Mediterranean Journal of Clinical Psychology

ISSN 2282-1619

MJCP

Volume 11, n 3, 2023

Articles

The Photo Investment Scale: analysis of psychometric properties, factorial structure, and invariance of an Italian version

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Abstract

Background: Photo investment refers to concerns about the quality of the photo and effort expended in choosing self-photos to post online; it demonstrated an association with negative body image. To examine it, the Photo Investment Scale (PIS) was developed. The current study aims to examine the factorial structure, gender invariance, internal consistency, temporal stability, and convergent validity of the Italian version of the PIS. Secondly, we examined the associations between photo investment and both body dissatisfaction and social anxiety.

Methods: A sample of 250 individuals (women: 56%; age: M = 25.36; SD = 7.97) completed the PIS alongside measures related to photo-based behaviours, body dissatisfaction, and social anxiety symptoms; 112 of them (women: 66.96%; age: M = 24.95; SD = 7.17) completed the PIS after 4 weeks. The sample was divided in two and one half was employed for an Exploratory Factor Analysis, while the other half for a Confirmatory Factor Analysis and a gender invariance. Furthermore, internal consistency was evaluated by calculating the McDonald's Omega and the Greatest Lower Bound. Temporal stability was tested using Pearson's correlations and t-tests. Moreover, convergent validity was tested using Pearson's correlations. Finally, hierarchical multiple regressions were computed to test the associations between photo investment and both body dissatisfaction and social anxiety.

Results: Firstly, the PIS showed a one-factor structure and a partial gender invariance. Internal consistency, temporal stability, and convergent validity were adequate. Secondly, photo investment emerged as uniquely associated with body dissatisfaction and social anxiety, after controlling for confounding variables.

Conclusions: The Italian version of the PIS as a valid and reliable instrument for the assessment of photo investment. Moreover, this photo-based behaviour emerged as a unique construct that supposedly could hinder individuals' body image and increase anxiety during social interactions. Thus, evaluating photo investment could be relevant for the assessment of body image disorders and social anxiety disorder.

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Keywords:

Photo investment; Photo Investment Scale; Social media; Body dissatisfaction; Social anxiety; Clinical Psychology.

Received: 13 September 2023

Accepted: 7 December 2023

Published: 28 December 2023

Citation: Mancin, P., Cerea, S., Spoto, A., Ghisi, M. (2023). The Photo Investment Scale: analysis of psychometric properties, factorial structure, and invariance of an Italian version. *Mediterranean Journal of Clinical Psychology 11*(3). https://doi.org/10.13129/2282-1619/mjcp-3928

1. Introduction

Since the introduction of the Internet in daily life, researchers in the clinical psychology field demonstrated a growing interest in studying its possible impact on psychological dimensions of its users. Accordingly, scholars identified specific forms of use, such as Problematic Internet Use or Internet Addiction (Ferrante & Venuleo, 2021; Odacı & Çikrici, 2017; Pellerone et al., 2019; Radeef & Faisal, 2018; Sicari et al., 2021), dysfunctional social media use (Andreassen et al., 2016; Caparello et al., 2023; Huang, 2022), and Problematic Gaming or Internet Gaming Addiction (Andreassen et al., 2016; Angelini et al., 2024; Ferraro et al., 2020), that could have a putative negative impact on people's well-being and psychological functioning. For example, Problematic Internet Use emerged as predictive of depression, anxiety, and stress among young adults (Odacı & Çikrici, 2017; Radeef & Faisal, 2018).

Some of the available studies focused on addressing the effects on body image, which is a mental representation of one's own body (Cash & Pruzinsky, 1990). In achieving this, scholars found that involvement in social media use (Caparello et al., 2023; Lee et al., 2014; Marques et al., 2022; Rodgers et al., 2020; Ryding & Kuss, 2020) could influence body image dimensions among adolescents and adults. In particular, appearance-based social media use, particularly photo-based behaviours, seemed salient (Holland & Tiggemann, 2016; Mancin et al., 2023; Meier & Gray, 2014). Among them, photo-based behaviours include 1) photo manipulation or photo editing, that refers to altering the overall appearance of the photo through filters or software before sharing it online (Fox & Rooney, 2015; McLean et al., 2015); 2) body image control in photos, related to control over one's physical appearance during and after taking a picture (Boursier & Manna, 2019); 3) photo investment, that refers to effort expended in choosing the right photo to share and concerns about other people reactions to it (Butkowski et al., 2019; McLean et al., 2015; Veldhuis et al., 2020). Photo investment revealed a unique negative effect on body image. In fact, high levels of photo investment were associated with high levels of body dissatisfaction and dysfunctional eating among male and female adults and adolescents (Butkowski et al., 2019; Hao, 2023; Lonergan et al., 2019; McLean et al., 2015; Veldhuis et al., 2020).

The most utilized and specific measure to assess photo investment is the Photo Investment Scale (PIS). This measure was developed by McLean et al. (2015) and is composed of 8 items anchored by opposing statements, three of which are negative worded. Raters utilized a visual analogue scale, ranging from 0 to 100, to assess the degree of accordance with one of the two statements (McLean et al., 2015). Higher total scores, derived from the mean of all items,

indicate higher degree of photo investment. This measure was first utilized in a sample of Australian adolescent girls active in social media use and photo-sharing (McLean et al., 2015). Authors found a Cronbach's alpha (α) of .85 and excellent agreement four weeks apart from the first assessment (Intraclass correlation = .93, $p < .001$; $M_{t1} = 52.92$, $SD_{t1} = 25.02$; $M_{t2} = 51.14$, $SD_{t2} = 22.98$). The PIS appears as a brief questionnaire (only 8 items) dealing with each aspect of photo investment, namely efforts expended in choosing the right photo to post (e.g., "I take a long time to choose the photo vs. I choose the photo very quickly") and concerns for other people reactions to one's own photo (e.g., "I worry about whether anyone will "Like" my photos vs. I don't care whether anyone will "Like" my photos"; McLean et al., 2015).

McLean et al. (2015) did not perform a factorial analysis, nor a principal factor analysis (PCA) to assess whether all the items of the PIS well represent the supposed underlying construct. Thus, within their study on the relationship between photo-based behaviours and self-reported eating disorders symptoms, Lonergan et al. (2020) analysed whether several social media measures, including the PIS, assessed separate constructs (Lonergan et al., 2020). Accordingly, they conducted a PCA with oblimin rotation merging the items of the PIS with items of the other measures related to social media photo-based behaviours (Lonergan et al., 2020). Data were collected from a large sample of male and female Australian adolescents (Lonergan et al., 2020). Concerning the PIS, the negative and positive worded items loaded in two different constructs and the first item ("It's easy to choose the photo vs. It's hard to choose the photo") loaded in both constructs (Lonergan et al., 2020). Later, Authors decided to combine the two different constructs, following the logic of the questionnaire. Internal consistency of the overall scale was .68 for boys and .77 for girls (Lonergan et al., 2020).

To our knowledge, no available Italian version of this measure has been described. Thus, the present study aimed to analyse psychometric properties, factorial structure, and gender invariance of an Italian translation of the PIS among male and female individuals. Since young adults frequently engage in social media use (Perrin et al., 2015) and the original version of the PIS demonstrated comparable psychometric properties (Cohen et al., 2018; Mingoia et al., 2019) and mean scores between adolescents and adults (Mingoia et al., 2019), we recruited a sample from the general adult population. Only active in photo-sharing individuals were considered, as for the original version (McLean et al., 2015). Furthermore, individuals should utilize at least one appearance-focused and image-sharing social media, such as Facebook, Instagram, and Snapchat (Griffiths et al., 2018) to be included in the main sample.

First, we examined the factorial structure of the PIS and, according to Lonergan and colleagues (2020), we expected a unidimensional construct. Moreover, we explored invariance among male and female individuals since no previous study ascertained whether the PIS would allow gender comparisons. Internal consistency and temporal stability were also assessed: we hypothesized to find adequate indices replicating previous findings concerning the original version (e.g., Cohen et al., 2018; McLean et al., 2015; Mingoia et al., 2019). Convergent validity was tested utilizing both the Photo Manipulation Scale - Revised (Gioia et al., 2023a) and the Body Image Control in Photos questionnaire - Revised (Boursier & Manna, 2019), to ascertain whether the Italian version of the PIS assesses a construct close to, but different than, photo manipulation and body image control in photos.

As a second aim, we examined the association between photo investment and both body dissatisfaction and social anxiety symptoms, controlling for other photo-based behaviours. As for body dissatisfaction, we expected a unique contribution of the PIS, replicating previous studies (Cohen et al., 2018; Lonergan et al., 2019; McLean et al., 2015), even after controlling for confounding variables, such as gender (Gioia et al., 2020) and other photo-based behaviours. Moreover, we explored its role on social anxiety, a psychological dimension associated with social media use (Carruthers et al., 2019; Faelens et al., 2021), whose relationship with photo-based social media behaviours has not been deeply assessed yet. Available studies highlighted a non-significant association between photo manipulation and social anxiety symptoms (Mustafa & Akram, 2022; Pham et al., 2022); however, they did not address photo investment.

In achieving these purposes, we demonstrated that the PIS could be a valid and reliable tool in assessing photo investment among Italian individuals active in photo-sharing, and we underscored the importance of photo investment in the assessment of body image and social anxiety.

2. Method

2.1 Participants

2.1.1 Main sample

Three hundred and three participants were initially recruited. Fifty-two of them were excluded since they reported not to publish self-photo on social media, not to use Facebook, Instagram, and/or Snapchat. In the remaining sample, only one participant identified as neither male nor female; thus, they were excluded from the dataset too. Therefore, the final main sample consisted of 250 participants (women: n = 140; 56%). Participants ranged between 18 and 66

years for their age (M = 25.36; SD = 7.97) and between 5 and 21 years for their education (M = 14.40; SD = 2.60). Male and female participants did not differ on age ($t_{(248)}$ = 1.81; p = .07; d = .231) or years of education ($t_{(248)}$ = -.61; p = .54; d = -.078). Concerning occupational status, half of the participants identified themselves as students (51.2%), while some participants had a full-time job (24.4%), a fixed time job (5.2%), a part-time job (6%), or were unemployed (2.4%). One participant identified as a housewife (.4%) and two as retired (.8%). Twenty-four participants did not identify in any of the previous categories (9.6%). Gender differences emerged on occupational status ($\chi^2_{(7)}$ = 17.72; p = .01). As for men, 42.73% identified as students, 33.64% had a full-time job, 4.55% had a fixed time job, 2.73% had a part-time job, 2.73% were unemployed, 1.82% were retired, and 11.82% did not identify in any previous categories. As for women, 57.86% identified as students, 17.14% had a full-time job, 5.71% had a fixed time job, 8.57% had a part-time job, 2.14% were unemployed, .71% identified as housewife, and 7.86% did not identify in any previous categories. Pertaining to marital status, 124 individuals were single (49.6%), 92 had a fiancé/were in a non-domestic relationship (36.8%), 31 were married/in a domestic relationship (12.4%), one was separated or divorced (.4%), and two did not identify in any previous categories (.8%). No gender differences emerged concerning marital status ($\chi^2_{(4)}$ = 1.95; p = .75).

2.1.2 Retest sample

Out of the main sample, 112 participants (women: n = 75; 66.96%) completed the retest of the PIS after 4 weeks. Their age ranged from 18 to 59 years (M = 24.95; SD = 7.17) and their years of education ranged from 7 to 21 years (M = 14.98; SD = 2.23); no gender differences emerged (age: $t_{(110)}$ = 1.38; p = .17; d = .277; years of education: $t_{(110)}$ = 1.42; p = .16; d = .284). As for occupational status, 64 were students (57.14%), 19 were full-time employees (17%), 7 were fixed-time employees (6.25%), 8 were part-time employees (7.14%), 2 were unemployed (1.79%), and one was retired (.89%). Eleven participants did not identify in any of the previous categories (9.82%). Concerning marital status, 60 were single (53.57%), 37 had a fiancé/were in a non-domestic relationship (33.03%), 14 were married/in a domestic relationship (12.5%), and one did not recognize in the previous categories (.89%). Male and female participants did not differ on both occupational ($\chi^2_{(6)}$ = 9.36; p = .15) and marital ($\chi^2_{(3)}$ = .55; p = .91) status.

2.2 Measures

Demographics and social media use. A brief informative form was designed to assess personal information (i.e., gender, age, years of education, marital status, occupational status) along with anamnestic details (i.e., current or past psychological or psychiatric issues, regular medication

use). Participants were also asked to report the frequency of taking, but not sharing, self-photos and the frequency of taking and sharing self-photos on social media on a Likert scale, ranging from 1 ("never") to 10 ("always"). Moreover, individuals were asked to assess the frequency of use of several social media platforms, including Facebook, Instagram, and Snapchat, using a Likert scale ranging from 1 ("almost never") to 10 ("always"). If participants did not have an account or did not utilize a social media platform, they were asked to flag "I don't use it/I don't have an account".

Photo investment. The Italian version of the PIS (McLean et al., 2015) consisted of 8 items on a visual analogue scale with opposing statements. Items are presented along a visual analogue scale from 0 to 100; higher scores reflect higher investment in photo sharing through social media. The PIS was first utilized in a sample of Australian adolescent girls active in social media use and photo-sharing: it demonstrated a Cronbach's alpha (α) of .85 and excellent agreement four weeks apart from the first assessment (Intraclass correlation = .93, $p < .001$; $M_{t1} = 52.92$, $SD_{t1} = 25.02$; $M_{t2} = 51.14$, $SD_{t2} = 22.98$). Later, this measure was translated and adapted into other languages (i.e., Dutch: Rousseau, 2021; Chinese: Hao, 2023), demonstrating adequate internal consistency (Rousseau: $\alpha = 0.73$; Hao: $\alpha = 0.80$).

Photo manipulation. The Photo Manipulation Scale - Revised (PMS-R; Italian version by Gioia et al., 2023a, 2023b) was utilized to assess photo manipulation. The PMS-R is a revised version of the PMS, developed by McLean et al. (2015) and evaluated among Australian adolescent girls active in social media use. The PMS is a self-report measure comprised of 10 items and a Likert scale from 1 ("never") to 5 ("always") assessing the extent to which they manipulated or edited photos of themselves prior to sharing; higher scores indicate higher levels of photo manipulation. It has demonstrated good internal consistency ($\alpha = 0.85$) and test-retest reliability (McLean et al., 2015). The PMS was later translated into other languages (e.g., Dutch: Rousseau, 2021). In adapting this measure to the Italian context, the Authors included an item to examine the use of interactive filters and removed several others after conducting an Exploratory Factor Analysis (Gioia et al., 2023a). The PMS-R is composed of 8 items and a 5-point Likert scale from 1 ("never") to 5 ("always") and enables the computation of a total score and a score for each of three different factors. The three subscales composing this measure include photo filter use ("How often do you adjust the light/darkness of the photo?"), body image manipulation ("How often do you make specific part of your body look larger or look smaller?"), and facial image manipulation ("How often do you edit or use apps to smooth skin?"). The total score of the PMS-R demonstrated adequate internal consistency ($\alpha = .80$), as well as each subscale (photo

filter use: α = .67; body image manipulation: α = .75; facial image manipulation = α .74), among Italian adolescent boys and girls (Gioia et al., 2023a). The factorial structure and the good psychometric properties of the PMS-R were replicated also in a sample of young adults (Gioia et al., 2023b). In the current sample, the McDonald's ω for the PMS-R total score was .78 (95% Confidence Interval [CI]: .72, .83) and for women and .71 (95% CI: .63, .80) for men, while Greatest Lower Bound (glb) was .90 (95% CI: .87, .93) for women and .81 (95% CI: .69, .91) for men.

Body image control in photos. The Body Image Control in Photos questionnaire -Revised (BICP-R; Boursier & Manna, 2019) is the revised version of the Body Image Control in Photos questionnaire (BICP; Pelosi et al., 2014) and was utilized to assess how participants control their physical appearance through self-photos on social media. It is a 16-item self-report questionnaire with a 5-point Likert scale ranging from 1 ("never") to 5 ("always"). The BICP-R is composed of a total score and five factors: selfie-related factor, assessing selfie-related behaviours ("I prefer my image as it appears in self-portraits, because I know how to make it look better"); privacy filter behaviors factor, assessing the use of privacy restrictions on social media ("I use privacy filters in order to show photos in which I appear more attractive only to certain people"); positive body image factor, related to effort expended self-presenting positively one's body to other users ("I post those photos which I hope will receive praise for my appearance"); sexual attraction factor, related to sexualized dimensions of self-photo portraits ("I have posted provocative photos on Facebook and/or other social media in order to attract attention to myself"); and negative body image factor related to efforts in avoiding a negative body self-presentation to other users ("I feel awkward if I notice that someone has posted photos that show my body's defects"). The total score showed good internal consistency (α = .89; Boursier & Manna, 2019). To date, it is available only in Italian. In the current sample, the McDonald's ω for the BICP-R total score was .84 (95% CI: .80, .88) for women and .87 (95% CI: .84, .91) for men, while gbl was .92 (95% CI: .91, .95) for women and .94 (95% CI: .94, .97) for men.

Body dissatisfaction. The Body Dissatisfaction (BD) subscale of the Eating Disorder Inventory-3 (EDI-3; Garner, 2004; Italian version by Giannini et al., 2008) was employed to assess body dissatisfaction. The EDI-3 is a self-report questionnaire comprised of 91 items examining eating disorder dimensions and associated features. The BD is one of its subscales: a 10-item measure that assesses dissatisfaction with the overall shape and with the size of specific body regions, focus of concern to those with eating disorders (i.e., stomach, hips, thighs, buttocks). Participants rate using a 6-point Likert scale ranging from 1 ("never") to 6 ("always"). The

original English version of this subscale demonstrated excellent internal consistency in adult clinical samples (αs ranging from .88 and .92) and good test-retest reliability (Garner, 2004). This subscale was translated and utilized in samples with other languages, including Danish (Clausen et al., 2011), Spanish (Elosua & López Jáuregui, 2012), and Iranian (Dadgostar et al., 2017), which demonstrated adequate internal consistency and psychometric properties overall. The BD subscale of the EDI-3 is also available in Italian, demonstrating good internal consistency in both clinical (α = .85) and non-clinical (α = .85) samples and good indices of validity (Giannini et al., 2008). In the current sample, the McDonald's ω was .89 (95% CI: .86, .92) among females and .79 (95% CI: .73, .85) among males, while gbl was .95 (95% CI: .94, .97) for females and .89 (95% CI: .86, .93) for males.

Social anxiety symptoms. The Social Interaction Anxiety Scale (SIAS; Mattick & Clarke, 1998; Italian version by Sica et al., 2007) is a 19-item self-report measure designed to assess social interaction anxiety on a 5-point Likert scale ranging from 0 ("not at all") to 4 ("very much"); higher scores indicate higher levels of social interaction anxiety. The original English version of the SIAS demonstrated a one-factor structure, excellent internal consistency in clinical (social phobia: α = .93; agoraphobia: α = .91; simple phobia: α = .92), undergraduates (α = .88), and community (α = .94) samples, and adequate test-retest reliability (four weeks: α = .92; twelve weeks: α = .92; Mattick & Clarke, 1998). The SIAS was also adapted for use in populations adopting other languages, such as Spanish (Olivares et al., 2001), Dutch (de Beurs et al., 2014), German (Stangier et al., 1999), and Chinese (Ye et al., 2007), demonstrating adequate psychometric properties. The Italian version demonstrated good internal consistency (α = .86) and test-retest reliability after 30 days (Sica et al., 2007). In the current sample, the McDonald's ω was .94 (95% CI: .93, .96) among female and .90 (95% CI: .88, .93) among male participants, while gbl was .97 (95% CI: .97, .99) for females and .96 (95% CI: .96, .98) for males.

2.3 Adaptation of the PIS

To prepare the Italian version of the PIS, the translation process followed the standard steps proposed in the psychology literature (Brislin, 1986). First, the 8 items were translated in Italian from the original English version (McLean et al., 2015) by three independent translators, adopting idiomatic Italian at the sixth-grade level, and avoiding terms that would make the interpretation of the items difficult. Secondly, the translators reached an agreement on a common version. Then, the shared version was back-translated by a bilingual individual. The back-translation emerged close to the original one, that was ultimately utilized for the study after few adjustments.

2.4 Procedure

Participants were recruited through personal acquaintances and social media platforms. To be included in the study, participants needed to 1) utilize Facebook, Instagram, or Snapchat; 2) be active in self-photo sharing; and 3) be at least 18 years old. Individuals interested in participating completed an online link that included the informed consent with information about the study goals, the voluntary nature of the participation, and the possibility to withdraw without penalty. Then, participants were asked to answer items related to personal and social media-related information, followed by self-report questionnaires.

Participants were also asked to add their e-mail address to be contacted for the retest after 4 weeks and to create a personal code with the first letters of their name and surname followed by their date of birth. The code was utilized to guarantee privacy and to associate test-retest compilations.

The study was conducted in accordance with the Declaration of Helsinki and approved by the Ethical Committee of the School of Psychology, University of Padova.

3. Results

3.1 Statistical analyses

There were no missing responses in the dataset. To examine the factorial structure of the PIS, we used the main sample to conduct an Exploratory Factor Analysis (EFA) and a Confirmatory Factor Analysis (CFA).

First, we examined the distribution, skewness, and kurtosis of each item: some items demonstrated a violation of the ±1 interval for skewness and kurtosis (Appendix: S-Table 1).

A ratio of 10:1 (respondents: items) was considered adequate for the sample (Yong & Pearce, 2013); thus, at least 80 respondents were considered for the EFA and 160 for the CFA, due to invariance analyses. Then, we split the main sample in two datasets: the first one was used for the EFA (women: n = 60; men: n = 30) and the second one for the CFA (women: n = 80; men: n = 80). We decided to reach a random and even gender distribution for the CFA, while the remaining part of the sample was employed for the EFA. There were no significant differences with respect to age ($t_{(248)}$ = -.33; p = .75; d = -.043), years of education ($t_{(248)}$ = 1.64; p = .10; d = .217), and distribution of both marital ($\chi^2_{(4)}$ = 4.02; p = .40) and occupational ($\chi^2_{(7)}$ = 3.09; p = .88) status.

Due to the results of the item distribution analysis, the EFA was conducted using Weighted-Least Square (WLS) as an estimation method (Mîndrilă, 2010), an oblimin oblique rotation, and

fixed numbers for factor extraction based on the scree-plot analysis. According to Yong and Pierce (2013), a model with the number of factors proposed by the scree plot was compared to a model with one more factor and a model with one less factor (Yong & Pierce, 2013). To assess data factorability, the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test of sphericity were selected: the KMO should be at least ≥ .70 and Bartlett's test of sphericity should be significant to justify the application of an EFA (Watkins, 2018). To estimate the number of factors extracted and to assess factor structure adequacy, we examined the following fit indices: the model chi-square (χ^2), the Root Mean Square Error of Approximation (RMSEA) and its 90% Confidence Interval [CI], the Tucker-Lewis Index (TLI), and the Bayesian Information Criterion (BIC). The RMSEA should show values < .06, and the TLI should show values ≥ .95 for good fit (Hu & Bentler, 1999). Items' factor loadings were considered appropriate when > .30. The CFA was conducted to test the factorial models extracted with the EFA and to estimate the proper one. Diagonally Weighted-Least Square (DWLS) was utilized as an estimator (Mîndrilă, 2010). The chosen indices of good fit were the factor model χ^2, the Comparative Fit Index (CFI), the TLI, the RMSEA, and the Standardized Root Mean Square Residual (SRMR). The CFI should show values ≥ .95 for adequate fit, and the SRMR should show values < .09 for good fit (Hu & Bentler, 1999).

Then, a multi-group CFA was performed to assess gender invariance at configural, metric, and scalar levels using the second dataset. Configural invariance examines if the unconstrained model is equal across genders. Metric invariance implies that the magnitude of loading is similar across the two genders. Scalar invariance implies similarity on factor loadings and item intercepts between the male and female groups. Since the sample size is small (n ≤ 300), we considered ΔCFI ≥ -.005 and the ΔRMSEA ≤ .010 or ΔSRMR ≤ .005 (≤ .025 for loading invariance) for invariance (Chen, 2007). Moreover, a chi-square (χ^2) was utilized to test invariance or partial invariance by comparing the constrained with the unconstrained model.

Moreover, internal consistency was assessed utilizing McDonald's Omega (ω) coefficient and its 95% CI (Dunn et al., 2014) and Greatest Lower Bound (glb; Sijtsma, 2009). To confirm adequate internal consistency, values should be greater than .70 (Nunnally, 1978).

Within the test-retest sample, temporal stability was assessed utilizing Pearson's correlations and a paired t test. Effect sizes for the paired t test were examined with Cohen's d: effect sizes are commonly divided as small (d = .20), medium (d = .50), and large (d = .80) based on benchmarks suggested by Cohen (1988). As for convergent validity, tested utilizing the overall sample, Pearson's correlations among the PIS score, the PMS-R total score, and the BICP-R total score

were computed. According to Cohen (1992), correlations ≤ .10 were considered weak, ~ .30 were considered moderate, and ~ .50 were considered strong.

Finally, we tested the associations of the PIS. First, Pearson's correlations among age, the PIS score, the PMS-R total score, the BICP-R total score, the BD score, and the SIAS score were computed. Then, two hierarchical multiple regressions were conducted, using the BD and SIAS scores as dependent variables: age, gender (coded as a dummy variable: 1 = male; 2 = female), and photo-based related scores were entered in the first step as control variables, while the PIS score was added in the second step.

All the analyses were conducted using JASP 0.16.2.0, except for gender invariance, tested with RStudio, version 2022.2.2.485. (Rstudio, 2022), based on R, version 4.2.0 (R Core Team, 2022), and the lavaan (Rossell, 2012) and semTools (Jorgensen et al., 2021) packages.

3.2 Exploratory Factor Analysis

Following Yong and Pearce's guideline (2013) and according to the scree plot inspection, two distinct EFAs were conducted, fixing a priori one and two factors (Appendix: S-Figure 1).

The KMO was adequate (.72) and Bartlett's test of sphericity emerged as significant ($\chi^2_{(28)}$ = 326.79; $p < .001$), allowing to conduct a factor analysis. The first EFA was conducted fixing one factor a priori: all items showed a high factor loading in a single factor, ranging from .815 to .460 (Table 1). Concerning fit indices, the model χ^2 was significant ($\chi^2_{(20)}$ = 90.22; $p < .001$), the RMSEA was .20 (90% CI: .16, .24), the TLI was .67, and the BIC was .222. The factor extracted explained 43.1% of the variance in the measure.

The second EFA was conducted fixing a priori two factors. As shown in Table 1, item 3 and item 5 demonstrated strong crossloadings in both factors: according to their major factor loading, item 3 was considered with factor 2, while item 5 was considered with factor 1. Moreover, the fit indices were worse compared to the first solution: the model χ^2 was significant ($\chi^2_{(13)}$ = 72.98; $p < .001$), the RMSEA was .23 (90% CI: .18, .28), the TLI was .56, and the BIC was 14.485. The first factor was mostly related to effort in choosing the right photo to share, while the second factor was related to concerns on number of likes received by other users. The two factors were highly associated (r = -.53). Finally, according to the rotated solution, the first factor extracted explained 33.5% of the variance, while the second factor explained 18.1% of the variance in the PIS.

Table 1. Results for EFA conducted with one and two fixed factors

PIS Item	One-factor structure	Two-factor structure	
		Factor 1	Factor 2
(1) It's easy to choose the photo *vs.* It's hard to choose the photo *È facile scegliere la foto* vs. *È difficile scegliere la foto*	**.815**	**.800**	-.076
(2) I take a long time to choose the photo *vs.* I choose the photo very quickly *Ci metto molto per scegliere la foto* vs. *Scelgo la foto molto velocemente* (R)	**-.771**	**-.718**	.114
(3) I feel anxious or worried about the photos I share/post *vs.* I feel very comfortable about the photos I share/post *Mi sento ansioso/a o preoccupata/o per le foto che pubblico/condivido* vs. *Mi sento molto a mio agio per le foto che pubblico/condivido* (R)	**-.652**	**-.346**	**.415**
(4) I share/post whichever photo is available *vs.* I take photos especially for posting/sharing *Pubblico/condivido qualsiasi foto disponibile* vs. *Faccio foto appositamente per pubblicarle/condividerle*	**.460**	**.732**	.264
(5) I don't care what others will think about how I look *vs.* I worry about what others will think about how I look *Non mi interessa quello che le altre persone penseranno rispetto a come appaio* vs. *Mi preoccupo di quello che le altre persone penseranno rispetto a come appaio*	**.786**	**.494**	**-.464**

(6) I don't care which photos I share/post *vs.* I carefully select the best photo to share/post *Non mi interessa quali foto pubblico/condivido* vs. *Scelgo attentamente la miglior foto da pubblicare/condividere*	**.651**	**.632**	-.067
(7) I worry about whether anyone will "Like" my photos *vs.* I don't care whether anyone will "Like" my photos *Mi preoccupo del fatto che nessuno metterà "Mi piace/Like" alle mie foto* vs. *Non mi interessa il fatto di non ricevere "Mi piace/Like" alle mie foto* (R)	**-.499**	.031	**.701**
(8) I don't take any notice of how many "Likes" my photos get *vs.* I take notice of how many "Likes" my photos get *Non faccio attenzione a quanti "Mi piace/Like" ricevono le mie foto* vs. *Faccio attenzione a quanti "Mi piace/Like" ricevono le mie foto*	**.512**	.119	**-.511**

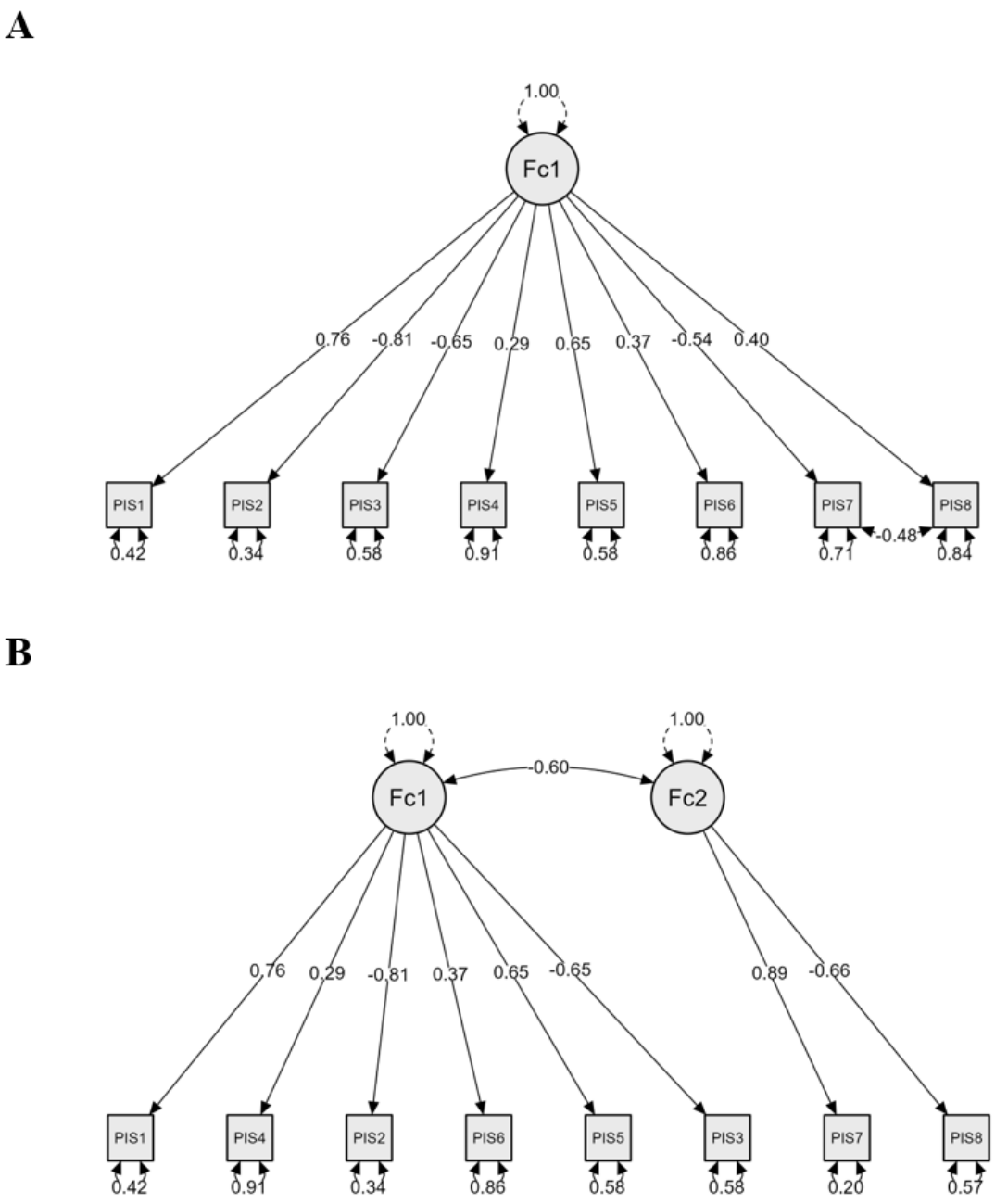
Note. The extraction method was weighted least squares with an oblique rotation. Factor above .30 are in bold. Reverse-scored items are denoted with (R).

3.3 Confirmatory Factor Analysis

Two distinct CFAs were conducted to match the one and two factor structures emerged from the EFAs, utilizing DWLS as an estimator. Pertaining the one factor structure, it demonstrated good fit (factor model $\chi^2_{(20)} = 47.30$; $p < .001$; CFI = .95; TLI = .93; RMSEA = .09 [90% CI: .06, .13]; SRMR = .10). To improve the fit of the model, modification indices were examined. Accordingly, the residual covariances of items 7 and 8 were set. The final model is presented in Figure 1 and demonstrated adequate fit: factor model $\chi^2_{(19)} = 30.93$; p = .04; CFI = .98; TLI = .97; RMSEA =.06 [90% CI: .01, .10]; SRMR = .08.

As for the two-factor model, it demonstrated a good fit (factor model $\chi^2_{(19)} = 45.44$; $p < .001$; CFI = .95; TLI = .93; RMSEA = .09 [90% CI: .06, .13]; SRMR = .09), similar to the one described in the previous model. Following modification indices, item 3 was introduced in factor

1. The final model is presented in Figure 1 and demonstrated adequate fit: factor model $\chi^2_{(19)}$ = 30.93; p = .04; CFI = .98; TLI = .97; RMSEA =.06 [90% CI: .01, .10]; SRMR = .08.



Note. Path diagram for the one-factor model (A) and the two-factor model (B) of the PIS. The circle represents the latent construct, while the squares represent the items. The standardized factor loadings are presented on each path connecting the squares with the circle (all ps < .001), and residual variables are presented under each item. The path between item 7 and item 8 represents their residual covariance set.

Figure 1

After few adjustments, the two factorial structures were similar and demonstrated good fit indices. However, within the two-factor model, the second factor related to concerns over other people reactions to self-photo shared comprised only two items with similar content (item 7: "I worry about whether anyone will "Like" my photos vs. I don't care whether anyone will "Like" my photos"; item 8: "I don't take any notice of how many "Likes" my photos get vs. I take notice of how many "Likes" my photos get"), while item 5 ("I don't care what others will think about how I look vs. I worry about what others will think about how I look") that refers to the same aspect of photo investment was included in the other factor. Thus, the two-factor structure could raise concern for the assessment of preoccupations over other people reactions within photo investment. According to these considerations, the one-factor structure was preferred over the two-factor one.

3.4 Gender invariance

A multi-group CFA was performed to assess gender invariance in the final one-factor structure with the second dataset. The configural model showed invariance, as reported in Table 2. To support metric invariance, factor loadings for items 4 and 6 were set free. Furthermore, to support scalar invariance, both factor loadings for items 4 and 6 and intercept of item 5 were set free. Therefore, metric and scalar invariances were partially supported.

Table 2. Measurement of Gender Invariance

Model	χ2	df	CFI	RMSEA	SRMR	Model comparison	Δχ2	Δdf	p	ΔCFI	ΔRMSEA	ΔSRMR
Configural	44.12	38	.988	.045	.083							
Partial Metric	50.28	43	.986	.046	.090	Partial Metric vs Configural	6.16	5	.29	-.002	.001	.007
Partial Scalar	57.13	49	.985	.046	.095	Partial Scalar vs Partial Metric	6.85	6	.33	-.001	< .001	.005

Note. The estimator method was Diagonally Weighted Least Squares. CFI = comparative Fit Index; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardized Root Mean Square Residual.

3.5 Internal consistency

In the main sample, the internal consistency was adequate among women (ω = .83, 95% CI = .79, .88; glb = .93, 95% CI = .91, .95), men (ω = .79, 95% CI = .73, .85; glb = .88, 95% CI = .86, .93), and the overall sample (ω = .82, 95% CI = .79, .85; glb = .92, 95% CI = .89, .93).

3.6 Temporal stability and convergent validity

Within the retest sample, the PIS total score showed strong correlation between test and retest among men (r = .88, p < .001), women (r = .86, p < .001), and the overall sample (r = .88, p < .001). Moreover, according to Cohen's classification (1988), the effect size (Cohen's d) of the difference between test and retest measures was small for men (M_{test} = 42.38, SD_{test} = 19.07; M_{retest} = 41.35, SD_{retest} = 18.56; d = .113), women (M_{test} = 56.49, SD_{test} = 20.98; M_{retest} = 53.72, SD_{retest} = 20.38; d = .251), and the overall sample (M_{test} = 51.83, SD_{test} = 21.35; M_{retest} = 49.64, SD_{retest} = 20.56; d = .210).

As for convergent validity, the PIS demonstrated a moderate association with the PMS-R (r = .41, p < .001) and a strong association with the BICP-R total score (r = .67, p < .001) in the overall sample (Appendix: S-Table 2).

3.7 Associations between photo investment and both body dissatisfaction and social anxiety

According to Pearson's correlations (Appendix: S-Table 2), two hierarchical multiple regression models were computed utilizing the subscale BD of the EDI-3 and the SIAS total score as dependent variables for the first and the second regression models, respectively. In the first regression model shown in Table 3, gender (coded as 1 = male and 2 = female), the PMS-R total score, and the BICP-R total score were introduced in Step 1: being female and engaging in body image control in photos emerged as associated with body dissatisfaction. Introducing the PIS total score in Step 2 (F change = 4.03; p = .046) increased variance explained and emerged as significantly associated, alongside gender and the BICP-R total score.

Table 3. Results of Multiple Hierarchical Regression Analysis for the Association with Body Dissatisfaction

Variables		B	ES	*β*	*t*	*p*	*F*	*df*
Step 1							35.77***	3,246
	Constant	-.26	1.77		-.15	.88		
	PMS-R total score	-1.94	1.06	-.13	-1.84	.07		
	BICP-R total score	6.31	1.02	.43	6.18	< .001		
	Gender	5.55	1.08		5.14	< .001		
Step 2							28.17***	4,245
	Constant	-.79	1.77		-.44	.66		
	PMS-R total score	-1.94	1.05	-.13	-1.85	.07		
	BICP-R total score	4.91	1.23	.34	3.99	< .001		
	PIS total score	.07	.03	.14	2.01	.046		
	Gender	5.60	1.07		5.22	< .001		

Note. DV: BD = Body Dissatisfaction subscale; Step 1: R^2 = .304; Step 2: R^2 = .315; *p < .05, **p < .01, ***p < .001; PIS = Photo Investment Scale; PMS-R = Photo Manipulation Scale - Revised; BICP-R = Body Image Control in Photos questionnaire - Revised.

In the second regression shown in Table 4, gender, age, the PMS-R total score, and the BICP-R total score were introduced in Step 1: being younger and engaging in body image control in photos emerged as associated with high levels of social anxiety symptoms. The PIS total score entered in Step 2 significantly increased the variance explained by the model (*F* change = 26.97; p < .001) and emerged as significantly associated alongside gender, age, and the BICP-R total score.

Table 4. Results of Multiple Hierarchical Regression Analysis for the Association with Social Anxiety symptoms

Variables		B	ES	*β*	*t*	*p*	*F*	*df*
Step 1							17.62***	4,245
	Constant	15.19	3.81		3.98	< .001		
	Age	-.26	.09	-.17	-2.91	.004		
	PMS-R total score	-3.03	1.61	-.14	-1.88	.06		
	BICP-R total score	8.89	1.56	.42	5.71	< .001		
	Gender	3.69	1.65		2.23	.03		
Step 2							20.99***	5,244
	Constant	11.76	3.69		3.19	.002		
	Age	-.22	.09	-.14	-2.49	.01		
	PMS-R total score	-2.98	1.54	-.13	-1.94	.05		
	BICP-R total score	3.61	1.80	.17	2.01	.046		
	PIS total score	.25	.05	.38	5.19	< .001		
	Gender	3.95	1.57		2.52	.01		

Note. DV: SIAS = Social Interaction Anxiety Scale; Step 1: $R^2 = .223$; Step 2: $R^2 = .301$; *$p < .05$, **$p < .01$, ***$p < .001$; PIS = Photo Investment Scale; PMS-R = Photo Manipulation Scale - Revised; BICP-R = Body Image Control in Photos questionnaire - Revised.

4. Discussion

Since both social media use and photo-based behaviours could negatively affect body image (e.g., Caparello et al., 2023; Vandenbosch et al., 2022) and scholars highlighted the need of reliable and valid instruments to assess photo-based behaviours (Jarman et al., 2022), the present study aimed to validate the Italian version of the PIS, assessing its factorial structure, gender invariance, internal consistency, temporal stability, and convergent validity in a sample of Italian individuals. Furthermore, the associations between photo investment and both body dissatisfaction and social anxiety symptoms were examined after controlling for other confounding variables.

After performing EFAs and CFAs, the Italian version of the PIS demonstrated a one-factor structure, corroborating the conceptualization of photo investment as a unidimensional construct (Lonergan et al., 2020; McLean et al., 2015). Moreover, according to gender invariance analysis, this factorial structure was partially representative for both female and male responders. In fact, even though configural invariance emerged adequate, both scalar and metric invariance required few adjustments, mostly related to item 4 and item 6. Accordingly, score comparisons between individuals identifying as male and female need to be interpreted with caution. However, indices of internal consistency demonstrated an adequate reliability among female and male individuals, as found in previous studies employing this measure in English-speaking samples (Cohen et al., 2018; McLean et al., 2015; Mingoia et al., 2019).

Concerning temporal stability, high correlations and small effect sizes for the paired t test replicated and broadened findings from the original English version (McLean et al., 2015) by including adults and male individuals. Therefore, photo investment appears mainly as a general attitude toward social media use.

Concerning convergent validity, the moderate correlation with photo manipulation is supported by previous studies that found week-to-moderate associations between these dimensions (Lonergan et al., 2020; McLean et al., 2015; Mingoia et al., 2019; Modica, 2020). The strong association between photo investment and body image control in photos represented a novel finding and contributed to the conceptualization of photo investment. In fact, the magnitude of this correlation highlighted how these constructs could be considered as conceptually different, even though they are highly related. Body image control in photos and photo investment may overlap since they include reliance on other people reactions to one's photo (Boursier & Manna, 2019; McLean et al., 2015). However, the former is specifically focused on attention toward physical appearance portrayed (Boursier & Manna, 2019), while the latter relates to the general quality of the photo (McLean et al., 2015), supposedly including attention toward elements not strictly related to physical appearance. Accordingly, photo investment may refer to a wider attention toward aspects of the photo shared (e.g., presence of other people, animals, and environmental elements in the picture) and a general tendency to value self-presentation. However, given the lack of studies deeply exploring photo investment, this explanation remains highly speculative. Overall, these findings demonstrated that photo investment could be reasonably intended as a construct close to other photo-based behaviours, but independent from them.

Through hierarchical multiple regression analysis, photo investment emerged as significantly associated with body dissatisfaction in men and women. This finding replicated previous studies showing how this photo-based behaviour associates with negative body image among women (Cohen et al., 2018; Hao, 2023; Lonergan et al., 2019), men (Lonergan et al., 2019; Modica, 2020), and adolescent girls (McLean et al., 2015). Moreover, this relationship was significant even after controlling for other photo-based behaviours. Finally, opposite to what has been described for photo manipulation (Mustafa & Akram, 2022; Pham et al., 2022), photo investment revealed an association with social anxiety symptoms. This novel finding allowed to hypothesize that photo-based behaviours could influence social anxiety symptoms. Moreover, since these symptoms are often described among individuals with body image-related disorders (Godart et al., 2003; Fang & Hofmann, 2010), this finding underscored that photo investment may influence body image both directly (i.e., through increased dissatisfaction toward one's physical appearance) and indirectly (i.e., through fear of a negative evaluation from others). Thus, photo investment could intervene in the development and maintenance of body image disorders.

Finally, the findings obtained from the hierarchical regression models consolidated previous findings that highlighted the negative impact of the Internet (Ferrante & Venuleo, 2021; Odacı & Çikrici, 2017; Pellerone et al., 2019; Radeef & Faisal, 2018; Sicari et al., 2021) and social media (Caparello et al., 2023; Holland & Tiggemann, 2016; Marques et al., 2022; Meier & Gray, 2014; Rodgers et al., 2020) use, as well as control-oriented behaviours (e.g., Myles et al., 2020), on individuals well-being and psychological functioning. Thus, they corroborate the relevance of considering online behaviours when considering psychological interventions in clinical settings.

The current study was subjected by several limitations. First, the analysis would benefit from a larger sample size. Furthermore, an examination of current online behaviours was not performed; such analysis would address whether self-reported behaviours well represent current online behaviours. Then, the BICP-R is available only in Italian; thus, replicating these findings could be difficult in countries utilizing other languages. Finally, the cross-sectional nature of the study did not enable to infer causality among variables examined.

Future studies should address the factorial structure of the PIS in other languages to establish validity and reliability of this measure in culturally different backgrounds. Moreover, the factorial structure could be tested and replicated among different age groups (e.g., adolescents). Furthermore, employing a measure of offline self-presentation would allocate photo investment into a broader tendency toward interpersonal presentation. Similarly, a qualitative analysis of

photo-based behaviours could be beneficial for a deeper understanding of this construct. Finally, a longitudinal study, following adolescent social media users into adulthood, would allow researchers and clinicians to understand the development of photo investment.

Despite these limitations, this study had several strengths. Firstly, it allowed to assess validity and reliability of the PIS for the Italian population. Secondly, novel findings concerning the factorial structure of the PIS were found, showing the uniqueness of the photo investment construct. Finally, photo-based behaviours performed online revealed an important role for body dissatisfaction and social anxiety symptoms, that require to be deeper investigated in future studies with different designs.

In conclusion, this study highlighted good validity and reliability of the Italian version of the PIS. Finally, online photo-based behaviours revealed an association with both body dissatisfaction and social anxiety symptoms, that require deeper investigation in future studies.

Ethical approval

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee for the Psychological Research of the School of Psychology, University of Padova (7E65AD16025355D433951AF77D77477D; 09/03/2021).

Informed consent statement

Informed consent was obtained from all subjects involved in the study.

Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Conflict of interest statement

On behalf of all authors, the corresponding author states that there is no conflict of interest.

Authors' contribution

P.M.: Conceptualization, Methodology, Formal analysis, Data curation, Writing – Original Draft. S.C.: Methodology, Writing – Review & Editing. A.S.: Formal analysis, Writing – Review & Editing, Supervision. M.G.: Methodology, Writing – Review & Editing, Supervision.

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DOI: 10.13129/2282-1619/mjcp-3928

Appendix

S-Table 1. Means, standard deviations, skewness, and kurtosis of the items of the PIS

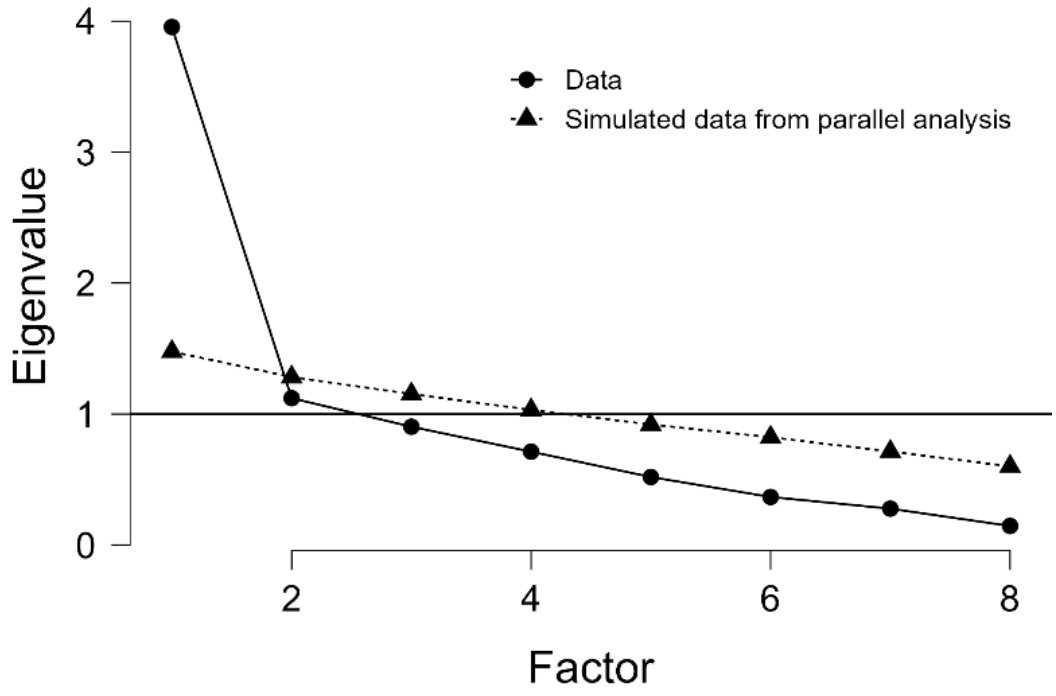
Item	Mean (SD)	Skewness (SE)	Kurtosis (SE)
PIS 1	54.58 (30.08)	-.23 (.15)	-1.06 (.31)
PIS 2 (R)	42.77 (32.27)	.33 (.15)	-1.19 (.31)
PIS 3 (R)	59.78 (30.29)	-.36 (.15)	-.95 (.31)
PIS 4	55.64 (28.57)	-.35 (.15)	-.73 (.31)
PIS 5	49.41 (31.07)	-.02 (.15)	-1.13 (.31)
PIS 6	71.94 (25.56)	-1.06 (.15)	.62 (.31)
PIS 7 (R)	57.90 (30.15)	- .09 (.15)	-1.16 (.31)
PIS 8	47.92 (31.15)	-.05 (.15)	-1.18 (.31)

Note. SD = Standard Deviation; SE = Standard Error. Reverse-scored items are denoted with (R) and are presented prior being reversed

S-Table 2. Means, Standard Deviations, and Bivariate Correlations Between Photo Investment, Age, Photo Manipulation, Body Image Control in Photos, Body Dissatisfaction, and Social Anxiety in the overall sample

	1	2	3	4	5	6
1. Age	1					
2. PIS tot	-.16*	1				
3. PMS-R tot	-.11	.41***	1			
4. BICP-R tot	-.12	.67***	.62***	1		
5. EDI-3: BD	-.04	.39***	.25***	.48***	1	
6. SIAS tot	-.22***	.49***	.19**	.41***	.47***	1
Mean	25.36	52.38	1.61	2.11	13.04	24.19
(standard deviation)	(7.97)	(19.81)	(.59)	(.63)	(9.16)	(13.21)

Note. *$p < .05$, **$p < .01$, ***$p < .001$; PIS = Photo Investment Scale; PMS-R = Photo Manipulation Scale - Revised; BICP-R = Body Image Control in Photos questionnaire-Revised; EDI-3 = Eating Disorder Inventory – 3; BD = Body Dissatisfaction subscale; SIAS = Social Interaction Anxiety Scale.



Scree plot for the Explorative Factor Analysis of the PIS, originated by JASP. The dots represent the eigenvalues of the sample data; the triangles represent simulated data; the straight line allow to identify the eigenvalues with a value > 1.

S-Figure 1