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RESEARCH ARTICLE



Being grateful every day will pay off: a daily diary investigation on relationships between gratitude and well-being in Chinese young adults

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ABSTRACT

Preceding research has demonstrated the positive relation between gratitude and well-being at the trait level, but less is known about the day-to-day association between them. This study investigated the within-person associations of gratitude with hedonic and eudaimonic well-being using a daily diary design. A sample of 363 young adults ($M = 19.77$, $SD = 1.84$) finished an online questionnaire once a day for 14 consecutive days. The results indicated that gratitude was positively related to hedonic and eudaimonic well-being on the same day, and gratitude positively predicted next-day hedonic and eudaimonic well-being, but not vice versa. We also found the reciprocal relation between the cognitive component of daily hedonic well-being (i.e., life satisfaction) and daily gratitude measured by the Gratitude Questionnaire. Moreover, these cross-lagged relations were not moderated by trait gratitude. These results provide supportive and convincing evidence for the positive effect of gratitude at the state level.

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Gratitude; hedonic well-being; eudaimonic well-being; diary study

1 Introduction

A surging number of researchers have endeavored to study gratitude, defined 'as part of a wider life orientation towards noticing and appreciating the positive in the world' (Wood et al., 2010). With flourishing research on gratitude, more and more scholars have revealed that gratitude correlates with many positive outcomes, such as enhanced happiness, life satisfaction, and positive affect, along with less depression and anxiety (McCullough et al., 2004; Kendler et al., 2003; Lambert et al., 2012). However, most previous studies have focused on the between-person association between gratitude and well-being. Thus, in the current study, we would examine their within-person relation using a daily diary design.



1.1 Hedonic and eudaimonic conceptualizations of well-being

Well-being can be investigated through two approaches, hedonic well-being (HWB) and eudaimonic well-being (EWB). On one hand, the HWB (or subjective well-being, SWB) approach emphasizes happiness or contentment and defines well-being as pursuing positive emotional experiences and ease in life (Diener, 1984). HWB is composed of two

constructs: life satisfaction as the cognitive component and positive affect and negative affect as the affective component (Diener et al., 1999). On the other hand, the EWB (or psychological well-being, PWB) approach highlights the pursuit of personal goals and conceptualizes well-being based on the realization and development of oneself (Ryan & Deci, 2001). EWB consists of self-acceptance, environmental mastery, personal growth, positive relations with others, purpose in life, and autonomy (Ryff, 1989; Ryff & Keyes, 1995). Apart from the different conceptualizations, the distinction between HWB and EWB has been revealed using the exploratory structural equation modeling, so they are considered as two distinct constructs (Joshanloo, 2016). Therefore, to comprehensively investigate how gratitude relates to well-being, it is critical to examine HWB and EWB simultaneously.

1.2 The relationship between gratitude and well-being

The association between gratitude and well-being has been supported by some theoretical frameworks. One theoretical explanation for the predictive effect of gratitude on well-being is that gratitude may make positive

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events or experiences of a day more salient (Watkins, 2014). For instance, it has been evidenced that gratitude is related to positive memory bias (i.e., recalling more positive memories; Lambert et al., 2012; Watkins et al., 2008, 2004), and induces positive interpretation of ambiguous scenarios (Watkins et al., 2021). We thus supposed that the positive thinking induced by gratitude helps us have easier access to the positive aspect of a day, which may improve our well-being. In contrast, the predictive effect of well-being on gratitude was supported by the broaden-and-build theory (Fredrickson, 2004), according to which, positive emotions broaden the thought-action repertoire to facilitate the cognitive and behavioral process which would build up extensive resources. Accordingly, well-being may play a significant role in accumulating positive resources, which has been revealed in both longitudinal and experimental studies (Lyubomirsky et al., 2005). The enhanced resources such as emotional intelligence predicted increased gratitude (Geng, 2016). Based on this perspective, well-being can be an antecedent to gratitude.

In fact, using the between-person design, empirical studies have consistently found that trait gratitude can exhibit a positive predictive effect on well-being. First, correlational research has demonstrated that gratitude is substantively associated with HWB (Chopik et al., 2019; Kong et al., 2017; McCullough et al., 2002; Wood et al., 2007) and EWB (Greene & McGovern, 2017; Mason, 2019; Wood et al., 2009). Second, the longitudinal method has been used to investigate the temporal association between trait gratitude and well-being. For example, Jans-Beken et al. (2018) reported that trait gratitude was a significant predictor of HWB 7.5-month later in Dutch adults. Furthermore, Yang et al. (2021) assessed cross-lagged relations between trait gratitude and HWB in adolescents and found trait gratitude could predict positive components of HWB (i.e., life satisfaction and positive affect), but not vice versa. In addition, some studies uncovered the positive effect of gratitude interventions on well-being (Killen & Macaskill, 2015; Rash et al., 2011; Sheldon & Lyubomirsky, 2006; Watkins et al., 2014).

It is worth attention that besides the trait level, gratitude can be measured at the state level to capture the day-to-day fluctuations of gratitude (Emmons & McCullough, 2003). To test the day-to-day relation between gratitude and well-being, some researchers have used the daily diary method which captures the daily fluctuations of variables and studies behaviors and experiences in a natural context (Reis et al., 2014). For instance, Kashdan et al. (2006) found that daily gratitude was positively linked with daily HWB and daily EWB in

veterans. However, this study failed to investigate the lagged effects. Using the lagged analysis, prior studies have reported discrepant results. On one hand, two studies have reported the predictive effect of gratitude on well-being. For example, Algoe et al. (2010) found gratitude from interaction on the previous day could positively predict relationship satisfaction on the following day, but not vice versa. In addition, Nezlek et al. (2017) used hedonic and eudaimonic measures of well-being and found a lagged relation from daily gratitude to daily HWB but no relations from daily gratitude to daily EWB. On the other hand, Krejtz et al. (2016) found a lagged relation from daily HWB to daily gratitude.

Although research has made advances in understanding the relation between daily gratitude and daily well-being, further investigations are still needed in this field. First, the sample size of most existing studies was relatively small. According to the results of Monte Carlo simulation power analysis with the R package, *simr* (Arend & Schafer, 2019), 14 diaries from 131 participants (1834 total diaries) would create 80.7% power to detect a small level-1 effect in a multilevel model ($\gamma_{10, \text{std}} = .10$, $\alpha = .05$, $\text{ICC} = .50$). Thus, the sample size utilized by Krejtz et al. (2016) ($N = 58$) is far from adequate. Besides, Nezlek et al. (2017)'s sample of 130 participants could create 79% power to detect a small level-1 effect in a multilevel model ($\gamma_{10, \text{std}} = .10$, $\alpha = .05$, $\text{ICC} = .50$), suggesting that the sample size of 130 may not provide sufficient power. Therefore, to some extent, the findings of most previous studies may be not reliable and replicable. Given the small sample size is an important cause of the replication crisis in the field of psychology (Diener & Biswas-Diener, 2018), high-powered research is needed to obtain reliable findings.

Second, all previous studies were based on a sample of western participants, but it is still unknown whether existing findings on the day-to-day relation between gratitude and well-being can generalize to eastern people. In China, collectivism involves strong bonds with the group, while individualism in western society emphasizes autonomy and a weak tie with others outside the smallest family unit (Kagitçibasi, 2007). When expressing gratitude, the Chinese tend to take the benefactor's feelings and needs into consideration (i.e., connective gratitude) than western participants (Mendonça et al., 2018). Furthermore, expression of gratitude would elicit the benefactor's perception of the caring and relational information from the recipient, which is beneficial for building social relationships (Algoe, 2012). As positives relation with others is one important component of EWB (Ryff, 1989; Ryff & Keyes, 1995), Chinese participants' EWB may be particularly promoted with interpersonal relationships improved.

Third, different measures of daily gratitude may lead to discrepant findings on the day-to-day relation between gratitude and well-being. In the study by Nezlek et al. (2017), they used the Gratitude Adjective Checklist (GAC) which assesses grateful feelings, while Krejtz et al. (2016) utilized the Gratitude Questionnaire (GQ) which mainly measures the cognitive thoughts about the specific things or people that participants are grateful for.

Finally, prior research on the day-to-day relation between gratitude and well-being did not test the moderating role of trait gratitude. Gratitude can be defined as a trait or a state. Trait gratitude is regarded as a relatively stable personality trait that reflects individual differences in the propensity to experience gratitude (McCullough et al., 2002), while state gratitude is considered as a temporal experience and its fluctuations depend on specific events of a day (Emmons & McCullough, 2003). The interaction between trait and state gratitude in predicting one's well-being has been supported theoretically. According to the resistance hypothesis (McCullough et al., 2004), for individuals who are high in trait gratitude, state gratitude is determined so thoroughly by trait processes that their daily moods are resistant to the effect of daily events related to gratitude. On the contrary, people with low trait gratitude are more sensitive to the effect of gratitude-elicited events. Thus, we supposed that experiencing state gratitude is particularly rewarding for individuals with low trait gratitude. Empirical research supported the resistance hypothesis, indicating that gratitude interventions were especially effective to improve the life satisfaction of those with lower trait gratitude (Rash et al., 2011). Nevertheless, it is still unclear how trait gratitude moderates the lagged association between state gratitude and well-being at the daily level.

Our aim was to bridge the above gaps in the literature in four main ways. First, we used a relatively large sample (i.e., 363 participants) to provide more reliable evidence for the relation between daily gratitude and daily well-being. Second, we replicated prior work and examined whether the effects that have been revealed primarily in the western culture generalize to the eastern culture. Third, to test whether the different measures of daily gratitude may lead to discrepant results, we included both the GQ and the GAC to measure daily gratitude. Finally, because trait gratitude might affect the link of state gratitude with daily well-being, we disentangled whether the lagged relation between daily gratitude and daily well-being would be moderated by trait gratitude, which is an under-explored area of inquiry.

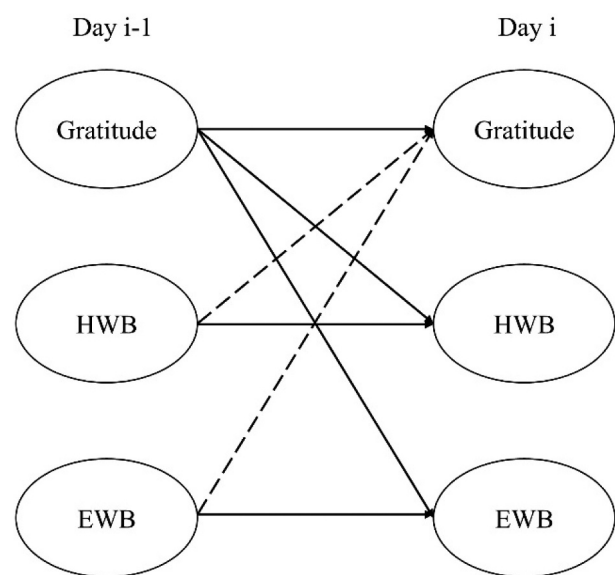


Figure 1. Two hypotheses about the cross-lagged relations between daily gratitude and daily well-being. *Note.* The solid lines represent the paths in ‘gratitude-as-antecedent’ hypothesis. The dotted lines symbolize the paths included in ‘well-being-as-antecedent’ hypothesis.

1.3 The present study

The current study contributed to existing research on the relation between gratitude and well-being with three central goals. First, we tested the same-day associations of daily HWB and daily EWB with daily gratitude. Because the converging evidence indicated that daily gratitude had a positive same-day relation with daily well-being (e.g., Kashdan et al., 2006), we assumed that gratitude would be positively correlated with both HWB and EWB at the same-day level.

Second, we investigated their cross-lagged relationship at the within-person level using two measures of daily gratitude with a sample of 363 Chinese young adults. We put up two hypotheses (see, Figure 1). For one thing, because gratitude helps highlight the positive aspects of a day, resulting in the improvement of well-being, we expected to discover lagged effects of gratitude on next-day HWB and EWB. That is called the ‘gratitude-as-antecedent’ hypothesis. For another, based on the broaden-and-build theory (Fredrickson, 2004), we supposed lagged effects of HWB and EWB on next-day gratitude (i.e., the ‘well-being-as-antecedent’ hypothesis).

Third, we examined whether their lagged relations would be moderated by trait gratitude. Based on the resistance hypothesis, we presumed that the lagged relation between daily gratitude and daily well-being would be stronger within individuals with low trait gratitude.

2 Method

2.1 Participants and procedure

A sample of 409 undergraduate students was enrolled online and volunteered to participate in this research. First, written informed consent was obtained from all participants. Next, participants were instructed to complete an online baseline survey of trait gratitude via the free online questionnaire platform (www.wjx.cn). Then, participants would receive an online diary link through QQ, an instant messaging software service, from the next day at 18:00. They were asked to complete a multi-section questionnaire (daily gratitude and daily well-being) before 24:00 every evening for 14 successive days. A follow-up link was conveyed at 9:00 via QQ to those who did not finish their diary the night before. In this link, we changed the time-frame 'today' into 'yesterday' in the daily survey to access yesterday's state and included this part of data in the analysis. Throughout the study, we would send messages at around 22:00 every day to remind those who have not finished the daily measures yet. Participants received 30 RMB for participating in this study. At the end of the study, 14 participants who did not finish any daily surveys and 32 participants who completed less than three diaries were excluded. Of the remaining observations, 15 diaries were missing because 10 participants failed to complete the diary for some specific days. Finally, 363 participants (307 females; age: $M = 19.77$ years, $SD = 1.84$ years, range 17–27 years; 91.2% undergraduate and 8.8% graduate students; 45.5% born in cities and 54.5% in the countryside) remained for further analysis. We obtained 5067 daily diary entries, which were distributed with a mean of 13.96 per person (range from 11 to 14 days). This study was approved by the Ethics Committee of Shaanxi Normal University.

2.2 Measures

2.2.1 Between-person level variables

2.2.1.1 Trait gratitude. Given that the day-to-day association between gratitude and well-being might be affected by trait gratitude, we asked participants to evaluate their trait gratitude levels before the daily investigation and tested the moderating effect of trait gratitude in further analysis. Trait gratitude was estimated by the sum score of the GQ-6 (McCullough et al., 2002) with a higher score representing a higher level of trait gratitude, including six items (e.g., 'I feel thankful for what I have received in life'). Each item was evaluated on a 7-point Likert scale (1 = strongly disagree; 7 = strongly agree). It has been shown that the Chinese version of the

GQ-6 has great reliability and validity (Hao et al., 2022; Kong et al., 2015, 2020). The alpha reliability of the GQ-6 was 0.782 in this study.

2.2.2 Within-person level variables

2.2.2.1 Daily gratitude. Daily gratitude was estimated through the GQ (McCullough et al., 2002) and the GAC (Emmons & McCullough, 2003). We used the sum score of two items on the basis of the GQ with a higher score representing greater gratitude: 'Today I have so much in life to be thankful for.' and 'Today I am grateful to a wide variety of people'. Each item was evaluated on a 7-point Likert scale that ranged from 1 (strongly disagree) to 7 (strongly agree). Additionally, we utilized the 3-item GAC to evaluate grateful feelings such as 'Thankful' and 'Grateful' on a 5-point Likert scale (1 = never to 5 = very often or always). The aggregate of these items was calculated with a higher score representing stronger grateful feelings. The within-person Omega reliability coefficients were 0.874 for the GQ and 0.881 for the GAC, and the between-person Omega reliability coefficients were 0.977 for the GQ and 0.978 for the GAC.

2.2.2.2 Daily HWB. Daily HWB was indicated by life satisfaction (LS), positive affect (PA), and negative affect (NA). Scores of daily HWB were calculated by subtracting NA from the sum of life satisfaction and PA with larger scores reflecting greater HWB (Chang et al., 2014; Gadermann & Zumbo, 2006; Vittersø, 2001). Two items from the Satisfaction With Life Scale (Diener et al., 1985) were selected to assess LS: 'Today, I am satisfied with my life' and 'In most ways, my life today is close to my ideal'. Each item was rated on a 7-point Likert scale anchored by strongly disagree (1) to strongly agree (7). These items were selected based on the factor loadings from the Satisfaction With Life Scale (Ed Diener et al., 1985) and had good item-level reliability and validity (Jiang et al., 2019). The total score of these two items represented the level of LS, with a higher score implying a higher level of LS. The within- and between-person Omega reliabilities of this scale were 0.841 and 0.972, respectively.

PA and NA were assessed using the 12-item scale established by Diener et al. (2010), each item of which was evaluated on a 5-point Likert scale anchored by 1 = very rarely or never to 5 = very often or always. Participants reported the extent to how they felt on each of the six items for each subscale during that day (PA: positive, good, pleasant, happy, joyful, and contented; NA: negative, bad, unpleasant, sad, afraid, and angry). The sum score of each subscale reflected the participant's positive and negative affect respectively, with a higher score reflecting greater affect. The within-person Omega reliabilities of this

measure were 0.919 (PA) and 0.844 (NA), and between-person Omega reliabilities were 0.992 (PA) and 0.980 (NA).

2.2.2.3 Daily EWB. Daily EWB was estimated using the 6-item PWB subscale from the mental health continuum-short form (MHC-SF; Keyes et al., 2009). The aggregate across the six items defined each person's daily EWB with a larger aggregate showing greater EWB (Yan et al., 2022). This subscale included 6 dimensions of PWB, with each item representing a single theoretical dimension: self-acceptance, environmental mastery, personal growth, positive relations with others, purpose in life, and autonomy. Every item was evaluated on a 7-point Likert scale (1 = strongly disagree; 7 = strongly agree). Sample items include 'Today, I have experiences that challenge me to grow and become a better person' and 'Today, I have warm and trusting relationships with others'. The within- and between-person Omega reliability coefficients of this scale were 0.857 and 0.979, respectively.

2.3 Data analysis

Our data has a nested structure: daily entries (level 1, $n = 14$) are nested within participants (level 2, $N = 363$). All analyses were carried out in Mplus 7.0 using multi-level modeling. First, the reliability of the daily measures was examined using the approach recommended by Bolger and Laurenceau (2013). Second, we established an unconditional random-intercept-only model without predictors to estimate the mean, the within- and between-variances and correlations, as well as intraclass correlation (ICC). Third, we constructed a random-

intercept and random-slope multilevel model by including gratitude as a group-mean centered predictor of same-day well-being. Fourth, we built a random-intercept and random-slope multilevel cross-lagged model (see, Figure 2). In this model, the autoregressive effects of all variables were controlled for. At the within-person level, Day $n-1$'s gratitude was entered as a group-mean centered predictor of Day n 's well-being, and Day $n-1$'s well-being was entered as a group-mean centered predictor of Day n 's gratitude. In addition, all slopes and intercepts were modeled as random. Besides, we conducted another analysis with time trend controlled for (level 2). For time trend, the date was coded based on the order of the day that participants completed the daily measures. Finally, we included trait gratitude as a between-level predictor to examine the moderating effect of trait gratitude on the lagged relations. All analyses tested the daily gratitude assessed by the GQ and the GAC separately. In all models, within-level variables were group-mean centered and between-level variables were grand-mean centered. All missing values were replaced with 999 in further analyses. All coefficients (i.e., B) are unstandardized. The data and analysis scripts can be found at <https://osf.io/2bqph/>.

3 Results

3.1 Preliminary results

Means, variances, intraclass correlation (ICC), within- and between-person correlations for daily gratitude, daily HWB, and daily EWB measures were shown in Table 1. The results showed that, for daily gratitude, daily HWB

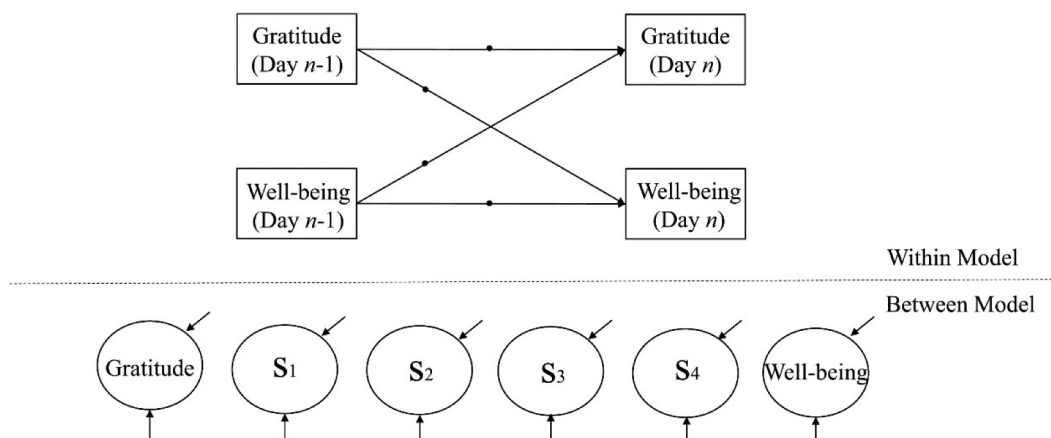


Figure 2. Random-slope and random-intercept cross-lagged panel analyses involving daily gratitude and daily well-being. *Note.* Dots represent random slopes. S1 and S2 represent the random slopes of the autoregressive effects of gratitude and well-being respectively. S3 (S4) represents the random slopes of the lagged relation from gratitude (well-being) on the previous day to well-being (gratitude) on the following day.

Table 1. Descriptive statistics for daily measures.

measure	M	Variance		ICC	1	2	3	4
		between	within					
1.GQ	10.439	3.385	2.715	.555	–	.916	.734	.768
2.GAC	10.453	4.438	2.884	.606	.575	–	.675	.708
3.HWB	20.030	52.185	44.634	.539	.488	.497	–	.849
4.EWB	31.570	22.263	14.757	.601	.386	.399	.604	–

Note. GQ, gratitude questionnaire; GAC, gratitude adjective checklist; HWB, hedonic well-being; EWB, eudaimonic well-being; M, Mean; ICC, intraclass correlation. Between-person correlations are on the upper half and within-person correlations are on the lower half.

and daily EWB, ICCs were around 0.6, implying the suitability of multilevel analysis. Within- and between-person correlations for study measures varied from 0.386 to 0.916.

3.2 Same-day relationship between daily gratitude and daily well-being

Next, we explored the same-day relation between daily gratitude and daily well-being. As we expected, the same-day relations between gratitude and HWB (for the GQ: $B = 1.879$, $p < .001$, $d = 2.200$; for the GAC: $B = 1.772$, $p < .001$, $d = 2.231$), and EWB (for the GQ: $B = 0.856$, $p < .001$, $d = 1.739$; for the GAC: $B = 0.814$, $p < .001$, $d = 1.903$) were significant, suggesting that on days that participants felt more grateful than they typically experienced over the course of the study, their well-being tended to be greater.

3.3 Cross-lagged relationship between daily gratitude and daily well-being

Then, we conducted two cross-lagged panel models (Model 1 and 3) to test the day-to-day relationship between gratitude and well-being. The results for the GQ and the GAC were shown in Table 2 and 3, respectively. The cross-lagged effects of all daily measures of well-being on daily gratitude were not significant ($ps > .05$). However, the cross-lagged paths from daily gratitude to daily HWB (for the GQ: $B = 0.178$, $p = .018$, $d = 0.249$; for the GAC: $B = 0.198$, $p = .005$, $d = 0.296$) and daily EWB (for the GQ: $B = 0.195$, $p < .001$, $d = 0.431$; for the GAC: $B = 0.127$, $p = .002$, $d = 0.331$) were significant, indicating that gratitude on day $i-1$ was positively correlated with HWB and EWB on day i . In sum, the results revealed that gratitude on a given day could positively predict well-being on the next day, but there was no evidence for the reverse day-to-day relation between gratitude and well-being. Thus, the 'gratitude-as-antecedent' hypothesis was supported.

Besides, to test whether the daily gratitude of Chinese participants particularly improved interpersonal

relationships and then enhanced daily EWB, we analyzed the lagged relation from gratitude to the next-day EWB item that measures positive relations with others. The results indicated that this relation was not significant (for the GAC and GQ: $ps > .05$).

Furthermore, we conducted two additional models (Model 3 and Model 4) in which time trend was controlled for. The results indicated that the lagged effects of daily gratitude on daily HWB (for the GQ: $B = 0.151$, $p = .048$, $d = 0.208$; for the GAC: $B = 0.172$, $p = .014$, $d = 0.258$) and daily EWB (for the GQ: $B = 0.204$, $p < .001$, $d = 0.440$; for the GAC: $B = 0.123$, $p = .002$, $d = 0.320$) were still significant.

After that, we also tested the moderating role of trait gratitude measured by our scale. The results revealed that the moderating effect of trait gratitude on the gratitude-HWB (for the GQ: $B = -0.010$, $p = .451$; for the GAC: $B = 0.000$, $p = .994$) and gratitude-EWB links (for the GQ: $B = 0.007$, $p = .406$; for the GAC: $B = 0.012$, $p = .114$) was not statistically significant, suggesting that the lagged relation between gratitude on the previous day and well-being on a given day was not influenced by trait gratitude.

Last but not least, we included LS, PA, and NA in the models to examine how daily gratitude related to each component of daily HWB. The cross-lagged analysis indicated that gratitude positively and significantly predicted next-day PA (for the GQ: $B = 0.090$, $p = .019$, $d = 0.246$; for the GAC: $B = 0.117$, $p = .001$, $d = 0.334$). There were no significant relations between daily gratitude and daily NA (for the GQ: $B = -0.013$, $p = .726$; for the GAC: $B = -0.026$, $p = .419$). It should be noted that the significant reciprocal association between daily LS and daily gratitude measured by the GQ was found (from daily gratitude to daily LS: $B = 0.103$, $p < .001$, $d = 0.489$; From daily LS to daily gratitude: $B = 0.043$, $p = .021$, $d = 0.242$), but only the lagged effect of daily gratitude on daily LS was significant when using the scores from the GAC ($B = 0.084$, $p < .001$, $d = 0.502$). Besides, these findings remained stable when time trend was controlled for. In addition, trait gratitude did not moderate these associations ($ps > .05$).

4 Discussion

The present research applied a daily diary design to explore the cross-lagged relation between daily gratitude and daily well-being in Chinese young adults and investigated whether their relationship is moderated by trait gratitude. The results indicated that gratitude had positive associations with same-day HWB and EWB. Most importantly, the within-person associations between gratitude and next-day HWB and EWB were found.

Table 2. Fixed and Random effects from the cross-lagged model using the GQ.

	Model 1			Model 2				
	Fixed effects (means)		Random effects (variances)	Fixed effects (means)		Random effects (variances)		
	B (SE)	95%CI	B (SE)	95%CI	B (SE)	95%CI		
Gratitude intercept	10.507(0.100)***	[10.311, 10.703]	3.448(0.246)***	[2.966, 3.930]	10.507(0.100)***	[10.311, 10.703]	3.448(0.246)***	[2.966, 3.930]
HWB intercept	20.107(0.394)***	[19.335, 20.879]	53.066(4.571)***	[44.106, 62.025]	20.107(0.394)***	[19.335, 20.879]	53.080(4.570)***	[44.123, 62.038]
EWB intercept	31.556(0.258)***	[31.051, 32.060]	23.028(1.897)***	[19.309, 26.747]	31.555(0.258)***	[31.051, 32.060]	23.028(1.897)***	[19.309, 26.746]
Autoregressive effects								
Gratitude _{n-1} → Gratitude _n	0.157(0.019)***	[0.119, 0.195]	0.032(0.009)***	[0.015, 0.049]	0.157(0.019)***	[0.119, 0.195]	0.032(0.009)***	[0.015, 0.049]
HWB _{n-1} → HWB _n	0.081(0.017)***	[0.047, 0.115]	0.024(0.006)***	[0.012, 0.035]	0.079(0.017)***	[0.046, 0.113]	0.023(0.006)***	[0.011, 0.035]
EWB _{n-1} → EWB _n	0.055(0.017)**	[0.022, 0.088]	0.025(0.005)***	[0.015, 0.035]	0.053(0.017)**	[0.020, 0.086]	0.025(0.005)***	[0.015, 0.035]
Cross-lagged effects								
Gratitude _{n-1} → HWB _n	0.178(0.075)*	[0.031, 0.324]	0.172(0.150)	[-0.123, 0.467]	0.151(0.076)*	[0.002, 0.301]	0.168(0.152)	[-0.131, 0.466]
HWB _{n-1} → Gratitude _n	0.003(0.005)	[-0.008, 0.014]	0.003(0.001)	[0.001, 0.005]	0.003(0.005)	[-0.008, 0.014]	0.003(0.001)**	[0.001, 0.005]
Gratitude _{n-1} → EWB _n	0.195(0.048)***	[0.102, 0.289]	0.098(0.047)*	[0.006, 0.189]	0.204(0.049)***	[0.109, 0.299]	0.097(0.047)*	[0.006, 0.189]
EWB _{n-1} → Gratitude _n	0.001(0.008)	[-0.015, 0.017]	0.003(0.001)	[0.000, 0.006]	0.001(0.008)	[-0.015, 0.017]	0.003(0.001)*	[0.001, 0.006]
Time trend → HWB					0.055(0.028)*	[0.000, 0.110]		
Time trend → EWB					-0.013(0.017)	[-0.046, 0.020]		

Note. Model 1 is the model without covariates and Model 2 is the model with time trend controlled for. HWB, hedonic well-being; EWB, eudaimonic well-being. B (SE) = unstandardized coefficient (standard error). 95% CI = lower and upper 95% confidence interval. **p* < 0.05; ***p* < 0.01; ****p* < 0.001.

Table 3. Fixed and Random effects from the cross-lagged model using the GAC.

	Model 3			Model 4		
	Fixed effects (means)		Random effects (variances)	Fixed effects (means)		Random effects (variances)
	B (SE)	95%CI	B (SE)	95%CI	B (SE)	95%CI
Gratitude intercept	10.501(0.114)***	[10.277, 10.725]	4.553(0.330)***	[3.906, 5.200]	10.501(0.114)***	[10.277, 10.725]
HWB intercept	20.107(0.394)***	[19.335, 20.879]	53.073(4.574)***	[44.109, 62.037]	20.108(0.394)***	[19.335, 20.879]
EWB intercept	31.556(0.258)***	[31.051, 32.060]	23.023(1.898)***	[19.304, 26.743]	31.556(0.258)***	[31.051, 32.060]
Autoregressive effects						
Gratitude _{n-1} → Gratitude _n	0.100(0.021)***	[0.059, 0.140]	0.034(.009)***	[0.017, 0.051]	0.100(0.021)***	[0.059, 0.141]
HWB _{n-1} → HWB _n	0.072(0.017)***	[0.038, 0.106]	0.024(0.005)***	[0.013, 0.034]	0.068(0.017)***	[0.034, 0.102]
EWB _{n-1} → EWB _n	0.062(0.017)***	[0.028, 0.096]	0.028(0.006)***	[0.017, 0.051]	0.061(0.017)***	[0.027, 0.095]
Cross-lagged effects						
Gratitude _{n-1} → HWB _n	0.198(0.070)**	[0.060, 0.336]	0.230(0.104)*	[0.027, 0.433]	0.172(0.070)*	[0.035, 0.310]
HWB _{n-1} → Gratitude _n	0.004(0.005)	[-0.007, 0.015]	0.002(0.001)	[0.000, 0.004]	0.004(0.006)	[-0.006, 0.015]
Gratitude _{n-1} → EWB _n	0.127(0.040)**	[0.048, 0.206]	0.062(0.036)	[-0.008, 0.132]	0.123(0.040)**	[0.044, 0.203]
EWB _{n-1} → Gratitude _n	0.007(0.008)	[-0.009, 0.024]	0.002(0.002)	[-0.001, 0.006]	0.007(0.008)	[-0.009, 0.023]
Time trend → HWB					0.094(0.028)**	[0.039, 0.149]
Time trend → EWB					0.014(0.016)	[-0.018, 0.046]

Note. Model 3 is the model without covariates and Model 4 is the model with time trend controlled for. HWB, hedonic well-being; EWB, eudaimonic well-being. B (SE) = unstandardized coefficient (standard error). 95% CI = lower and upper 95% confidence interval. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Furthermore, the lagged relation between state gratitude and well-being was not moderated by trait gratitude. The above findings were consistent across different measures of daily gratitude. It is worth noting that daily gratitude measured by the GQ had a positive bidirectional relationship with daily LS, but only the lagged relation from daily gratitude to daily LS was found when utilizing the scores from the GAC.

Corresponding to prior studies uncovering the positive relation between gratitude and well-being at both between- and within-person levels (Algoe & Zhaoyang, 2016; Jans-Beken et al., 2018; Nezlek et al., 2017; Wood et al., 2008), we discovered that, at the same-day level, gratitude was positively correlated with HWB and EWB. That means, on the day that individuals felt more grateful than they typically experienced throughout the study, they tended to obtain a higher level of well-being.

Importantly, consistent with the 'gratitude-as-antecedent' hypothesis, our findings showed that no matter what daily assessment of gratitude was used, gratitude on the previous day positively predicted LS, PA, and total HWB but not NA on the following day. This finding fits nicely with a daily diary study which showed that daily gratitude measured by the GAC was positively related to daily LS and daily PA but not daily NA, especially negative activated affect in a sample of western adults (Nezlek et al., 2017). Thus, we extended these findings to a sample of Chinese adults. These findings can be explained by the theoretical framework provided by Watkins (2014), according to which, gratitude may make the positive event or experience of a day more conspicuous, which helps individuals have easier access to the positive sides of a day. They thus feel more satisfied with life and obtain more positive affect. In addition, previous studies have found the interaction between gratitude and some variables such as stressful life events (Deichert et al., 2019) and self-reassuring (Petrocchi & Couyoumdjian, 2015) in predicting negative emotional experiences such as depression, which implies that some unidentified variables might moderate the weak link between daily gratitude and daily NA. Future studies should explore the exact factor that influences the link.

More importantly, we found that LS was positively associated with next-day gratitude measured by the GQ but not the GAC. This discrepancy may be due to the different content of these two measures: the GAC only evaluates the grateful affect, while the GQ mainly includes the assessment of cognitive thoughts about the thing or person that participants are grateful for. It seems that LS, as a cognitive component of HWB, exhibited a unique predictive effect on the cognitive aspect of gratitude. This finding seems to be explained by the top-

down theory (Feist et al., 1995; Tov, 2018). According to the theory, people interpret the event in a way that is congruent with their beliefs and attitude, and higher levels of global LS help individuals adopt a more positive interpretation of life experiences, which further influences their satisfaction with specific life domains (Feist et al., 1995; Tov, 2018). Thus, higher levels of LS may help individuals evaluate the benefit as more valuable and have more positive appraisals of the benefactor, which leads to greater gratitude towards the benefactor or grateful events. Moreover, to our knowledge, our study is the first to indicate a feedback loop between daily gratitude and daily LS. Considering the different associations of the GAC and GQ with life satisfaction, we also invited further studies to explore relationships between gratitude and other outcomes using different gratitude assessments.

The cross-lagged relationship from daily gratitude to daily EWB was also found in this study, indicating that gratitude on the previous day could predict EWB on the following day. However, using the same scale of daily gratitude, no such relation was revealed in the study by Nezlek et al. (2017). Moreover, Krejtz et al. (2016) found lagged relations from positive affect and negative affect to next-day gratitude, which are absent in the present study. The different sample sizes may be a possible reason for the discrepant results. Nezlek et al. (2017) and Krejtz et al. (2016) used a relatively small sample ($N = 130$ and 58). It has been indicated that effects observed in smaller samples are less likely to be replicated than those observed in larger samples (Cohen, 1962; Tajika et al., 2015). Besides, according to the sensitivity analysis, with the power of .80 and $\alpha = .05$ cutoff, the minimum effect that our final sample size ($N = 363$) would be able to detect is small ($\gamma_{10, \text{std}} = .06$). Thus, the sample sizes of Nezlek et al. (2017) and Krejtz et al. (2016) may not provide sufficient power to obtain reliable results to some extent, and these findings cannot be replicated in the present study.

Moreover, inconsistent with our hypothesis, the lagged relation from gratitude to the next-day EWB item that measures positive relations with others was not significant, suggesting that gratitude did not particularly improve interpersonal relationships and then promote EWB among Chinese participants. This may be because the Chinese tend to control the expression of emotions, especially positive emotions (Gross et al., 2006; Tsai & Levenson, 1997). Gratitude, as a positive emotion, may be suppressed to be expressed in Chinese culture (Corona et al., 2019). Given the positive effect of gratitude expression on interpersonal relationships (Lambert et al., 2010; Lambert & Fincham, 2011), merely experiencing gratitude but not expressing it

might not enhance interpersonal relationships. Consistent with the cultural-specific hypothesis, Algoe et al. (2010) found that gratitude from interactions positively predicted relationship connection and satisfaction the following day. Therefore, future research is needed to explore the moderating effect of gratitude expression on the association between daily gratitude and daily EWB.

Interestingly, inconsistent with our hypothesis, trait gratitude did not moderate the relation from state gratitude to next-day well-being. This suggests that trait and state gratitude may work independently to predict next-day well-being. As is known, trait gratitude is a relatively stable personality trait that reflects individual differences in the propensity to experience gratitude (McCullough et al., 2002). Nevertheless, state gratitude refers to the temporal grateful affect after receiving help (Wood et al., 2008). Besides, trait and state gratitude were correlated in the present work ($r = 0.428$). However, individuals' next-day well-being is increased with the higher intensity of temporal grateful feelings, which is independent of their propensity to experience gratitude. Future research on gratitude should consider simultaneously measuring trait and state gratitude to comprehensively explore the beneficial effect of gratitude.

Some limitations of this study should be noted. First, all participants were recruited from the college and most of them were young adult women, so whether our results could be replicated in other samples need to be further examined. Second, we collected the data once a day, which might be not enough to evaluate the substantial variability of gratitude and well-being during a day. Thus, future research could assess these variables more often, such as 2–4 times a day. Third, our findings were based on self-report questionnaires, so other methods, such as experiments, could be used to provide more evidence on the causal relation between gratitude and well-being. For example, researchers can manipulate gratitude through writing a gratitude list or making gratitude contemplation to explore how gratitude influences well-being. Fourth, no significant predictive effects of the total daily HWB and EWB on daily gratitude were found in the present study, which is in contradiction to the hypothesis deduced from the broaden-and-build theory. Future studies can further test whether daily well-being would need to build up resources over time, and then ultimately influence people's grateful feelings.

In conclusion, the present work utilized a daily diary design to investigate the within-person link between daily gratitude and daily well-being. Our findings suggest that advantageous effects of gratitude occur not only at the trait level but also in day-to-day living. That is,

on a given day, experiencing more gratitude than one's personal average was associated with increased same-day and next-day well-being. Furthermore, the lagged relationship between daily gratitude and daily well-being was not moderated by trait gratitude. This study gives rise to inspiration for research on the nature of gratitude and its outcomes. First, future studies on gratitude should pay more attention to the effect of trait and state gratitude. Second, considering the nature of different components of well-being, more works need to be done to examine whether there are differential mechanisms of how gratitude relates to components of well-being.

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Informed Consent

Written informed consents were obtained from all individual participants included in the study.

Data availability statement

The data described in this article are openly available in the Open Science Framework at <https://doi.org/10.1080/17439760.2022.2131606>.

Open scholarship



This article has earned the Center for Open Science badge for Open Data. The data are openly accessible at <https://doi.org/10.1080/17439760.2022.2131606>.

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