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Relationships between problematic social media use and social comparison: a meta-analysis

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Abstract

We examined the relationship between problematic social media use (PSMU) and social comparison via a meta-analysis. We conducted a systematic literature review and meta-analysis. The study includes quantitative data from 20 independent studies published between January 2019 and October 2025 that examined the relationship between PSMU and social comparison. The studies encompassed adolescents, university students, and the general adult population from both individualistic and collectivist cultural contexts. Effect sizes were calculated using Fisher's z-transformation under a random-effects model. The results indicated a modest positive relationship between PSMU and social comparison, with an effect size (ES) of 0.24 (95% CI [0.13, 0.36]). Following the Trim-and-Fill adjustment, the effect size decreased slightly, but the overall pattern was preserved. Additional meta-analyses based on standardized regression coefficients showed that, when control variables were included, the association weakened but remained detectable (ES = 0.169, 95% CI [0.029, 0.309]). Effect sizes in unpublished studies were close to zero; however, this finding should be interpreted with caution, as it is based on a limited number of unpublished studies. A high degree of heterogeneity was observed across the analyses. Moderation and meta-regression analyses indicated that the relationship may vary depending on the type of social comparison scale, age, gender composition, and countries' Global Innovation Index scores. Studies using theory-based measures of social comparison reported higher effect sizes. Higher effect estimates were observed in samples comprising older participants, in groups with a greater proportion of men, and in countries with lower levels of national innovation. In contrast, effect estimates in adolescent samples were relatively small and, in some subgroup analyses, remained trivial despite reaching statistical significance. In conclusion, social comparison shows a limited, context-sensitive relationship in magnitude rather than a strong or universal one with PSMU. However, it is unclear whether the observed relationship reflects a genuine connection between the independent constructs or partial conceptual overlap between the measurement instruments. The findings suggest that, although some sub-group effects may be statistically significant, their practical importance may remain limited. Therefore, the relationship between PSMU and social comparison should be evaluated within a multi-layered theoretical framework that accounts for measurement approaches, socio-technical contexts, and potential conceptual overlaps between constructs.

Keywords Digital behaviors, Problematic social media use, Social comparison, Meta-analysis

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Introduction

The widespread use of social media in daily life has become a key digital context shaping individuals' social interactions, self-presentation, and self-evaluation in relation to others [7]. However, findings regarding the effects of social media use on psychological well-being are inconsistent in the literature. In particular, studies focusing solely on usage duration or frequency have reported weak or context-dependent findings regarding associations with psychological outcomes [17, 62]. Consequently, recent research has shifted its focus from the duration of social media use to the individual's usage patterns and the processes related to the functional outcomes of such use. In this context, problematic social media use (PSMU) is increasingly being examined in the literature as a more specific construct denoting usage patterns that are difficult to control despite negative consequences [3, 32].

PSMU is conceptualized as a construct associated with patterns of continued use despite negative consequences and is examined in terms of its relationships with variables such as depression, anxiety, stress, loneliness, and low psychological well-being [25, 53]. However, the magnitude and consistency of these relationships vary across studies, and some research suggests that PSMU may not directly or uniformly overlap with psychological distress [54]. However, the strength and direction of these relationships vary significantly across studies. While some studies report stronger associations, others yield weak, non-significant, or context-dependent results. These inconsistencies may be related to sample characteristics, measurement tools, methodological differences, and cultural contexts [28]. Furthermore, whether PSMU constitutes an independent clinical diagnosis or merely reflects broader psychological vulnerabilities remains a subject of debate in the literature. PSMU is not recognized as an official psychiatric diagnosis, and the conceptual boundaries of the concept of behavioral addiction are also still debated. In particular, debates in the fields of gaming disorder and problematic internet use suggest that certain digital behaviors may be pathologized to an excessive degree and that these constructs may overlap significantly with more general psychological vulnerabilities [1, 59]. Ongoing debates regarding the conceptual boundaries and clinical validity of the concept of behavioral addiction also contribute to this uncertainty. Some researchers argue that the strong associations between PSMU and depression, anxiety, loneliness, and difficulties with emotion regulation suggest that these constructs may not be entirely independent psychological processes [1, 59]. From this perspective, PSMU may emerge in some individuals not as an independent disorder but rather as a symptom of more general psychological distress, neurotic tendencies, or difficulties with

self-regulation [26]. Therefore, it is important to consider the possibility of conceptual overlap and shared psychopathological processes when interpreting the relationships between PSMU and mental health variables. Furthermore, the fact that self-report measures assessing PSMU and related psychological variables capture similar emotional and cognitive processes at the content level raises the possibility that some of the observed relationships may reflect inter-measure common variance rather than genuine inter-construct relationships. This situation necessitates a careful evaluation of methodological assumptions regarding the independence of these constructs when interpreting such relationships. For this reason, there is a need for meta-analytic syntheses that enable more comprehensive and balanced assessments of the psychological processes associated with PSMU. However, it is also important to account for conceptual overlap among measures and sources of common variance in such syntheses.

Social comparison is considered one of the key psychological processes potentially associated with PSMU. According to social comparison theory, individuals tend to evaluate their own abilities, achievements, and values by comparing themselves with others [20]. Social media environments may also encourage upward social comparisons by increasing some users' exposure to idealized representations of life [61]. However, these relationships are not consistent across all studies; some have reported limited or insignificant associations.

Some studies have reported that social comparison on social media may be associated with low self-esteem, negative mood, and psychological distress [60]. However, the strength of these associations varies across studies, and some research reports limited or insignificant associations [18, 22]. It is thought that social comparison may play a role in the link between PSMU and mental health, particularly for some individuals [61]. However, the strength of the relationship and the variables that may influence it have not been systematically clarified [60].

The theoretical foundations of PSMU are primarily addressed within behavioral addiction frameworks, self-regulation models, and theories of compensatory Internet use. They indicate that PSMU is associated with negative emotions, stress, or unmet psychological needs, but eventually leads to loss of control and compulsive usage patterns [32]. However, some researchers suggest that PSMU may be a symptom of more general psychological vulnerabilities or neurotic tendencies rather than an independent disorder. This raises the possibility that certain measures associated with PSMU may conceptually overlap with broader indicators of psychopathology, such as depression, psychological distress, or difficulties with emotion regulation. Therefore, when interpreting the relationships between PSMU and mental health

variables, shared variance and conceptual similarities across measures should be considered. PSMU has also been linked to many mental health problems, such as depression, anxiety, stress, emotion regulation, and loneliness, which have been shown [25, 53]. Meta-analytic studies support these relationships. For example, Huang, [25] demonstrated significant and moderate links between PSMU and depression and anxiety. Shannon et al., [53] highlighted that PSMU is linked with psychological distress among adolescents and young adults, but effect sizes varied widely across studies. This variability indicates that PSMU is not a unidimensional construct but may be influenced by different individual and contextual factors.

PSMU has been studied using various methods, primarily through self-report instruments. Numerous measurement tools have been developed to assess different components of PSMU, such as loss of control, mental preoccupation, tolerance, and withdrawal-like symptoms; however, this diversity makes it difficult to compare research findings and interpret them holistically [38]. Therefore, there is a need for a systematic synthesis of individual studies to understand better the psychological processes associated with PSMU. Furthermore, it is argued that PSMU cannot be explained solely by the duration of social media use; rather, it should be understood as a more complex construct that involves the functional outcomes of use, difficulties with self-regulation, and psychosocial vulnerability. In this context, PSMU provides an important conceptual framework for understanding how social media environments influence individuals' self-perception, emotional experiences, and social evaluation processes. Given the comparative nature of social media, a comprehensive examination of how PSMU relates to social comparison processes remains a significant gap in the literature.

Social comparison is a psychological process where people judge themselves by comparing themselves to others. Initially, Festinger [20] posited that people look to others for self-assessment and shape their self-perception in two ways: upward (comparing themselves with those who are better off) and downward (comparing themselves with those who are worse off).

Social media platforms provide digital contexts that can facilitate social comparison processes for some users [31]. It has been suggested that exposure to selective and idealized content may increase upward social comparisons in some individuals [30, 61]. However, findings on the psychological consequences of social media-based social comparisons are inconsistent across studies. While some studies report that social comparison may be associated with low self-esteem, negative mood, and psychological distress [4, 60], other studies report more limited or insignificant associations [18, 22]. Therefore,

the effects of social media-based social comparisons may vary depending on individual, contextual, and methodological factors.

Similarly, the literature on social media and body image research is also not entirely consistent. While some studies suggest that media-based comparisons may be associated with body dissatisfaction and negative self-evaluation, meta-analytic and critical reviews highlight ongoing debates about the magnitude, consistency, and generalizability of these effects [16, 24].

It is thought that social media use may influence individuals' motivations related to online visibility, social validation, and self-presentation processes. Some studies suggest that constant exposure to others' life updates may increase individuals' search for online approval and intensify their social media use [2, 37]. However, these processes do not operate the same way for all users, and their effects may vary across individuals.

Recent reviews and meta-analytic studies suggest that social comparison may help explain the psychological outcomes of social media experiences [60]. However, the magnitude and direction of current findings vary significantly across studies. This variability may be related to sample characteristics, measurement methods, cultural contexts, and the conceptual frameworks employed [25]. Therefore, there is a need for a more systematic examination of the relationship between social comparison processes and PSMU.

Despite the rapid growth of research on the psychological effects of social media use, the scope and nature of the link between PSMU and social comparison remain unclear. Whereas social comparison theory posits that individuals evaluate themselves by comparing themselves to others, research has shown that social media environments sustain and intensify this process [60]. Despite this theoretical basis, empirical findings on the relationship between social comparison and PSMU are inconsistent.

Previous findings indicate that generally small to moderate associations have been reported between PSMU and depression, anxiety, and psychological distress [25, 53]. However, the strength of these links varies widely across studies. This indicates that PSMU is not a single outcome but a complex construct influenced by personal traits, cognitive-emotional processes, and environmental factors [9].

In the context of social media, social comparison has been suggested to be related to some individuals' motivations for using it. It has been reported that upward social comparisons can increase negative emotions among certain users and encourage more intensive social media use [4]. Similarly, it is proposed that individuals more prone to social comparison may exhibit more intense or compulsive patterns of use [37]. However, these relationships

do not manifest consistently across all samples and are sensitive to individual differences.

However, studies examining the relationship between PSMU and social comparison differ significantly in terms of sample characteristics, age groups, measurement methods, and cultural contexts. This variability makes it challenging to directly compare findings and results across the fragmented literature [60]. Therefore, rather than relying on conclusions from individual studies, comprehensive quantitative syntheses across diverse contexts and samples are necessary. In this regard, meta-analysis is a suitable method for reliably determining the overall strength of the relationship between PSMU and social comparison. Meta-analytic approaches yield more reliable effect estimates by systematically combining results from multiple studies [25]. However, reporting only the average effect size does not adequately account for the heterogeneity observed in the literature. By examining how effect sizes vary with sample and study characteristics, meta-analyses clarify the mechanisms underlying inconsistent findings in the literature [53].

In this regard, we aimed to assess the overall relationship between PSMU and social comparison using a meta-analytic approach and to explain the observed heterogeneity in this relationship. The goal was to synthesize scattered findings from social media studies into a comprehensive framework, thereby strengthening theoretical explanations and providing a stronger scientific basis for preventive and intervention-based initiatives. More specifically, we aimed to answer the following questions.

1. Is there a general relationship between PSMU and social comparison?
2. Does the relationship differ according to moderator variables?

Method

We used a meta-analytic approach to derive a pooled effect size from individual studies examining the relationship between PSMU and social comparison. In line with the study's aim, we conducted a systematic review of the literature on PSMU and social comparison, following the PRISMA (2020) guidelines for the meta-analysis.

Inclusion and exclusion criteria for studies

1. Research product: Studies should have focused on the relationship between PSMU and social comparison. Studies that examined relationships between these variables and other constructs were excluded.
2. Research design: Studies should be conducted using a survey model. Those studies involving interventions were excluded. Intervention-based

research may have different moderating variables. Therefore, studies with experimental designs were excluded.

3. Participants: There was no participant restriction. Studies encompassing school-age individuals (i.e., children, adolescents, young adults) and adults were included. In other words, participants from the general population are included.
4. Publication type: Studies, published articles, or unpublished reports (i.e., conference papers and book chapters), only in English, were included.
5. Publication year range: Studies conducted between 2015 and 2025 were included. Research on social media comparison has increased since 2015. Therefore, this study is limited to the last 10 years.
6. Data structure: Studies including sufficient statistical indices to calculate the effect size were selected.

Data collection and extraction

We used the Web of Science, Scopus, EBSCOhost (ERIC, Academic Search Ultimate, PsycInfo), and ProQuest databases to retrieve the data for the study. The databases were searched for studies published between January 2015 and October 2025. Keywords used in the databases included “problematic social media use” and “social media exposure” in the first group and “social comparison” in the second group. We performed searches using pairwise combinations of the keyword groups. We selected the option to include the first- and second-group keywords in the title. In line with the objectives of this study, we defined inclusion and exclusion criteria and created the dataset accordingly.

We excluded irrelevant and repetitive studies that did not address relationships among the variables of interest after a thorough examination of the titles and abstracts. We excluded studies whose full texts were not accessible ($n = 2$) and those that reported insufficient statistical data to calculate effect sizes ($n = 31$) (see Fig. 1).

Coding of study characteristics

Researchers prepared a coding form that reflected the characteristics of survey research. The basic research includes codes such as outcome type, PSMU scale type, Social Com. scale type, mean age of the sample, gender distribution of the sample, country's cultural type, average “Global Innovation Index” (GII), participant type, research quality score, report type, publication year and citation bias. The first and second authors did the data coding. First, 5 randomly selected studies from the dataset were coded by the coders and researchers together through discussion. Based on this preliminary coding process, a standardized coding form was developed using Microsoft Excel. An overview of the coded variables and their operational definitions is presented in Table 1.

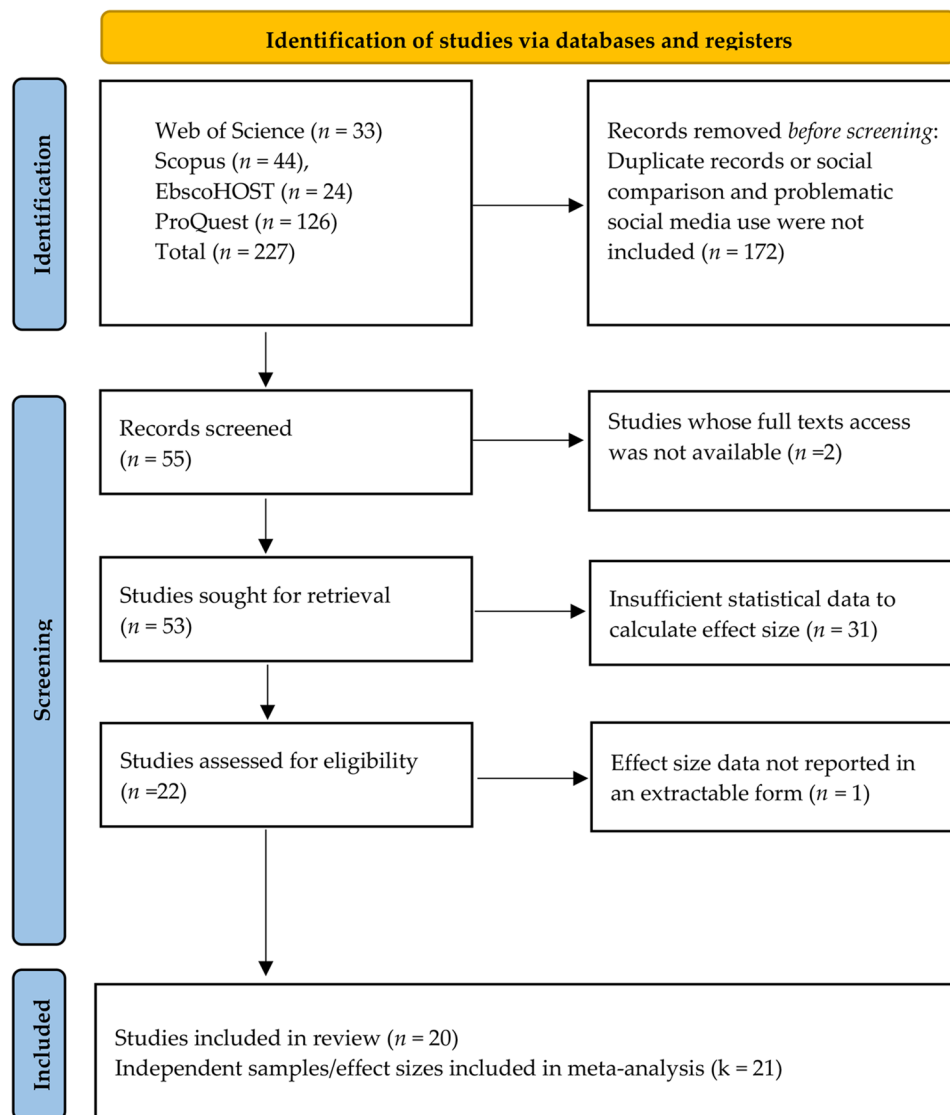


Fig. 1 Data flow diagram of the data sets

Subsequently, the coders independently coded the studies in the dataset. A high level of agreement was observed between the coders (Cohen's Kappa coefficient $\kappa=0.90$). Inconsistency between coders occurred more frequently between scale types. For inconsistent codes, it was decided to consult two experts in psychology and psychological counseling.

Quality appraisal

To assess the methodological quality of the primary studies included in this study, the Best Research Practices checklist proposed by Ferguson et al., [17] was used. This quality assessment framework was developed to evaluate methodological rigor and transparency in quantitative research practices, particularly in psychology and the behavioral sciences. The scale consists of six criteria:

(1) the use of standardized measurement instruments, (2) the preference for measurement instruments that are clinically or empirically valid, (3) the provision of appropriate control conditions, (4) the use of distractor questions or tasks designed to minimize demand characteristics, (5) the examination of whether participants predicted the research hypothesis, and (6) the prior registration of the analysis plan. Each criterion was coded as '1' if met in the relevant study and '0' if not met. Thus, a total quality score ranging from 0 to 6 was obtained for each study. Higher scores indicate that the research is methodologically stronger and demonstrates greater adherence to good research practice.

Data analysis

We conducted statistical analyses using a random-effects model. The unit of analysis is at the research level. In

Table 1 Coding scheme for study characteristics

Group	Description / Coding
Study reference	Studies were cited according to APA 7th edition guidelines.
Social comparison type	The products are coded according to the types of social comparisons combined in the meta-analysis. If no specific type of comparison is given, it is coded as "General"; if they are evaluated together, it is coded as "Combined"; if an upward comparison is considered, it is coded as "Up"; and if a downward comparison is involved, it is coded as "Down".
Participant	The data were coded according to the characteristics of the participants included in the meta-analysis. If the group being studied for social comparison was not limited, it was coded as "General population"; if it focused solely on students, it was coded as "Student".
PSMU scale type	The type of scale used to assess PSMU levels among individuals in the studies included in the meta-analysis is specified. The scales are coded as "Bergen," "Sahin29," and "Other."
Social comparison scale type	This refers to the type of scale used to determine the level of social comparison among individuals in the studies included in the meta-analysis. The scales used are coded as "INCOM," "Gilbert11," and "Other."
Publication year	The studies included in the meta-analysis were coded by publication year as "2019–2021," "2022–2024," and "2025".
Report type	Report type was coded as 'published' or 'unpublished' based on publication status.
Research quality	The methodological quality of the primary studies was coded in accordance with the 'best research practices' approach proposed by Ferguson et al., [17].
Gender ratio	The gender of participants in the studies included in the meta-analysis was coded as "more female," "more male," or "NR".
Age	The age of the participants in the studies included in the meta-analysis was coded as "under 21," "21–25," "over 25," and "NR".
Sample location	The country in which each study was conducted was coded according to the study location
GII level	The GII levels of the countries included in the meta-analysis studies are shown. Accordingly, the GII index levels of the countries are coded as "High," "Medium," and "Low".
Culture type	The data included in the meta-analysis refer to the cultural types of the countries from which the research participants were drawn. Accordingly, the countries' cultural types were coded as "Collectivist" or "Individualist".
Citation Bias	During the coding process, studies were coded as follows: if the study presented PSMU as uncontroversial/established, and there were no criticisms, measurement issues, or null findings, bias was assumed to exist and it was coded as 1; if there were at least partial conceptual discussions, measurement issues, null/weak findings, or criticisms of behavioral dependence, bias was assumed to be absent and it was coded as 0.

GII Global Innovation Index, NR Not reported

other words, a sample is represented by an effect size. In studies with related effect sizes from the same sample, the average effect size was calculated. We used Fisher's index as the effect size index. The primary research studies reported Pearson correlation coefficients ($n=20$). Pearson correlation coefficients take values between -1 and $+1$. These limited value ranges can reduce variance in the distribution of effect sizes. Therefore, we converted the r , R , and R^2 values reported by the primary research studies to Fisher's z ($Fz = ES$).

We assessed the heterogeneity of effect sizes using the Q statistic. In addition, we used I^2 and tau2 statistics to assess the magnitude and sources of heterogeneity in the effect sizes. We performed a moderator analysis to calculate effect sizes by moderator variable and to assess whether there were statistically significant differences between subgroups of the moderator variables using Q (between) tests.

The reliability of the calculated effect sizes is related to publication bias. In this context, we conducted various tests to evaluate the advantages of different statistical methods for assessing publication bias. We used Funnel Plot analysis, Egger Regression (ER), and Duval and Tweedie Trim-and-Fill (DTTF) techniques to assess publication bias. The characteristics of the studies included in the research are given in Table 2. In addition, the gender distribution percentages were coded as dummy variables, and a meta-regression analysis was conducted, controlling for gender and age.

Findings

Publication bias analyses for the data sets

The funnel plot of effect sizes is shown in Fig. 2. Studies with small sample sizes located to the right of the mean effect size are noteworthy. The effect sizes do not exhibit a perfectly symmetrical distribution. When examining the effect size bias analyses, the ER test shows no publication bias (intercept = 2.86, SE = 4.43, $p = .53$). However, the DTTF test indicates that symmetry could be achieved by adding a $k=2$ effect size to the left of the mean. Accordingly, the corrected mean effect size was calculated as $ES = 0.22$, $LL = 0.11$, $UL = 0.33$ ($Q(\text{total}) = 508.91$). The difference between the calculated effect size and the corrected value is quite small. Therefore, we conclude that there is negligible publication bias.

Zero-order correlation meta-analysis and moderator analyses

We analyzed $k=21$ effect sizes from $N=21$ samples, as reported in $n=20$ primary studies. Effect sizes range from $ES=-0.44$ to $ES=0.51$. The Forest plot graph of the effect sizes is presented in Appendix 1. The mean effect size between PSMU and social comparison is weak ($ES = 0.24$, $LL = 0.13$, $UL = 0.36$). The total heterogeneity of

Table 2 The characteristics of the studies included in the meta-analysis

Number	Study	Report Type	Participant	Location	Culture type	Innovation Index	Gender (% Female)	Age (Mean)	Social comparison type	Quality Assessment	Citation Bias	Scale 1	Scale 2
1	Han et al. [123]	Article	Working adults	China	Collectivist	High	55.3	30.5	General	2	1	Social Media Addiction Scale (Jamal Al-Menayes, 2015) – adapted to WeChat; 10 items; $\alpha = 0.735$	INCOM – Social Comparison Orientation (Gibbons & Buunk; Chinese version by Wan et al., 2006); 11 items; $\alpha = 0.832$
2	Kavaklı and Ünal [27]	Article	University students	Türkiye	Collectivist	High	71.1	20.96	General	1	0	Social Media Addiction Scale, Student Form (Şahin, 2018; 29 items; $\alpha = 0.92$)	Allan & Gilbert Social Comparison Scale (18 items; 6-point; $\alpha \approx 0.79$)
3	Kim et al. [29]	Article	Adult SNS users	Austria	Individualist	High	NR	27.62	Combined	2	0	Bergen Social Media Addiction Scale (BSMAS) – (6 items; German back-translation; $\alpha \approx 0.80$)	INCOM – Ability (6 items; German version)
4	Lerma [33]	Thesis (Master's)	College students	USA	Individualist	High	76.9	20.57	General	2	0	BSMAS – (6 items; $\alpha = 0.84$ in sample)	Allan & Gilbert Social Comparison Scale (11 items; $\alpha \approx 0.90$)
5	Lewin et al. [34]	Article	Undergraduate students	USA	Individualist	High	65.7	20	Combined	2	1	BFA's adapted separately for Facebook/Instagram/Snapchat/TikTok/Twitter	INCOM – Ability subscale (6 items)
6	Macrynikiola [36]	Thesis (PhD Dissertation)	Smartphone users	USA	Individualist	High	78	23.14	General	1	0	BSMAS ($\alpha = 0.75$ in sample)	INCOM – lowa–Netherlands Comparison Orientation Measure (offline general; $\alpha = 0.78$)

Table 2 (continued)

Number	Study	Report Type	Participant	Location	Culture type	Innovation Index	Gender (%) Female	Age (Mean)	Social comparison type	Quality Assessment	Citation Bias	Scale 1	Scale 2
7	Nor et al. [40]	Article	Social media users	Pakistan	Collectivist	Low	55.25	28.4	General	1	1	Social Media Use Questionnaire (9 items; adapted for Instagram (Xanidis & Brignell, 2016)	INCOM – lowa–Netherlands Comparison Orientation Measure (11 items)
8	Onat Kocabyik [41]	Article	University students	Türkiye	Collectivist	High	28	21.22	General	2	0	Social Media Addiction Scale (Tutgun-Unal & Deniz, 2015; 41 items; 5-point; $\alpha=0.965$)	INCOM – lowa–Netherlands Comparison Orientation Measure (Turkish adaptation; 11 items; $\alpha=0.806$)
9	Parveiz et al. [42]	Article	Young adults	Pakistan	Collectivist	Low	54	22.58	General	2	1	Social Media Addiction Scale; Student Form (29 items; $\alpha=0.92$)	INCOM – lowa–Netherlands Comparison Orientation Measure (11 items; $\alpha=0.80$)
10	Pikó et al. [43]	Article	University students	Hungary	Individualist	High	70.6	21.8	General	2	0	BSMAS (HU; $\alpha=0.74$)	INCOM – lowa–Netherlands Comparison Orientation Measure (HU; 11 items; $\alpha=0.82$)

Table 2 (continued)

Number	Study	Report Type	Participant	Location	Culture type	Innovation Index	Gender (%) Female)	Age (Mean)	Social comparison type	Quality Assessment	Citation Bias	Scale 1	Scale 2
11	Pikó et al. [44]	Article	University students	Hungary	Individualist	High	70.6	23.61	General	2	0	BSMAS (Hungarian ver.; $\alpha = 0.89$)	INCOM – lowa–Netherlands Comparison Orientation Measure (Hungarian adaptation; 11 items; $\alpha = 0.85$)
12	Riaz et al. [46]	Article	Students	Pakistan	Collectivist	Low	49.6	17.54	General	1	1	Social Media Addiction Scale; Student Form (29 items; $\alpha = 0.93$)	INCOM – lowa–Netherlands Comparison Orientation Measure (Hungarian adaptation; 11 items; $\alpha = 0.85$)
13	Robinson et al. [47]	Article	Undergraduates Students	USA	Individualist	High	82.1	20.4	Combined	1	1	BSMAS (6 items; $\alpha = 0.85$)	Upward social comparison item (Vogel et al., 2015; single item, 5-point)
14	Rohimi et al. [48]	Article	University students	Malaysia	Collectivist	High	67	22.88	Combined	1	1	BSMAS (6 items; $\alpha = 0.77$)	UPACS/DACS – Upward/Downward Physical Appearance Comparison Scales ($\alpha = 0.92/0.93$)
15	Salimi et al. [49]	Article	High school students	Iran	Collectivist	Medium	NR	15.05	General	1	1	Social Media Addiction Scale (Tutgun-Unal & Deniz, 2015)	Adolescent Social Comparison Scale–Revised (ASCS-R; Xavier et al., 2014)

Table 2 (continued)

Number	Study	Report Type	Participant	Location	Culture type	Innovation Index	Gender (%) Female	Age (Mean)	Social comparison type	Quality Assessment	Citation Bias	Scale 1	Scale 2
16	Samraet al. [50]	Article (Brief Report)	University students	Australia	Individualist	High	45	20.15	Up	2	1	BSMAS (PSMU), 6 items, $\alpha=0.87$	SCSM – Upward/Downward Focus (2 items); NSMCS – Negative Social Media Comparison Scale (7 items, $\alpha=0.89$)
17	Servidio et al. [51]	Article	University students	Italy	Individualist	High	74.4	23.05	Ability	2	1	BSMAS – (PSMU), 6 items, $\alpha=0.77$	INCOM, lowland Comparison Orientation Measure (Ability subscale), 6 items, $\alpha=0.78$
18	Shang and Bao [52]	Article	University students	China	Collectivist	High	51.6	NR	Up	1	0	NR – not PSMU/addiction/excessive (used Social Media Intensity)	INCOM – Upward Social Comparison (Chinese adaptation) INCOM; FOMO Scale; SWLS
19	Steinberger and Kim [55]	Article	Adults using SNS	Austria / Netherlands	Individualist	High	72.97	26.99	General	2	1	Bergen Social Networking Scale	INCOM; FOMO Scale; SWLS
20	Yaqoob et al. [63]	Article	University students	Pakistan	Collectivist	Low	47.3	21.38	General	1	0	BSMAS	INCOM-16; DASS-21

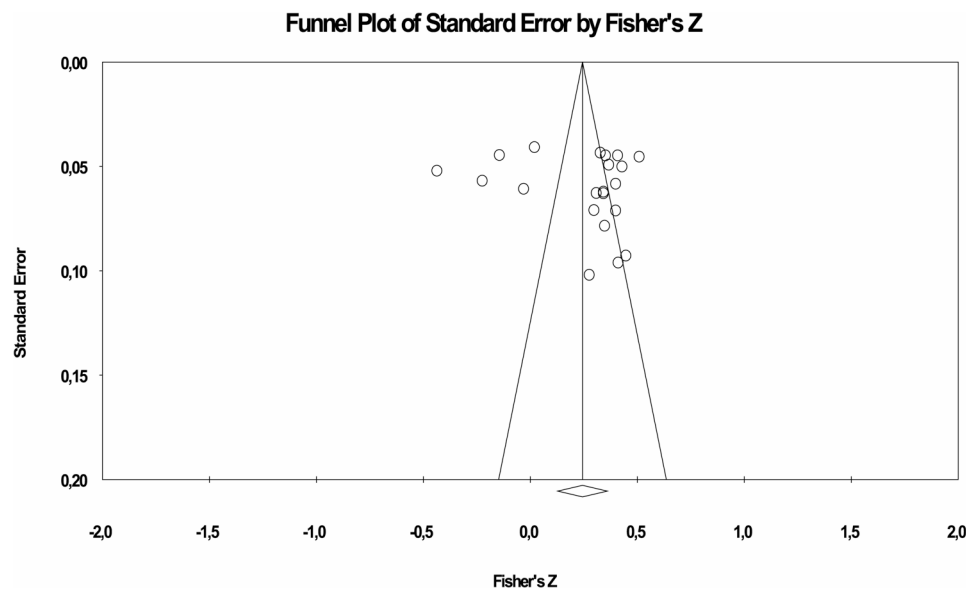


Fig. 2 The funnel plot

the effect sizes was calculated as $Q(20) = 464.76$, $p < .001$. Again, the distribution of effect sizes exhibits substantial heterogeneity ($I^2 = 95.70$). Heterogeneity is attributable to sampling error and inter-study variability ($\tau^2 = 0.07$). The findings from moderator analyses by categorical variables, accounting for the diversity of primary studies, are presented in Table 3.

Table 3 shows that the relationship between PSMU and social comparison differs significantly across social comparison scale types [$Q(2) = 8.91$, $p < .05$]. The INCOM scale group produced a larger effect size ($k = 9$; $ES = 0.35$, $LL = 0.26$, $UL = 0.49$), while the Other group produced a very weak effect size ($ES = 0.05$, $LL = -0.17$, $UL = 0.27$).

Furthermore, the relationship between PSMU and social comparison differs statistically significantly according to the GII level of the countries [$Q(2) = 12.01$, $p < .05$]. Countries with a high GII level showed a smaller effect size ($k = 16$; $ES = 0.25$, $LL = 0.14$, $UL = 0.35$). In comparison, the group with a low GII level produced a higher effect size ($k = 4$; $ES = 0.40$, $LL = 0.18$, $UL = 0.61$).

It was found that the methodological quality levels of the studies did not exert a statistically significant moderating effect on the relationship in question ($Q_{\text{between}}(1) = 1.345$, $p = .246$). However, when the effect sizes and heterogeneity within the quality subgroups were examined, notable numerical differences were observed. The pooled effect for studies in the Partially High/Controlled Quality group indicates a positive relationship of moderate strength ($k = 12$; $r = .288$, 95% CI [0.206, 0.366]; $z = 6.641$, $p < .001$). In contrast, the pooled effect in the Low/Basic Quality group remained lower and was not statistically significant ($k = 9$; $r = .169$, 95% CI [-0.060, 0.382]; $z = 1.480$, $p = .140$). Furthermore, the level of

heterogeneity among studies in the Low/Basic Quality group ($I^2 = 97.61\%$; $\tau^2 = 0.116$) was higher than that in the Partially High/Controlled Quality group ($I^2 = 85.09\%$; $\tau^2 = 0.020$). However, because the difference between the groups was not statistically significant, this pattern should not be directly attributed to methodological quality and should be interpreted with caution.

On the other hand, the levels of heterogeneity in some moderator subgroups are noteworthy. The distribution of effect sizes across participant types in the general population group appears homogeneous ($k = 8$; $I^2 = 0.00$, $\tau^2 = 0.00$). This indicates that the basic studies produced consistent results. A moderate correlation is observed in effect size for the general population ($k = 8$; $ES = 0.37$, $LL = 0.20$, $UL = 0.55$). Similarly, studies from the European country group show a homogeneous pattern ($I^2 = 0.00$, $\tau^2 = 0.00$), indicating that studies from European countries produced similar findings. The effect size for the European group indicates a moderate correlation ($k = 6$; $ES = 0.35$, $LL = 0.15$, $UL = 0.55$).

Furthermore, a moderator analysis examining the trend in citation bias in the PSMU literature revealed no statistically significant difference between the subgroups ($Q_{\text{between}}(1) = 0.08$, $p = .78$). Studies with and without citation bias yielded effect sizes of similar magnitude. However, heterogeneity remained high in both subgroups ($I^2 > 90\%$), suggesting that the variability in effect sizes cannot be explained solely by the way the literature is presented.

The meta-regression results examining the potential moderating effects of sample characteristics on the effect size are presented in Table 4.

Table 3 Moderator analysis of the data set

Subgroup	Effect size %95 CI			Heterogeneity						
	k	Fz	LL	UL	z	p	Q(t)	p	I ²	tau2
Outcome										
General	13	0.22	0.07	0.37	2.86	0.00	304.41	0.00	96.06	0.084
Combined	5	0.20	−0.05	0.44	1.60	0.11	100.34	0.00	96.01	0.059
Up	2	0.48	0.09	0.87	2.42	0.02	0.36	0.55	0.00	0.000
Ability	1	0.31	−0.24	0.85	1.11	0.27				
Q (between)	Q(3)=1.70 p=.64									
Participant										
General population	8	0.37	0.20	0.55	4.15	0.00	3.95	0.79	0.00	0.000
Student	13	0.17	0.03	0.30	2.38	0.02	372.37	0.00	96.78	0.093
Q (between)	Q(1)=3.29 p=.07									
PSMU scale										
Bergen version	12	0.25	0.09	0.41	3.02	0.00	150.03	0.00	92.67	0.043
Sahin29	3	0.19	−0.13	0.52	1.18	0.24	84.80	0.00	97.64	0.133
Other	6	0.25	0.02	0.48	2.17	0.03	224.76	0.00	97.78	0.123
Q (between)	Q(2)=0.10 p=.95									
Social comparison scale										
INCOM	14	0.35	0.23	0.46	5.94	0.00	83.88	0.00	84.50	0.017
Gilbert11 items	3	0.03	−0.23	0.28	0.20	0.84	34.75	0.00	94.24	0.07
Other	4	0.05	−0.17	0.27	0.43	0.67	158.20	0.00	98.10	0.16
Q (between)	Q(2)=8.91 p=.01									
Publication year										
2019–2021	9	0.18	0.01	0.36	2.07	0.04	168.65	0.00	95.26	0.062
2022–2024	8	0.23	0.04	0.41	2.42	0.02	219.43	0.00	96.81	0.100
2025	4	0.41	0.15	0.67	3.08	0.00	6.09	0.11	50.71	0.003
Q (between)	Q(2)=2.03 p=.36									
Report type										
Published	19	0.26	0.13	0.38	4.11	0.00	446.63	0.00	95.97	0.071
Unpublished	2	0.12	−0.27	0.50	0.59	0.55	6.67	0.01	85.01	0.040
Q (between)	Q(1)=0.46 p=.50									
Quality										
1 (Low/Basic)	9	0.169	−0.06	0.38	1.48	0.14	365.07	<0.001	97.61	0.116
2 (Controlled)	12	0.288	0.21	0.37	6.64	<0.001	84.02	<0.001	85.01	0.020
Q (between)	Q(1)=1.73 p=.19									
Location										
Europe	6	0.35	0.15	0.55	3.47	0.00	2.10	0.83	0.00	0.000
USA	4	0.02	−0.22	0.27	0.19	0.85	17.01	0.00	82.36	0.014
Other	11	0.26	0.12	0.41	3.55	0.00	320.49	0.00	96.88	0.093
Q (between)	Q(2)=4.36 p=.11									
GII level										
High	16	0.25	0.14	0.35	4.54	0.00	262.61	0.00	94.29	0.052
Low	4	0.40	0.18	0.61	3.66	0.00	0.77	0.86	0.00	0.000
Medium	1	−0.44	−0.86	−0.01	−2.03	0.04	0.00	1.00	0.00	0.000
Q (between)	Q(1)=1.345 p=.246									
Culture type										
Collectivist	10	0.25	0.08	0.42	2.85	0.00	316.56	0.00	97.16	0.096
Individualist	11	0.24	0.08	0.40	2.87	0.00	137.14	0.00	92.71	0.045
Q (between)	Q(1)=0.03 p=.95									
Citation Bias										
0 (No bias)	10	0.26	0.09	0.41	2.98	0.00	136.66	0.00	93.41	0.055
1 (Bias)	11	0.22	0.07	0.37	2.75	0.01	319.13	0.00	96.87	0.083
Q (between)	Q(1)=0.08 p=.78									

Table 4 The moderating role of age and gender distribution on effect size: meta-regression results

Covariate	Coefficient	Standard Error	0.95 Lower	0.95 Upper	Z-value	Two-sided p-value
Intercept	-0.20	0.22	-0.63	0.23	-0.91	0.36
Mean age of the sample ($k=20$) $Q = 4.05$, $df = 1$, $p = 0.04$, $R^2 = 0.15$	0.02	0.01	0.00	0.04	2.01	0.04
Intercept	0.36	0.06	0.24	0.48	5.81	0.00
Gender distribution of sample* ($k=19$) $Q = 4.16$, $df = 1$, $p = 0.04$, $R^2 = 0.16$	-0.18	0.09	-0.36	-0.01	-2.04	0.04

*The distribution percentages by gender are dummy-coded. The group with a median $\leq 66\%$ is classified as the lower group, and the group with a median $> 66\%$ is classified as the upper group for the meta-regression analysis. The median value of $= 66\%$ was used as the reference group.

It was found that the mean age of participants is a statistically significant predictor of the effect size ($Q=4.05$, $df=1$, $p=.04$). As the mean age of participants increases, the effect size also increases (Coefficient = 0.02, $p=.04$). Most included studies were based on samples with a relatively high proportion of female participants. In this case, the participants in the basic studies are divided into two groups based on the median of the gender distribution. These groups are the $\leq 66\%$ lower-median group and the $> 66\%$ upper-median group. Meta-regression analysis was conducted with these groups coded as dummy variables. The results of the meta-regression analysis showed that the distribution of samples by gender is a statistically significant predictor of effect size ($Q=4.16$, $df=1$, $p=.04$). The effect size was smaller in samples in which the proportion of female participants exceeded 66% (Coefficient = -0.18 , $p=.04$). In other words, if a substantial portion of the sample consists of women, the effect size decreases. This finding should be interpreted with caution, given that women predominantly lead most basic studies. These findings suggest that the sample's gender composition may be associated with variation in effect size, although this pattern should be interpreted with caution.

Standardized regression coefficient-based meta-analysis

To examine the robustness of the relationship while accounting for control models, an additional meta-analysis was conducted on studies reporting standardized regression coefficients (β). Accordingly, 15 independent effect sizes that met the criteria were included in the analysis. To ensure comparability, all coefficients were converted to the Fisher z (y_i) scale and modeled using sample variances (v_i). A forest plot of the effect sizes is presented in Appendix 2. The heterogeneity analysis revealed substantial variability in the regression coefficients across studies ($Q(14) = 347.47$, $p < .001$; $I^2 = 95.63\%$; $\tau^2 = 0.072$). Consequently, the Random Effects Model (REML) was employed in the analyses. According to the results of the random effects model, the pooled effect size based on standardized regression coefficients was found to be 0.169 in terms of Fisher's z ($SE = 0.071$, 95%

CI [0.029, 0.309]; $z = 2.372$, $p = .0177$). This finding indicates that, whilst the relationship between PSMU and social comparison remains statistically significant when control variables are taken into account, it is of a lower magnitude.

Comparison of zero-order and adjusted effect estimates

When the results of the meta-analysis using zero-order correlation coefficients were compared with those using standardized regression coefficients, differences in the pooled effect sizes were observed. In the correlation-based analysis, the overall effect size was $ES = 0.24$ (95% CI [0.13, 0.36]), whereas in the analysis based on standardized regression coefficients, the effect size was $ES = 0.169$ (95% CI [0.029, 0.309]). This result indicates that the magnitude of the relationship can be estimated more accurately when control variables are taken into account. However, a positive and statistically significant relationship between PSMU and social comparison was maintained in both analyses. Furthermore, a high degree of heterogeneity was observed in both approaches (correlation: $I^2 = 95.70\%$; regression: $I^2 = 95.63\%$). This finding suggests that the variability in effect sizes is not solely attributable to control variables and that methodological and contextual differences across studies may play a role. Consequently, the regression-based results were interpreted as a complementary sensitivity analysis of the robustness of the main findings.

Discussion

The current meta-analysis finds a generally small positive association between PSMU and social comparison, though this association may vary across contexts and samples. These results align with other studies on the effects of social media use and psychological processes. Meta-analyses examining the links between PSMU and depression, anxiety, stress, and other negative mental health indicators generally report small-to-moderate associations between PSMU and various psychological risk indicators; however, the magnitude and consistency of these associations vary across studies. Current findings also suggest that PSMU is not just about intensive usage;

it is a more complex phenomenon closely tied to psychological functioning.

Social comparison is one psychological process that may be associated with PSMU in certain individuals and contexts. Social media can provide digital contexts associated with social comparison processes, alongside exposure to idealized representations of others [60, 61]. Previous studies have shown that social comparison may play a role in the link between PSMU and depression, and that PSMU may be associated with negative psychological experiences through upward comparisons [50]. Similarly, social media use is indirectly associated with self-esteem and psychological well-being, particularly among young adults, primarily through social comparison processes [15].

However, social comparison processes do not operate uniformly among social media users. While some individuals actively use social media for self-evaluation and self-assessment, consciously seeking out comparative content, others are exposed to such comparisons passively and incidentally. Aubry et al., [6] argue that social comparison on social media is not merely passive exposure; rather, it is an interactive and dynamic process driven by the individual's self-evaluation motivations. This motivational heterogeneity may contribute to variations in psychological patterns associated with social comparison among individuals.

The weak yet statistically significant overall relationships identified in this meta-analysis are consistent with some prior findings and indicate that PSMU is associated with various psychological processes. The small effect size indicates that social comparison is only one of several psychosocial pathways leading to PSMU. Furthermore, a supplementary meta-analysis using standardized regression coefficients showed that the effect size remained smaller when control models were included ($ES = 0.169$). However, the direction of the relationship was preserved, and statistical significance persisted. This pattern suggests that the association between social comparison and PSMU has not completely disappeared, but that the controlled psychosocial factors may influence the magnitude of the relationship. However, it should not be assumed that the entire observed relationship reflects actual relationships among independent psychological constructs. Some items in self-report measures assessing PSMU, social comparison, and psychological distress may overlap conceptually with difficulties in self-regulation, negative affect, or general psychological vulnerability. This suggests that some of the observed relationships may reflect common variance across measures rather than relationships among constructs. Furthermore, the fact that social comparison processes vary by individuals' motivational orientations, their purposes for using social media, and their levels of active or passive participation

in comparisons may explain why the effect observed in the current meta-analysis remained weak to moderate. This relationship may vary based on context, individual differences, and measurement methods. It should also be noted that social comparison does not always lead to negative psychological outcomes. Recent studies indicate that the effects of social comparison on social networking services can vary with an individual's psychological characteristics, the direction of the comparison, the manner of social media use, and the purpose of the comparison [8]. While social comparison can support self-improvement, motivation, or a sense of social belonging in some cases, in others it can increase feelings of inadequacy, negative self-evaluation, and problematic usage patterns. This suggests that the relationship between social comparison and PSMU should be evaluated within a multi-layered, context-sensitive theoretical framework rather than as a linear, one-dimensional process. High heterogeneity suggests that the relationship between PSMU and social comparison does not follow a single pattern.

One of our most striking findings is that the social comparison measure moderates the relationship. Studies using scales based on the "Iowa-Netherlands Comparison Orientation Measure" (INCOM) have reported larger effect sizes for the relationship between PSMU and social comparison; in contrast, the relationship was insignificant or negligible in the shorter, context-specific measures classified as "other." However, the larger effect sizes observed in INCOM-based measures may stem not only from a more comprehensive assessment of social comparison tendencies but also from overlap between some items and more general psychological vulnerabilities or neurotic tendencies. This necessitates considering the possibility of conceptual overlap and common variance between social comparison and PSMU measures. For this reason, higher effect sizes should not be interpreted as indicating that the effect of social comparison on PSMU is directly stronger, but rather should be interpreted with partial conceptual overlap between the measures in mind. This finding indicates that a relatively stable cognitive tendency (a trait) shows a relatively stronger association with PSMU [10].

Theoretically grounded scales, such as INCOM, aim to assess social comparisons across contexts. They may better capture the cognitive and emotional aspects of social comparison [10]. Conversely, short- or situational-level measures focus on the temporary (state) aspects of social comparison and may not fully capture the deeper psychological processes underlying PSMU. Therefore, the higher correlations obtained with the INCOM should not be interpreted as indicating that the effect of social comparison on PSMU is directly stronger. Recent studies show that social comparison, measured in social media contexts, is associated with mental health indicators and

problematic use across various levels [61, 64]. This highlights that selecting measurement tools is essential not only for practicality but also for theoretical relevance when interpreting meta-analytic results. The variation in effect sizes across scale types suggests that findings on the relationship between PSMU and social comparison may be influenced by measurement preferences [25].

When considering country-level contextual variables, the emergence of the Global Innovation Index (GII) as a significant moderator of the relationship between PSMU and social comparison suggests that individual psychological tendencies cannot fully explain this relationship. This finding suggests that the socio-technological contexts in which social media is used may shape the psychological outcomes of social comparison processes. However, caution is warranted when interpreting this finding, as the mechanisms underlying the relationship between GII and PSMU have not yet been empirically tested. Therefore, the current moderating effect should be considered partially exploratory. According to meta-analytic findings, the stronger link between PSMU and social comparison in countries with relatively low GII levels may be related to social media becoming a more central arena for individuals in these contexts, particularly for social visibility, status display, and the production of symbolic capital. From the perspective of the digital divide, the fact that individuals in societies with lower innovation capacity have fewer resources for digital literacy, critical media literacy, and online coping skills may make social comparison processes and problematic usage patterns more apparent [58]. In socio-technological contexts where digital technologies and innovative applications are limited, social media platforms serve as primary public spaces where individuals compare themselves to others, thereby contributing to making social comparison processes more visible [39]. Furthermore, the technological affordances of social media platforms, such as visibility, constant accessibility, social feedback, and algorithmic recommendation systems, can intensify and sustain social comparison processes within specific socio-technological contexts [57]. This can amplify the psychological impact of social media-based comparisons, particularly in societies where alternative spaces for social and digital engagement are limited.

In contrast, in countries with higher levels of innovation, the deeper integration of digital technologies into daily practices enables individuals to engage in social interaction and self-positioning processes across multiple digital and physical contexts, beyond social media platforms [58]. In these environments, because individuals have easier access to various online and offline social networks, performance arenas, and points of comparison, the relative weight of social media-based social comparisons within an individual's overall social experience

may decrease, which may contribute to the relationship between social comparison and PSMU appearing relatively weaker [45]. In societies with a more saturated digital ecosystem, the decreased importance of social media for individual identity presentation and status building may have contributed to the weakening of the link between PSMU and social comparison at the meta-analytic level by dispersing the psychological effects of social comparison across different contexts [32, 58].

Our findings show that the relationship between PSMU and social comparison is influenced by context, not only by individual psychological traits but also by macro-level socio-technological factors. Modern approaches to explaining digital behaviors highlight that problematic online activities result from the interplay between personal vulnerabilities and environmental or structural conditions, indicating that ignoring these contextual factors can limit theoretical understanding [9, 38]. In this regard, including country-level indicators, such as the GII, in meta-analyses helps provide a more comprehensive understanding of how the relationship between PSMU and social comparison varies across contexts and constitutes a meaningful theoretical approach [9].

Moderator analyses indicate that participant type and age variables show differing patterns in the relationship between PSMU and social comparison. While the relationship appears stronger in adult samples, the effect sizes observed in some adolescent samples remain quite low. This may be because social media functions not only as a means of social interaction in adulthood but also as a platform for comparing career success, economic status, and living standards [4, 61]. Similarly, the fact that the relationship between PSMU and social comparison becomes increasingly pronounced with age is also meaningful in the context of developmental processes. Social media use during adolescence and early young adulthood mainly serves a normative function related to peer relationships and identity exploration; therefore, the impact of social comparison on problematic use remains relatively limited [39]. In contrast, linking social comparisons to more enduring adult life outcomes may heighten the psychological burden of this process and intensify its association with PSMU. These findings suggest that PSMU cannot be understood outside its developmental context and that considering age-specific psychosocial dynamics is important from both theoretical and empirical viewpoints.

Recent longitudinal studies also indicate that social media use may be associated with different cognitive and psychosocial outcomes depending on developmental stages. It has been reported that social media usage patterns during early adolescence are related to cognitive development in various ways and that social media experiences are developmentally heterogeneous [11].

This suggests that the relationship between social comparison and problematic social media use (PSMU) may differ not only quantitatively across age groups but also qualitatively in terms of underlying psychosocial mechanisms. Recent research suggests that vulnerabilities related to self-concept, particularly during adolescence, can make social media experiences more stressful. For example, it has been reported that low self-concept clarity is associated with digital stress processes such as approval anxiety, online vigilance, and fear of missing out (FoMO) [14]. Such psychological vulnerabilities may make individuals more sensitive to upward social comparisons in social media environments and, over time, reinforce problematic usage patterns. Furthermore, it has been demonstrated that dispositional characteristics, such as individual predispositions, patterns of social support, and types of online interactions, can create distinct risk profiles among adolescents [13]. In this context, considering developmental heterogeneity and individual differences can contribute to a more comprehensive understanding of the relationship between PSMU and social comparison.

Meta-regression analyses concerning gender distribution have indicated that gender composition may play a significant moderating role in the relationship between PSMU and social comparison. The relationship appears to be relatively stronger and more consistent in male-dominated samples. It can be hypothesized that social comparisons in male-dominated samples are more closely related to indicators of success, status, and performance; this may increase psychological stress and tendencies towards problematic use [4, 56, 61]. However, these findings should be interpreted with caution, as the pattern observed in male-dominated samples is based on a limited number of studies. Additionally, considering that gender interacts with motivations for social media use, forms of social comparison, and psychosocial vulnerability, further research with more balanced and developmentally diverse samples is necessary [56].

The absence of a statistically significant moderation effect by cultural type (individualist–collectivist) suggests that this relationship may show similar patterns across cultures. Because social media platforms usually offer similar structural features and facilitate user interactions through algorithmic mechanisms, these factors may have minimized the impact of differences between individualistic and collectivist cultures. Social media use and comparison processes often operate through similar psychological mechanisms across cultural contexts [60]. However, this finding should not lead to the conclusion that cultural factors are entirely irrelevant. Instead, the broad, coarse classification of cultures into individualistic and collectivist categories may have obscured subtler, culture-specific effects at the meta-analytic level. In this

context, incorporating culture-based explanations alongside more detailed socio-technological and contextual indicators, such as the level of development of digital ecosystems, innovation capacity, or access to technology, innovation capacity, or access to technology—could lead to a more accurate understanding of how culture influences the relationship between PSMU and social comparison [9].

Recent research suggests that PSMU may be shaped more by proximal psychosocial factors than by broad cultural classifications. Specifically, social support from family, teachers, and peers, as well as patterns of online interaction, may have important implications for PSMU and psychosocial well-being [21]. Similarly, gender and perceived social support appear to play important moderating roles in the relationship between PSMU and mental health difficulties [56]. This suggests that some of the heterogeneity observed in the current meta-analysis may be related to more proximal psychosocial factors, such as age, gender, social support, and online interaction patterns, rather than broad cultural classifications.

Statistically nonsignificant differences in the moderation analyses for outcome type, PSMU scale type, publication year, report type, and research quality score are an important and reinforcing methodological finding. These findings suggest that the link between PSMU and social comparison is not limited to a specific measurement tool, publication format, or study quality level.

These findings show that the link between PSMU and social comparison is not limited to a specific measurement tool, publication format, or low-quality studies; rather, it can manifest across different research designs and exhibit similar patterns. From a meta-analytic perspective, these findings imply that the observed effect arises from more fundamental psychological processes rather than from measurement or methodological biases. In particular, the lack of a significant moderation effect by publication year suggests that the relationship between social comparison and PSMU may remain relatively stable despite changes in the structure and functionality of social media platforms over time. This suggests that social comparison processes operate through more enduring cognitive and emotional mechanisms, rather than transient or periodic effects within social media environments [60, 61]. Similarly, recent longitudinal studies suggest that problematic social media use (PSMU) may be related not only to concurrent psychological processes but also to evolving value orientations and adaptation processes over time. Li et al., [35], by examining the relationships among PSMU, self-transcendence values, and school adaptation using a two-wave longitudinal design, emphasized the importance of considering PSMU within temporal and developmental dynamics. Therefore, future research should investigate

how the relationship between social comparison and PSMU changes not only at a cross-sectional level but also within longitudinal processes.

In contrast, the significant moderating effect observed for the social comparison scale type indicates that the measurement approach can substantially influence the strength of the relationship between PSMU and social comparison. In particular, scales such as INCOM, which treat social comparison as a more stable tendency or trait, tend to show stronger and more consistent relationships than shorter or more contextual measures. This suggests that how social comparison is operationalized can be decisive for meta-analytic results. Whether social comparison is viewed as a unidimensional trait, a multidimensional construct, or a state-level experience may lead to variations in the observed effect sizes. Recent measurement studies also emphasize the importance of assessing psychological processes related to social media using more sensitive, context-specific tools. For example, the Plan-net 25 scale, developed by Ciudad-Fernández et al., [12], highlights the importance of specialized measurement tools for capturing the overvaluation of social media. In this context, future research employing more standardized, multidimensional, and context-sensitive measurement instruments for social comparison processes could contribute to a more accurate understanding of heterogeneity in the PSMU literature.

Furthermore, the findings on the citation bias moderator indicated no significant difference in effect sizes between studies that presented the PSMU as an undisputed, established construct in the literature and those that included conceptual debates or alternative findings. This finding suggests that the way the literature is presented in primary studies does not, in itself, systematically increase the magnitude of the observed relationship. However, the persistence of high heterogeneity in both subgroups suggests that the relationship between PSMU and social comparison may be influenced by multiple factors—such as sample characteristics, measurement preferences, and contextual variables—rather than researchers' expectations.

Overall, this meta-analysis reveals that the relationship between PSMU and social comparison is modest and context-sensitive. In particular, the low effect sizes observed in certain subsamples (e.g., adolescent samples and specific cultural contexts) suggest that this relationship should not be viewed as a universal process operating with similar strength across all populations. This suggests that findings in the current literature may be more heterogeneous and inconsistent, depending on methodological, developmental, and socio-contextual factors. In addition, one should bear in mind that some of the observed relationships may be influenced by partial overlap in measurements rather than complete

independence between structures. PSMU theories should consider social comparison not only as an individual cognitive tendency but also as a multi-layered process shaped by the interaction of developmental, psychosocial, and contextual factors [9, 38].

Limitations and suggestions for further research

Findings should be interpreted in light of the limitations imposed by the study's inclusion criteria. First, because a significant portion of studies are based on student samples, the generalizability of the results to broader populations is limited. The scarcity of studies representing the general population limits conclusions about how the relationship between PSMU and social comparison varies across ages and life stages. Additionally, because most of the data came from research conducted in countries with higher GII scores, there is insufficient representation of countries with medium and lower levels of innovation. This limitation warrants cautious interpretation of moderator findings in these contexts. Finally, we were unable to conduct separate moderation analyses for social comparison sub-dimensions, such as upward-downward or ability- and perception-based comparisons. This limitation stems from differences in measurement and reporting across primary studies and has limited the ability to examine in detail the relationship between specific social comparison dimensions and PSMU. Additionally, this meta-analysis is limited to studies indexed in selected international databases and published in English. Therefore, some relevant studies published in languages other than English or available only in regional databases may have been excluded. This should be taken into account when assessing the cross-cultural generalisability of the findings. Furthermore, although the methodological quality assessment was conducted using the framework of best research practices proposed by Ferguson et al., [17], most of the primary studies were of low or moderate quality. In particular, the limited reporting on pre-registration, interventions aimed at reducing demand characteristics, and the use of multiple information sources have made it difficult to conduct more detailed comparisons regarding methodological quality. Therefore, future meta-analytic studies that include research meeting higher methodological standards could more clearly demonstrate the role of quality indicators on effect sizes. In this meta-analysis, the primary analyses were based on zero-order correlation coefficients; a supplementary meta-analytic analysis was also conducted using standardized regression coefficients. Regression-based analyses indicated that, whilst the direction of the relationship was preserved, the effect size was estimated to be lower. However, due to differences in control models and covariate structures across the primary studies, the adjusted effect estimates must be interpreted with

caution. Therefore, when interpreting the current findings, it should be noted that the observed relationships may be influenced by common variance, conceptual overlap, or uncontrolled psychological vulnerabilities. It will be important for future meta-analytic studies to synthesize research conducted using more standardized control models and comparable reporting practices.

We showed that single-factor accounts cannot explain the link between PSMU and social comparison. Therefore, future research should employ longitudinal and experimental designs to examine the temporal dynamics of this relationship and its potential reciprocal effects. Given the sensitivity of findings to measurement tools, using scales that can differentiate among social comparison dimensions and are grounded in robust theories will yield more consistent results. Additionally, given the important role of country-level indicators of innovation and the digital environment, PMSU should be viewed as a phenomenon shaped by contextual factors rather than individual-level tendencies. Studies that encompass multiple life stages and diverse sample types could provide a more comprehensive understanding of the developmental nature of this relationship.

The findings of this meta-analysis indicate that social comparison processes must be explicitly addressed in application and intervention strategies targeting PSMU. In psychoeducation-based interventions, increasing individuals' awareness of the selective and idealized nature of social media content, strengthening cognitive frameworks that support realistic self-assessment, and recognizing harmful comparison patterns can serve as protective factors. However, the current findings indicate that social comparison should not be considered an isolated risk factor; addressing it alongside self-perception, social support, online interaction patterns, and psychosocial vulnerabilities can yield more comprehensive intervention approaches. Especially in areas with relatively low levels of digitalization and innovation, combining digital literacy programs with themes of social comparison, self-worth, and algorithmic selection offers a key intervention to reduce the risk of problematic use. Findings on measurement tools also reveal important implications for the application. The use of standardized tools to evaluate social comparison in a multidimensional, context-sensitive manner may help identify individuals at risk more accurately and structure intervention processes more effectively. When considering age- and risk group-specific approaches, interventions focusing on work life, economic pressures, and status-focused comparisons in adult populations may be more effective, whereas programs addressing social comparison in the context of peer relationships, body image, and identity development may be more effective for adolescents and young adults.

Supplementary Information

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Supplementary Material 1.

Authors' contributions

All authors contributed equally to the study. All authors reviewed and approved the final manuscript.

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Competing interests

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