. Vrontis D, Makrides A, Christofi M, Thrassou A. Social media influencer marketing: a systematic review, integrative framework and future research agenda. *Int J Consum Stud*. 2021;45(4):617-644. doi:10.1111/ijcs.12647
59. Jin SV, Muqaddam A, Ryu E. Instafamous and social media influencer marketing. *Mark Intell Plan*. 2019;37(5):567-579. doi:10.1108/MIP-09-2018-0375
60. Dane A, Bhatia K. The social media diet: a scoping review to investigate the association between social media, body image and eating disorders amongst young people. *PLOS Glob Public Health*. 2023;3(3): e0001091. doi:10.1371/journal.pgph.0001091
61. Kelly B, Backholer K, Boyland E, et al. Contemporary approaches for monitoring food marketing to children to progress policy actions. *Curr Nutr Rep*. 2023;12(1):14-25. doi:10.1007/s13668-023-00450-7
62. Kelly B, Bosward R, Freeman B. Australian children's exposure to, and engagement with, web-based marketing of food and drink brands: cross-sectional observational study. *J Med Internet Res*. 2021;23(7): e28144. doi:10.2196/28144
63. Potvin Kent M, Pauzé E, Roy EA, de Billy N, Czoli C. Children and adolescents' exposure to food and beverage marketing in social media apps. *Pediatr Obes*. 2019;14(6):e12508. doi:10.1111/ijpo.12508
64. Haidt J. Social media is a major cause of the mental illness epidemic in teen girls. Here's the evidence. After Babel. Published February 2022. Accessed March 16, 2023. https://jonathanhaidt.substack.com/p/social-media-mental-illness-epidemic

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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