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Citation for published version (APA):

Yu, M., Sun, X., Xu, Y., Liu, Z., Wu, Y., Yang, S., & Luo, F. (2023). Mirror, mirror, on the social media ... WeChat Moments usage and negative body image among female college students: Evidence from ecological momentary assessment data. *Applied Psychology: Health and Well-Being*, 15(3), 1046-1064. <https://doi.org/10.1111/aphw.12425>

Document status and date:

Published: 01/08/2023

DOI:

[10.1111/aphw.12425](https://doi.org/10.1111/aphw.12425)

Document Version:

Publisher's PDF, also known as Version of record

Document license:

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ORIGINAL ARTICLE

Mirror, mirror, on the social media ... WeChat Moments usage and negative body image among female college students: Evidence from ecological momentary assessment data

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Abstract

Negative body image is prevalent among women and may lead to physical and mental health problems. Social media—including China's most popular platform, WeChat Moments—aggregates multiple aspects of appearance-related pressure and therefore is an important risk factor for negative body image. The current study examines the relationship between WeChat Moments usage and body image among female college students and the mediating mechanism of body surveillance. A sample of 151 female college students completed a 7-day ecological momentary assessment (EMA), responded to three surveys per day, and provided a total of 2949 EMA responses. We used multi-level structural equation modeling (MSEM) to examine the hypothesized models at both the between- and within-individual levels. The results showed that both overall WeChat Moments usage and appearance-related exposure on WeChat Moments were inversely and indirectly related to body image through the mediating role

Funding information This work was supported by the Beijing Natural Science Foundation under Grant 9202009, National Natural Science Foundation of China under Grant 71971028, the Advanced Innovation Center for Future Education at Beijing Normal University under Grant 27900-110631111, the Major Project of National Social Science Fund of China under Grant 19@ZH050, and the Major Project of National Social Science Foundation under Grant 19ZDA363.

of body surveillance at the between-individual level. However, both overall WeChat Moments usage and appearance-related exposure on WeChat Moments were positively and indirectly related to body image through body surveillance at the within-individual level. Our findings indicate that WeChat Moments usage is associated with college women's body image differently at the between- and within-individual level, and body surveillance serves as a crucial underlying mechanism.

KEYWORDS

body image, body surveillance, ecological momentary assessment, multilevel structural equation modeling, WeChat Moments

INTRODUCTION

Dissatisfaction with body shape and physical appearance has become a common phenomenon among women, with up to 80 per cent of college women expressing dissatisfaction with their bodies (Fitzsimmons-Craft et al., 2015). The multidimensional (cognitive, behavioral, affective, and evaluative) perception that people have of their own bodies is called body image, which forms a continuum of perceptions from positive to negative (Saiphoo & Vahedi, 2019). Negative body image stems from the discrepancy between actual and ideal appearance and can negatively affect people's mental well-being and behaviors. For example, negative body image was found to be strongly associated with low self-worth (Gillen, 2015), low life satisfaction (Hawi & Samaha, 2017), avoidance of social interaction (Maphis et al., 2013), depression, anxiety (Feragen & Stock, 2016), and eating disorders (Modica, 2019). To prevent people from experiencing these adverse consequences associated with negative body image, understanding the factors that affect body image should be prioritized.

Social media has become an important factor leading to negative body image due to a set of unique features, including multiple photo-related activities and highly visual environments (Holland & Tiggemann, 2016). On social media, people set up personal accounts, share their daily lives with others by posting photos or short videos of themselves, and learn of events in their friends' lives by viewing photos or short videos posted by others. Thus, visual information, especially appearance-related information, permeates social media. Another iconic feature of social media is the ability to provide users with immediate and quantifiable feedback (Brady et al., 2020), which enables people to comment on and like (or sometimes dislike) other users' photos while at the same time being subjected to other users' comments and judgments. During this process, it is almost inevitable that users will experience appearance pressure on social media. As a response to the pressure, many users post digitally retouched and beautified photos of themselves to meet the idealized beauty standards (Rosenberg & Egbert, 2011), and these unrealistic photos can make social media an even more severe source of appearance-related pressures and lead to negative body image for users.

Multiple social media platforms, such as Facebook, Instagram, Twitter, and WeChat Moments, have the aforementioned features. WeChat Moments is one of the most influential social network

sites in the world. As of June 2021, WeChat had 1.25 billion monthly active accounts, making it the most popular social network site in China, and its popularity is continually increasing in Singapore, Malaysia, and elsewhere. One of the fundamental functions of WeChat is WeChat Moments, where users can post texts, photos, videos, music, or web links; moreover, users can specify who can see their posts and set the length of time during which their posts are visible to others; additionally, users can browse or comment on others' posts as well. In a speech in January 2021, WeChat founder Xiaolong Zhang mentioned that, on a given day, 780 million users enter WeChat Moments and 120 million users post moments, comprising approximately 670 million photos and 100 million short videos. It can be seen that WeChat Moments provides a convenient platform for sharing and viewing images and videos. Many people are eager to share their retouched photos; moreover, they browse masses of photos and videos on WeChat Moments. In view of the popularity and the highly visual characteristics of WeChat Moments, in the present study, we aim to examine the relationship between WeChat Moments usage and body image.

WeChat Moments usage and body image

According to the tripartite influence model, media, family, and peers are the three main sources of female appearance-related pressures; frequent exposure to these appearance-related pressures may lead to negative body image and other psychological disturbances (Modica, 2019). Regarding media, the tripartite influence model proposes that social media, together with traditional media, generates substantial appearance-related pressures (Fardouly et al., 2017). Compared with traditional media, which generally presents conventional and professionally processed images of celebrities and models, social media makes it possible for anyone to post photos of him- or herself and to browse photos posted by others, including not only family members, peers, and close friends but also strangers (Fardouly et al., 2017; Fardouly & Vartanian, 2015). Thus, social media aggregates the tripartite pressures of media, family, and peers, which makes it an important potential influencer on body image (Holland & Tiggemann, 2016).

Although there are multiple social media platforms, the literature on body image has focused mostly on Facebook, which is the most popular social network site worldwide (Fardouly & Vartanian, 2016; Modica, 2019). For example, many correlational studies have shown that time spent on Facebook is associated with negative feelings about one's body (Eckler et al., 2017), body image concerns (Fardouly & Vartanian, 2015), low body esteem (Tiggemann & Slater, 2014), and body dissatisfaction (Marengo et al., 2018). In an experimental study, participants who viewed idealized body images on Facebook subsequently engaged in appearance comparisons that led to higher body dissatisfaction than was the case for participants who viewed the same images in conventional media, such as magazines and advertisements (Cohen & Blaszczynski, 2015). Additional research has examined social media usage and body image in relation to Instagram, which is an almost purely photo-based social network site (Cohen et al., 2017). Some correlational studies have shown that overall Instagram usage was associated with body image concerns (Fardouly et al., 2018), body dissatisfaction (Marengo et al., 2018), and thin-ideal internalization (Cohen et al., 2017). In addition, an experimental study showed that girls were more dissatisfied with their bodies after exposure to retouched Instagram photos than after exposure to the original Instagram photos, a difference that was especially pronounced in girls with high social-comparison tendencies (Kleemans et al., 2018).

Image and video sharing on WeChat Moments differs in several important aspects from the corresponding functions on Facebook and Instagram. First, on WeChat Moments, a user's

posts cannot be reposted by others, and a user's comments can be viewed only by friends (Wu, 2014). Such settings make WeChat Moments a platform mostly for acquaintances on which appearance-related pressures from family and peers might be prominent; thus, browsing WeChat Moments may bring about negative body image according to the tripartite influence model. Second, WeChat Moments prioritizes photos and videos. Its default setting is for users to upload photos or videos before they enter any text into a post (Wu, 2014). The emphasis on sharing visual information increases a user's opportunities for exposure to appearance-related pressures on WeChat Moments. Additionally, the pursuit of *face* (that is, dignity or prestige; *miànzi*, 面子) is prevalent among Chinese people, many of whom seek to bolster their positive self-image in social interactions (Wang & Yang, 2005). The sharing of beautified or filtered photos of one's appearance may be more prevalent due to the pursuit of *face* in Chinese culture, which further aggravates appearance-related pressures on WeChat Moments. Given these unique features, WeChat Moments is seemingly an important source of appearance pressures and a potential negative influencer of body image. However, few studies have focused on the relationship between WeChat Moments usage and body image. To the best of our knowledge, only one cross-sectional study (Wu et al., 2022) has focused on understanding the relationship between WeChat Moments and body dissatisfaction among female adolescents. Thus, in the present study, we aimed to explore the relationship between WeChat Moments usage and body image, with a focus on the mechanisms underlying this relationship.

Distinguishing between overall WeChat Moments usage and appearance-related exposure

Many studies have found a negative association between social media usage and body image, but some of these findings have been inconsistent. For example, one study found that overall time spent on Facebook was not associated with weight dissatisfaction or the pursuit of thinness; however, engaging in photo-oriented activities (e.g. viewing friends' photos of themselves, commenting on friends' photos, and viewing others' comments on friends' photos) on Facebook was associated with body image concerns (Meier & Gray, 2014). Another study found that substantial engagement in photo activities on Facebook—but not overall Facebook usage—was associated with body image concerns and thin-ideal internalization in young adult women (Cohen et al., 2017). One explanation for these seemingly inconsistent findings is that because some people may spend much time on Facebook browsing the news, working, and engaging in other activities unrelated to appearance, these people are not regularly exposed to sociocultural beauty ideals on the platform and therefore do not exhibit negative body image thoughts or behaviors (Modica, 2019). That is, social media users' exposure to appearance-related images may be a more critical factor leading to negative body image than the overall time spent on social media (Fardouly & Vartanian, 2016). Consistent with this interpretation, a study on Instagram found that in a sample of young adult women, their practice of following appearance-focused accounts on Instagram correlated with body surveillance and the drive for thinness (Cohen et al., 2017). Another study focusing on WeChat Moments showed that photo-related activities were positively associated with body dissatisfaction (Wu et al., 2022). Therefore, considering that WeChat Moments is a platform that integrates a variety of information, including the millions of photos and videos shared on it every day, when exploring the relationship between WeChat Moments usage and body image, it is necessary to distinguish between overall WeChat Moments usage and appearance-related exposure on WeChat Moments.

Body surveillance as a mediator: The objectification theory perspective

Body surveillance is a possible mediator of the effect of WeChat Moments usage on body image, as can be derived from the perspective of objectification theory. Objectification theory holds that there is a sociocultural tendency to construct women's bodies as objects to be gazed upon (Fredrickson & Roberts, 1997; McKinley & Hyde, 1996). In this social context, women also form a tendency to adopt an outsider's view of their own bodies and to treat their own bodies as objects, which is called self-objectification (Fredrickson & Roberts, 1997; McKinley & Hyde, 1996). Body surveillance is a typical behavioral manifestation of self-objectification (Fitzsimmons-Craft et al., 2014). When people are preoccupied with their physical appearance from the perspective of an outside observer, they practice body surveillance. While in this state, they attend only to their physical appearance instead of their internal body state (e.g. hunger), to ensure that they look good and do not feel ashamed of their appearance before others (Butkowski et al., 2019). Social media is a typical context that triggers self-objectification and body surveillance among its users. As mentioned above, when browsing on social media, women are frequently exposed to appearance-related photos and videos, which may then induce them to objectify others. Objectifying other women's bodies leads to women's concerns about how other people view their own bodies and the development of self-objectification, which is often manifested by body surveillance (Butkowski et al., 2019). In support of this conclusion, studies have reported that overall Facebook usage is positively correlated with self-objectification (Fardouly et al., 2015), objectified body consciousness (Manago et al., 2015), and body surveillance (Tiggemann & Slater, 2014); similar results have been supported regarding Instagram usage (Cohen et al., 2017; Feltman & Szymanski, 2018). In addition, studies have found that appearance-related exposure on social media in general is associated with self-objectification (Meier & Gray, 2014) and body surveillance (Cohen et al., 2017).

Objectification theory can also help to explain the relationship between body surveillance and body image. Research has suggested that when social media usage promotes a higher level of self-objectification and body surveillance, women are more likely to notice the discrepancies between their actual bodies and sociocultural idealized bodies (Fitzsimmons-Craft et al., 2014). This preoccupation with actual versus idealized bodies can have serious negative effects on body image. Many studies have found that body surveillance is associated with body shame, body dissatisfaction, and eating disorders (Butkowski et al., 2019; Wang et al., 2020). It can be seen that body surveillance serves as an important mediator of the effect of social media usage on negative body image. Therefore, in the present study, we aimed to extend the research on body surveillance to WeChat Moments; namely, we investigated whether and how body surveillance could mediate the relationship between WeChat Moments usage (including overall usage and appearance-related exposure) and body image.

The present study

In assembling a group of participants for the present study, we selected female college students for three main reasons: first, body dissatisfaction and body preoccupation are more typical in women than in men (Neighbors & Sobal, 2007); second, the 20- to 29-year-old age cohort accounts for 26.8 per cent of Chinese social media users, which is the largest proportion in the overall population, according to the Research Report on Chinese Social Application User Behavior (China Internet Network Information Center [CNNIC], 2019); and third, the media's influence on body image is

more powerful among women than among men (Paquette & Raine, 2004). Thus, female college students may be the group most representative of the social media phenomenon addressed in our study.

The ecological momentary assessment (EMA) data collection method repeatedly samples the psychological and behavioral variables experienced by the participants in their daily lives. The EMA method yields findings that are highly generalizable to real life, ensures high ecological validity, reduces memory recall bias among participants, and can strengthen researchers' assessment of the construct of interest (Myers et al., 2012). Only a handful of studies examining the relationship between social media and body image have adopted the EMA method (Fardouly et al., 2017; Holland et al., 2017), and no single EMA study has focused on the WeChat Moments platform and the mediating role of body surveillance. In the current study, we chose to use the EMA method to examine the relationship between WeChat Moments usage and body image.

Most previous studies in this field have examined the relationships among variables at the between-individual level without exploring dynamic within-individual processes. In the current study, we adopted multilevel structural equation modeling (MSEM; Preacher et al., 2010) to decompose the variations of variables into between- and within-individual levels, which represent the trait-like and state-like components of the constructs, respectively. Specifically, in our study, the between-individual relation examines whether female college students who generally use WeChat Moments more intensively tend to develop a more negative trait-like body image than those who generally use WeChat Moments less intensively. Additionally, the within-individual relation examines that during moments when a female college student spends more time on WeChat Moments than on average, would she demonstrate a more negative state-like body image than her average level of body image.

In sum, we examined the relationship between WeChat Moments usage (consisting of both overall WeChat Moments usage and appearance-related exposure) and body image among female college students, paying particular attention to the mediating role of body surveillance in the relationship between WeChat Moments usage and body image. We adopted MSEM to examine four hypotheses: overall WeChat Moments usage is negatively associated with body image through the mediating effect of body surveillance at both the between-individual level (H1a) and the within-individual level (H1b), and appearance-related exposure on WeChat Moments is negatively associated with body image through the mediating effect of body surveillance at both the between-individual level (H2a) and the within-individual level (H2b).

METHOD

Participants

All participants were recruited through online advertisements in social media aimed at female college students in China. They needed to have an active WeChat account and have been using the WeChat Moments function in their daily life. A total of 158 participants met the requirements and volunteered to participate in this study. To ensure sufficient power and reduce bias due to non-randomly distributed missing data, we retained participants who completed at least 50 per cent of the EMA surveys (Shiffman et al., 2008). The final sample contained 151 female college students, ranging from 18 to 29 years of age ($M_{\text{age}} = 21.32$, $SD = 1.81$), with an average BMI of 20.53 kg/m^2 ($SD = 2.58$).

Procedure

During the initial recruitment process, we had the participants join a WeChat group in which we informed them of the study's process, that is, collecting data over the next seven consecutive days. After confirming that the participants had provided informed consent, we required the participants to install the Psychorus research app (HuiXin, China) on their mobile phones. All the information for this study was collected through the app. First, with the Psychorus app, we asked the participants to submit demographic data: age, height, and weight (to calculate BMI). Then, during the following 7 days of EMA measures, Psychorus sent three notifications per day to the participants, respectively at 12:30 p.m., 5:30 p.m., and 10:30 p.m., reminding them to complete a corresponding questionnaire. We chose this data collection strategy due to the following considerations: First, to collect data on people's usage of WeChat Moments and potential accompanying psychological responses, we had to ensure that the participants were awake and had the opportunity to use WeChat Moments. We believed that 7:30 a.m. to 10:30 p.m. (cf., Fardouly et al., 2017) was an appropriate time range because it covered most of the time during which the participants might be awake and might be using WeChat Moments. Second, to ensure that the EMA data collection was not too frequent and annoying, which might result in participants dropping out or withdrawing, we limited our assessment to three times a day (for a total of 21 questionnaires over 7 days) to ensure compliance. Thus, the 15-h range (from 7:30 a.m. to 10:30 p.m.) was divided into three periods of 5 h each. Third, the three daily assessments were in concurrence with the life rhythm of most participants (i.e. lunchtime, dinnertime, and bedtime), enabling the participants to complete the questionnaire with ease. Specifically, we measured the participants' overall WeChat Moments usage, appearance-related exposure on WeChat Moments, body surveillance, and body image in the previous 5 h. Each questionnaire was available for only 1 h, and the participants were notified to complete them as soon as possible during that brief time span. The notification would not disappear until either the questionnaire was completed or the 1-h time period expired. The Academic Ethics Committee at the first author's institute approved the current study before it was conducted.

EMA measures

Overall WeChat Moments usage

We assessed overall WeChat Moments usage on the basis of three items, which we adapted from previous research measuring Facebook usage (Fardouly & Vartanian, 2015; Modica, 2019). The first two items were fill-in-the-blank questions concerning the total duration of WeChat Moments usage (i.e. "In the past five hours, approximately how many minutes did you browse your WeChat Moments?") and the total number of engagements in WeChat Moments usage ("In the past five hours, how many times did you check your WeChat Moments?"). The third item was a question concerning the frequency of WeChat Moments usage (i.e. "In the past five hours, approximately how often did you check your WeChat Moments?"; 1 = *never*, 2 = *once*, 3 = *once every 2 h*, 4 = *once an hour*, 5 = *once every half hour*, 6 = *once every 10 min*, 7 = *once every 5 min*). We standardized the responses on these three items as *Z* scores and averaged them to form a composite overall WeChat Moments usage variable (see also Fardouly & Vartanian, 2015; Modica, 2019). Higher composite scores represented a higher intensity of overall WeChat Moments usage.

Appearance-related exposure on WeChat Moments

Appearance-related exposure on WeChat Moments was assessed on the basis of two items, which we adapted from the photo subscale of the Facebook Questionnaire (Meier & Gray, 2014): “In the past five hours, to what extent did you view photos or videos that users posted of themselves on WeChat Moments?” and “In the past five hours, to what extent did you view photos or videos that users posted of other people on WeChat Moments?” The participants responded to these two items on a 7-point scale ranging from 1 (*never*) to 7 (*always*). We averaged the responses to the two items to obtain a single measurement of appearance-related exposure, with higher scores representing a greater extent of appearance-related exposure on WeChat Moments.

Body surveillance

Body surveillance was assessed on the basis of two items, which we adapted from the Body Surveillance Subscale of the Objectified Body Consciousness Scale (McKinley & Hyde, 1996): “In the past five hours, I have focused on how I look many times” and “In the past five hours, I have focused on how I look in others’ eyes many times.” The participants responded to these two items on a 7-point scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). We averaged the responses to the two items to constitute a single measurement of body surveillance, with higher scores representing a higher level of body surveillance.

Body image

We assessed body image with six items adapted from the Body Image States Scale (Cash et al., 2002). Sample items were as follows: “In the past five hours, how did you feel about your physical appearance?” and “In the past five hours, how did you feel about your body shape?” All items were rated on a 7-point scale ranging from 1 (*strongly dissatisfied*) to 7 (*strongly satisfied*). We averaged the responses to the six items to obtain a single measurement of body image, with higher scores representing a more positive body image.

Data analysis

Considering the hierarchical structure of the data in this study, with EMA measures (within-individual level, $N = 2949$) nested in participants (between-individual level, $N = 151$), we conducted MSEM in Mplus 8.3 to test our hypothesized models. As the EMA method mostly focuses on the state-like aspect of body image, and the changes in state body image are generally quick and momentary, we chose to examine the time-concurrent association, a more sensitive way to detect the relationship between WeChat Moments usage and body image, rather than the time-lagged analysis. As proposed in Preacher et al. (2010), we adopted the MSEM method with a 1-1-1 model, with overall WeChat Moments usage and appearance-related exposure as separate independent variables, body surveillance as a mediator, and body image as a dependent variable, which were all assessed at Level 1. By decomposing the variance of Level 1 variables into between- and within-individual components, MSEM was able to examine the relations between variables at both between- and within-individual levels. Given that MSEM implicitly

latent group-mean centers each Level 1 variable, no explicit centering of the observed variables was required (Preacher et al., 2010), and we applied MSEM to raw data. Random intercepts and random slopes were specified in all paths in the model. Therefore, the covariance between the random paths was included in calculating the accurate indirect effect at the within-individual level. Additionally, the times of EMA measures were controlled at the within-individual level for the purpose of excluding any potential linear trends in variables over time, and age and BMI were controlled at the between-individual level, in order to exclude their potential effects on body surveillance and body image.

RESULTS

Descriptive analysis

The participants provided a total of 2949 EMA recordings, with each participant completing an average of 19.53 surveys (average completion rate of 93.00%). Table 1 presents the descriptive statistics, intraclass correlation coefficients (ICCs), and reliability estimates for all measurements. We followed Geldhof et al. (2014) in estimating the Cronbach's α reliability coefficients for between- and within-individual levels. As shown in Table 1, all measurements showed adequate reliability for the between-individual level ($\alpha \geq .80$) and the within-individual level ($\alpha \geq .77$). In addition, all variables had the appropriate proportions of variance at the between-individual level ($\geq 37\%$) and within-individual level ($\geq 34\%$), indicating that the data were appropriate for MSEM analysis.

Multilevel mediation analysis

Overall WeChat Moments usage, body surveillance, and body image

We first tested the relationship between overall WeChat Moments usage and body image and the mediating role of body surveillance at both the between- and within-individual levels. The results are presented in Figure 1 and Table 2. At the between-individual level, the total effect of overall WeChat Moments usage on body image was negative and marginally significant (total

TABLE 1 Descriptive statistics, ICC, and reliability estimates

Measure	Sample size		Mean	SD (% variance)		Cronbach's α	
	T	N		Between	Within	Between	Within
Overall WeChat Moments usage	2949	151	0.02 [−0.09, 0.13]	0.67 (58%) [0.43, 0.91]	0.57 (42%) [0.48, 0.65]	.80 [0.73, 0.86]	.77 [0.72, 0.82]
Appearance-related exposure	2949	151	2.60 [2.45, 2.74]	0.87 (37%) [0.76, 0.98]	1.14 (63%) [1.07, 1.22]	.98 [0.97, 0.99]	.95 [0.94, 0.96]
Body surveillance	2949	151	3.40 [3.22, 3.57]	1.06 (40%) [0.94, 1.18]	1.29 (60%) [1.21, 1.37]	.99 [0.97, 1.00]	.89 [0.87, 0.92]
Body image	2949	151	4.28 [4.14, 4.42]	0.85 (66%) [0.71, 0.99]	0.62 (34%) [0.52, 0.72]	.98 [0.97, 0.99]	.78 [0.65, 0.91]

Note: T = number of EMA measures; N = number of participants. Values in square brackets are 95 per cent confidence intervals.

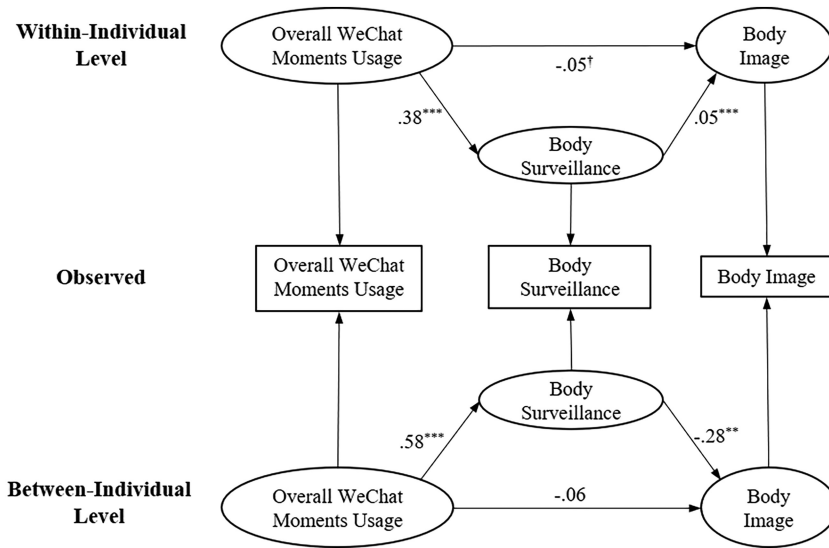


FIGURE 1 Multilevel mediation model with overall WeChat Moments usage as the predictor. Note: Unstandardised regression coefficients are displayed. † $p < .10$, ** $p < .01$, *** $p < .001$

TABLE 2 Results of multilevel mediation models

Parameter	Predictor			
	Overall WeChat Moments usage		Appearance-related exposure	
	Estimate (SD)	95% CI	Estimate (SD)	95% CI
Between-level				
a_B	0.58*** (0.13)	[0.34, 0.83]	0.66*** (0.10)	[0.46, 0.87]
b_B	-0.28** (0.09)	[-0.45, -0.11]	-0.33** (0.10)	[-0.53, -0.14]
c'_B	-0.06 (0.09)	[-0.23, 0.12]	0.07 (0.09)	[-0.11, 0.25]
indirect $_B$	-0.16** (0.06)	[-0.29, -0.04]	-0.22** (0.07)	[-0.36, -0.08]
total $_B$	-0.22† (0.12)	[-0.44, 0.01]	-0.15 (0.10)	[-0.35, 0.05]
Within-level				
a_W	0.38*** (0.07)	[0.25, 0.51]	0.22*** (0.03)	[0.16, 0.28]
b_W	0.05*** (0.01)	[0.03, 0.08]	0.06*** (0.01)	[0.03, 0.08]
c'_W	-0.05† (0.03)	[-0.10, 0.00]	-0.04* (0.02)	[-0.07, -0.01]
indirect $_W$	0.02† (0.01)	[0.00, 0.04]	0.01* (0.00)	[0.00, 0.02]
total $_W$	-0.03 (0.03)	[-0.09, 0.03]	-0.03† (0.02)	[-0.06, 0.00]

Note: CI = confidence intervals. Parameters in bold have 95 per cent CIs that do not cross zero. a_W represents the association between predictor and mediator, b_W represents the association between mediator and outcome, and c'_W represents the direct association between predictor and mediator.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

† $p < .10$.

effect = $-.22$, $p = .06$, 90% CI [-0.41 , -0.03]). Body surveillance was positively associated with overall WeChat Moments usage ($\gamma = .58$, $p < .001$) and was negatively associated with body image ($\gamma = -.28$, $p = .001$). Although the direct path between overall WeChat Moments usage and body image was nonsignificant ($\gamma = -.06$, $p = .54$), the indirect effect through body surveillance was significantly negative (indirect effect = $-.16$, $p = .008$, 95% CI [-0.29 , -0.04]).

At the within-individual level, the total effect of overall WeChat Moments usage on body image was nonsignificant (total effect = $-.03$, $p = .26$, 95% CI [-0.09 , 0.03]). Body surveillance was positively associated with overall WeChat Moments usage ($\gamma = .38$, $p < .001$) and was also positively associated with body image ($\gamma = .05$, $p < .001$). The direct relation between overall WeChat Moments usage and body image was negative and marginally significant ($\gamma = -.05$, $p = .07$), but the indirect effect through body surveillance turned out to be positive and marginally significant (indirect effect = $.02$, $p = .09$, 90% CI [0.00 , 0.03]).

Appearance-related exposure, body surveillance, and body image

We next tested the relationship between appearance-related exposure and body image and the mediating role of body surveillance at both the between- and within-individual levels. The results are presented in Figure 2 and Table 2. At the between-individual level, the total effect of appearance-related exposure on body image was nonsignificant (total effect = $-.15$, $p = .14$, 95% CI [-0.35 , 0.05]). Body surveillance was positively associated with appearance-related exposure ($\gamma = .66$, $p < .001$) and was negatively associated with body image ($\gamma = -.33$, $p = .001$). Although the direct relation between appearance-related exposure and body image was nonsignificant ($\gamma = .07$, $p = .44$), the indirect effect through body surveillance was significantly negative (indirect effect = $-.22$, $p = .002$, 95% CI [-0.36 , -0.08]).

At the within-individual level, the total effect of appearance-related exposure on body image was negative and marginally significant (total effect = $-.03$, $p = .06$, 90% CI [-0.06 , -0.003]).

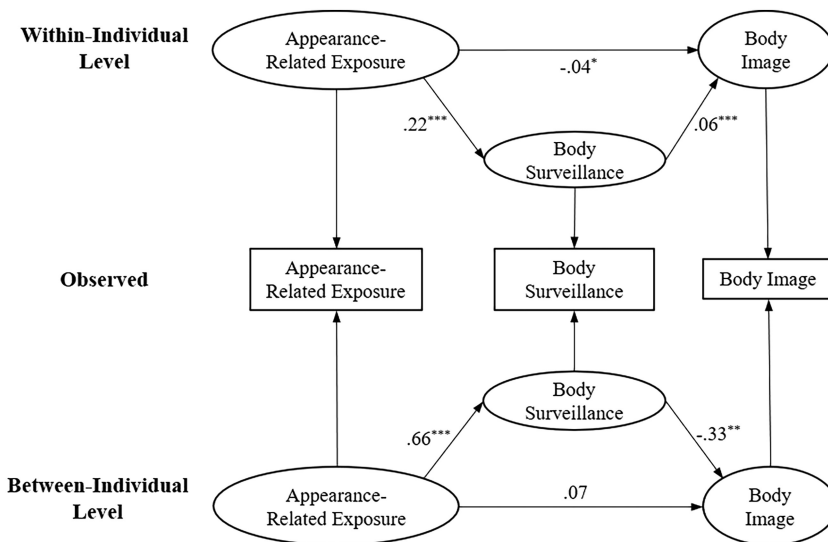


FIGURE 2 Multilevel mediation model with appearance-related exposure as the predictor. Note: Unstandardised regression coefficients are displayed. * $p < .05$, ** $p < .01$, *** $p < .001$

Body surveillance was positively associated with appearance-related exposure ($\gamma = .22, p < .001$) and was also positively associated with body image ($\gamma = .06, p < .001$). The direct path between appearance-related exposure and body image was negative and significant ($\gamma = -.04, p = .01$), but the indirect effect through body surveillance was positive and significant (indirect effect = .01, $p = .047, 95\% \text{ CI } [0.00, 0.02]$).

Supplemental analysis

We further examined an integrated model with both overall WeChat Moments usage and appearance-related exposure treated as predictors using MSEM. The results showed that at the between-individual level, the association between overall WeChat Moments usage and body surveillance became nonsignificant ($\gamma = .20, p = .24$), and the mediating effect of body surveillance on the relationship between overall WeChat Moments usage and body image was nonsignificant as well (indirect effect = $-.07, p = .28, 95\% \text{ CI } [-0.20, 0.06]$). However, appearance-related exposure was still negatively associated with body image through the mediating of body surveillance (indirect effect = $-.21, p = .004, 95\% \text{ CI } [-0.35, -0.07]$). Complete results of the supplemental analysis can be found in the [Supporting Information](#).

DISCUSSION

In the current study, we examined the effects of overall WeChat Moments usage and appearance-related exposure on body image as well as the mediating role of body surveillance in these relationships. We adopted the EMA method to collect data and used MSEM to distinguish the between-individual level from the within-individual level effects. In terms of the total effect, the results suggested that the total effect of overall WeChat Moments usage on body image was negative and marginally significant at the between-individual level but was nonsignificant at the within-individual level, and the total effect of appearance-related exposure on body image was nonsignificant at the between-individual level but was negative and marginally significant at the within-individual level. In terms of the mediating effect, the results showed that at the between-individual level, both overall WeChat Moments usage and appearance-related exposure were indirectly and negatively associated with body image through the mediating role of body surveillance. By contrast, at the within-individual level, overall WeChat Moments usage and appearance-related exposure were indirectly and positively associated with body image through the mediating role of body surveillance. These results broaden our understanding of WeChat Moments usage and body image.

In terms of the total effect of WeChat Moments usage on body image, at the within-individual level, we found that for a female college student, the overall time spent on WeChat Moments during the assessment period was not associated with the state-like body image. However, at the between-individual level, the female college students who spent more overall time on WeChat Moments than others demonstrated a more negative trait-like body image. This result suggests that because WeChat Moments is a platform that contains a wide variety of information, the overall usage of WeChat Moments is too broad to capture the core factor(s) that could trigger a momentary fluctuation in body image (Modica, 2019). However, pressure to conform to the beauty ideal prevails in the overall atmosphere of WeChat Moments and is associated with appearance dissatisfaction among college women who are heavy users of WeChat Moments over the long

term. In addition, the results showed that at the within-individual level, when a college woman was more exposed to appearance-related posts during the assessment period than on average, she would demonstrate a more negative state-like body image. However, at the between-individual level, college women's trait-like body image was not associated with appearance-related exposure on WeChat Moments. This result indicated that temporary fluctuations in body image were influenced by the activities people engaged in during the specific assessment period. It is the exposure to appearance-related information that demonstrate a momentary decline in state-like body image.

In terms of the indirect effect of WeChat Moment usage on body image via body surveillance at the between-individual level, in accordance with our hypothesis, our study showed that female college students who spent more overall time on WeChat Moments and/or were more frequently exposed to appearance-related posts than others tended to have more negative body image through greater body surveillance. This finding is consistent with previous single-measure studies that examined other social media platforms regarding between-level effects (Butkowski et al., 2019; Cohen et al., 2017; Fardouly et al., 2015), and these associations support the argument that self-objectification theory can explain how social media influences body image (Butkowski et al., 2019; Modica, 2019). Additionally, we included all variables in an integrated model in the supplemental analysis and found that appearance-related exposure was indirectly associated with body image through greater body surveillance at the between-individual level, even after controlling for the effect of overall WeChat Moments usage. However, the relationship between overall WeChat Moments usage and body surveillance disappeared after we controlled for appearance-related exposure. This result indicated that appearance-related exposure is a more critical factor associated with body surveillance than overall WeChat Moments usage, which is subsequently associated with negative body image at the between-individual level.

Moreover, regarding the indirect effect of WeChat Moment usage on body image via body surveillance at the within-individual level, we were surprised to find that during the assessment periods, when a female college student spent more time on WeChat Moments and/or was more exposed to appearance-related posts than on average she does, she would demonstrate a higher level of body surveillance and subsequently show a more positive body image. We suspected that these surprising results could be explained by the following reasons.

First, it is possible that during the 5-h assessment periods, after browsing WeChat Moments and the beauty-ideal photos and videos on it, the participants experienced an increased tendency to engage in body surveillance, leading some of them to engage in appearance-improving activities, such as putting on makeup, dressing up, and beautifying a selfie. These and other activities may make users of WeChat Moments temporarily feel better about their body image. One study found that self-objectification was positively associated not only with the frequency at which Instagram users posted self-objectifying images on the popular social networking website but also with the number of "likes" that the posts received (Bell et al., 2018). It is reasonable to speculate that posting moments with photos of oneself and obtaining compliments or positive feedback may also contribute to a temporary improvement in body image. Similarly, a two-wave longitudinal study found that the more a person engaged in social media usage and the higher the person's level of public self-consciousness was at Wave 1, the more likely the person would be to engage in selfie-editing behaviors at Wave 2 (Chae, 2017). This finding suggests that people take action to make their self-presentations more ideal. However, regardless of whether a person pursues this strengthened ideality by putting on makeup, dressing up, beautifying selfies, or even just receiving "likes" from others on social media, all of these actions can only temporarily improve his or her body image. In the long run, an increased intensity of WeChat Moments usage is likely

to lead to a worse body image, as suggested by our results at the between-individual level. Future EMA studies could collect data on participants' body image-boosting behaviors during survey intervals, which might prove helpful in elucidating the interesting within-individual results of our current study.

Another possible explanation is that although our indirect effect results at the within-individual level were not in line with our expectations, the total and direct effect of appearance-related exposure on body image was negative, which is consistent with our hypothesis. These results suggest that factors other than body surveillance may also mediate the relationship between WeChat Moments usage and body image at the within-individual level. In support of this possibility, Fitzsimmons-Craft et al. (2016) proposed that the tripartite influence model explicitly assumes the mediating role of social comparison and suggested that social comparison may mediate the relationship between the importance of the thin ideal and body dissatisfaction. In the present study, being exposed to others' photos on WeChat Moments might have provoked women to engage in appearance comparison. Because people often choose to post photos in which they look as perfect as possible and these photos are usually retouched before being uploaded to social media (Rosenberg & Egbert, 2011), appearance-related social comparisons are often associated with feelings of inferiority and dissatisfaction with one's own body image (Fardouly & Vartanian, 2015). Therefore, future studies could explore social comparison and other factors that might also mediate the relationship between WeChat Moments usage and body image at the within-individual level.

Third, according to Bolger and Laurenceau (2013), adequate sampling frequency is a major challenge in EMA study design. The rapid fluctuation in state-like body image requires frequent measurements. However, excessive measurements may threaten participant compliance and result in a large number of missing values. After thorough consideration (see the Methods section), we decided to measure the constructs three times per day at 5-h intervals. The 5-h sampling interval may be slightly long and still not precise enough to capture momentary body image fluctuations. It may also be possible that the participants, to some extent, had recall bias. Therefore, future studies can employ a relatively shorter interval in their EMA assessments to test the replicability of our findings.

Limitations and future directions

Several limitations of the current study and potential future directions should be noted. First, the present study focused only on female college students in China; males were excluded. However, idealizations of men's bodies, often associated with masculinity and power, are immensely popular in traditional media and social media (Gültzow et al., 2020; Tiggemann & Zaccardo, 2018). Research has shown that Instagram is saturated with photos of muscular men, and posts depicting muscular men's bodies can receive overwhelmingly positive responses, which reflect the marked attention that people pay to ideal "masculine" bodies on social media (Gültzow et al., 2020). Although beauty ideals tend to differ greatly between men and women, the emphasis on muscularity in the sociocultural male body ideal may negatively affect how men perceive their own bodies. A survey carried out in America showed that approximately 48 per cent of male respondents were dissatisfied with their weight, and 11 per cent felt that they were physically unattractive (Frederick et al., 2007). Having poor body image and unrealistic appearance standards have led to an increasing number of men gaining muscle mass through excessive bodybuilding (Ridgeway & Tylka, 2005). Therefore, it is necessary to investigate how social media usage (especially the neglected topic of WeChat Moments usage) may influence men's body image.

A second limitation of the present study is that the age range of the participants was limited (between 18 and 29 years). Research has suggested that an increasing number of older people are using social media in the United States, China, Australia, and many other countries (Leist, 2013; Russell et al., 2008; Zhou, 2018). The literature has also suggested that social media usage has a significant effect on older people's life satisfaction, self-efficacy, and loneliness (Leist, 2013; Zhou, 2018). Future studies could contribute greatly to the literature by exploring the effects of social media usage (especially WeChat Moments usage) on body image among older people. Although we found no evidence of a significant effect of age on body surveillance or body image in our study, controversial findings on the association between age and body image are documented in the literature. For instance, Gagne et al. (2012) reported that body image concerns gradually decline with age; however, Grippo and Hill (2008) found that women's body image concerns remain across their lifespan. Therefore, future studies could widen the age range of the participants to further investigate whether age moderates the association between WeChat Moments usage and body image.

Third, we used retrospective self-report to measure WeChat Moments usage, as was the case in most previous research on the topic. However, the accuracy of subjective self-report of social media usage is a fundamental concern (Parry et al., 2021), which might threaten the validity of our findings. Nowadays, technology-based assessments of app usage are available. For instance, most smartphones have a Screen Time function to record the time spent on a particular application. Future studies could collect such kind of objective data to test the robustness of our findings.

Fourth, because it uses the EMA method in data collection and the MSEM method in data analysis, the present study has many strengths compared with traditional single survey studies; however, our results are, by their nature, correlational rather than causal, which requires caution in causal interpretation. Future studies could employ experimental methods to examine the causal relationship between WeChat Moment usage, body surveillance, and body image (see in Cohen & Blaszczynski, 2015; Kleemans et al., 2018).

Finally, the current study did not explore the boundary condition of the proposed model. Future studies could examine the possible moderating roles of personality in the relationship between WeChat Moments usage and body image. For example, consider the personality trait of self-compassion, which is a nonjudgmental, caring, and compassionate attitude toward oneself during periods of suffering and perceived self-inadequacy (Modica, 2019; Neff et al., 2007). Self-compassion during such trying times can result in many positive mental health outcomes, such as happiness, positive affect, and psychological well-being (Neff et al., 2007). In previous studies on body image, self-compassion was also found to be positively associated with lower body dissatisfaction (Ferreira et al., 2013) and higher body acceptance (Raque-Bogdan et al., 2016). Moreover, in the face of appearance-related pressures, self-compassion was found to be a protective factor capable of countering factors that might exacerbate negative body image (Tylka et al., 2015). Therefore, future studies could further explore whether self-compassion moderates a negative body image when it is under threat, as is often the case on WeChat Moments and other social media platforms, where appearance-related pressures abound.

Practical implications

The present study has some important practical implications. First, we found that female college students who spent more time on WeChat Moments or browsed appearance-related posts more frequently tended to pay more attention to how others saw them and subsequently developed a

negative body image. This finding is a reminder that social media is a double-edged sword. If we fail to use social media in a rational and careful manner and do not remain alert to its negative influences, then the overt benefits of using it may be overshadowed by the pitfalls. Given that it is nearly impossible to prevent people from using social media, people need to be aware of the potential dangers of paying too much attention to appearance-related information on social media; additionally, the public needs to be able to critically analyze and absorb information while using social media.

Finally, our findings indicate that body surveillance is an important mechanism in the relationship between social media usage and body image. After viewing idealized images on social media, people tend to pay greater attention to their outward appearance while ignoring their internal body state, which will increase their risk of developing a negative body image. In response to this risk, interventions can reduce people's tendency to engage in body surveillance by diverting their attention to, for example, focusing more on how their bodies feel and function than on how their bodies look. In the long run, the hope is that people will learn to take better care of their bodies instead of merely emphasizing how their bodies can look better to others.

CONFLICT OF INTEREST

The authors have no competing interests to declare that are relevant to the content of this article.

ETHICS STATEMENT

All aspects of the work covered in this manuscript that have involved human participants have been conducted with the ethical approval of the Academic Ethics Committee of the Faculty of Psychology at Beijing Normal University.

DATA AVAILABILITY STATEMENT

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

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SUPPORTING INFORMATION

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

How to cite this article: Yu, M., Sun, X., Xu, Y., Liu, Z., Wu, Y., Yang, S., & Luo, F. (2022). Mirror, mirror, on the social media ... WeChat Moments usage and negative body image among female college students: Evidence from ecological momentary assessment data. *Applied Psychology: Health and Well-Being, 1–19*. <https://doi.org/10.1111/aphw.12425>