



# Time-of-day preference mediates the relationship between personality and breakfast attitudes☆☆☆

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## ABSTRACT

Personality and time-of-day preference (i.e., chronotype) are two reliable predictors of breakfast behaviors. The current study examined if time-of-day preference mediates the relation between the Big Five personality traits and breakfast-related attitudes and behaviors. Results revealed that conscientiousness, extraversion, and agreeableness predicted healthy breakfast attitudes and behaviors, whereas neuroticism predicted unhealthy breakfast attitudes and behaviors. Importantly, time-of-day preference mediated most of these relationships (except for the agreeableness models). Even when the direct effect of personality on breakfast attitudes and behaviors was not significant, all of the indirect effects through time-of-day preference were significant. Together, these findings indicate that personality differences in breakfast attitudes and behaviors are accounted for by time-of-day preference. These findings also suggest that future work should examine more integrative models of eating behavior to better understand how various individual differences relate to specific attitudes and behaviors.

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## 1. Introduction

Predicting what and why an individual eats is a burgeoning area of individual difference research. One specific eating outcome that has received an increasing amount of attention in the literature is breakfast eating behaviors (Meule, Roeser, Randler, & Kübler, 2012; Reeves, Halsey, McMeel, & Huber, 2013), particularly because breakfast is widely considered to be the most important meal of the day with its many positive health implications (de Castro, 2004; Johns Hopkins, n.d.; Mayo Clinic, 2014). Two reliable individual differences that have been associated with breakfast eating and numerous other eating behaviors are the Big Five personality factors (e.g., Keller & Siegrist, 2015) and time-of-day preference (i.e., an individual's peak performance time when he or she is at his or her most capable, physically and cognitively; Meule et al., 2012; Reutrakul et al., 2014). Critically, research has established that personality traits are related to time-of-day preference (Adan et al., 2012). However, no work has examined a more integrative

model of breakfast eating that includes both personality and time-of-day preference, which is the purpose of the current work.

### 1.1. Individual differences and breakfast

There have been a number of studies that have established that both personality and time-of-day preference predict breakfast eating attitudes and behaviors, as well as eating behaviors more generally. In terms of personality traits, conscientiousness has been shown to positively predict healthy breakfast eating behaviors, such as eating breakfast regularly (Reeves et al., 2013). Similarly, extraverted individuals consume more for breakfast than introverted individuals (Van Ittersum & Wansink, 2013). Other general eating research has revealed that conscientiousness, extraversion, agreeableness, and openness have both direct and indirect influences on eating behavior (Keller & Siegrist, 2015). For example, conscientiousness, extraversion, agreeableness, and openness positively predict healthy eating behaviors, such as restrained eating, and the consumption of fruits and vegetables. These same traits also negatively predict unhealthy eating behavior such as emotional eating (Elfag & Morey, 2008; Keller & Siegrist, 2015; Walker et al., 2015). Conversely, the personality trait of neuroticism is positively associated with unhealthy eating behaviors, such as emotional eating, and the consumption of energy-dense sweet and savory foods (Keller & Siegrist, 2015; Walker et al., 2015).

With respect to time-of-day preference, research has established that individuals with a morning preference eat breakfast more frequently than individuals with an evening preference (Boschloo et al., 2012;

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Meule et al., 2012; Reutrakul et al., 2014). Interestingly, individuals with an evening preference do not appear to report more feelings of hunger in the morning compared to individuals with a morning preference even though they have been without food for a longer period of time (Meule et al., 2012). Other eating research has shown that morningness positively predicts restrained eating and the consumption of vegetables and essential nutrients, whereas eveningness positively predicts uncontrolled eating and the consumption of fast food (Fleig & Randler, 2009; Sato-Mito et al., 2011; Schubert & Randler, 2008; Walker et al., 2015). Together, these findings demonstrate that both personality and time-of-day preference are reliable predictors of breakfast and general eating behaviors.

## 1.2. Personality and time-of-day preference

Critical to the current research, personality traits are related to time-of-day preference (Adan et al., 2012). Specifically, conscientiousness and agreeableness are associated with morning preference, whereas neuroticism is associated with evening preference (Adan et al., 2012; Tsaousis, 2010).<sup>1</sup> Extraversion and openness tend to be unrelated to time-of-day preference (Adan et al., 2012), although the literature is somewhat inconsistent regarding these two traits (see Walker et al., 2015). It is also necessary to note that the literature discusses this relationship in terms of personality predicting time-of-day preference, and not vice versa (Adan et al., 2012; Tsaousis, 2010; Walker, Kribs, Christopher, Shewach, & Wieth, 2014).

Although the relation between personality and time-of-day preference has been thoroughly established, few studies have examined more integrative models including both personality and time-of-day preference (Walker et al., 2014, 2015). In a recent study, Walker et al. (2015) tested if time-of-day preference mediates the relation between the Big Five personality traits and the three factors of eating (i.e., uncontrolled eating, restrained eating, emotional eating). In short, these researchers found that time-of-day preference partially mediated the relation between the personality traits (i.e., conscientiousness, neuroticism, and extraversion) and eating behaviors, primarily uncontrolled eating. The results from their study suggest that time-of-day preference, in part, accounts for personality differences in eating behavior. However, the Walker et al. (2015) study only tested the three factors of eating as outcome variables, and as noted previously, other research has demonstrated that both personality and time-of-day preference predict other eating outcomes. This suggests that time-of-day preference will mediate the relation between personality and other eating-related outcomes, such as breakfast eating attitudes and behavior.

## 1.3. Overview of the current study

The goal of this study was to test if time-of-day preference accounted for personality differences in breakfast attitudes and behaviors. Although a majority of previous research has examined breakfast eating behavior by simply by assessing breakfast frequency or breakfast skipping (e.g., Meule et al., 2012), one recent study more thoroughly examined breakfast attitudes and behaviors (Reeves et al., 2013). Thus, we adapted the Reeves et al. (2013) breakfast attitudes and behavior measure to test if time-of-day preference mediated the relation between the Big Five personality traits and breakfast attitudes and behaviors. We predicted that conscientiousness and agreeableness would predict healthy breakfast attitudes and behaviors, and that neuroticism would predict unhealthy breakfast attitudes and behaviors. Critically, we predicted that these relationships would be mediated by time-of-day preference. No *a priori* predictions were made for

extraversion and openness because of the inconsistent relationship these individual differences share with time-of-day preference.

## 2. Design

### 2.1. Participants

We recruited 279 (151 men and 128 women) participants via Amazon's Mechanical Turk worker pool (<https://www.mturk.com/>). Participants volunteered for the study on a first-come, first-served basis, and they received \$1.50 for their participation in the study. Participation was limited to U.S. workers only and we required that workers have a 95% approval rating in order to qualify for the study. Prospective participants were informed that they would be completing a series of individual difference measures via an internet-based survey and the study would take approximately 30 min. Participants ranged in age from 18 to 82 years ( $M = 34.08$  yrs,  $SD = 11.45$  yrs), and the distribution of age groups was as follows: 18 to 26 (30.5%), 27 to 35 (36.9%), 36 to 44 (14%), 45 to 53 (9.6%), 54 to 62 (6.8%), and 63 and older (2.2%). A majority of this sample was White (White = 234, Asian = 20, Black = 15, Latino/a = 3, American Indian or Alaska Native = 3, Native Hawaiian or other Pacific Islander = 1, other = 1, 2 not specified).<sup>2</sup>

### 2.2. Materials and procedure

#### 2.2.1. NEO-FFI-3

Participants first completed the 60-item NEO-FFI-3 (Costa & McCrae, 2008), which assesses the Big Five personality factors of conscientiousness ( $\alpha = .90$ ), agreeableness ( $\alpha = .83$ ), extraversion ( $\alpha = .88$ ), openness ( $\alpha = .83$ ), and neuroticism ( $\alpha = .92$ ). Responses were made on a scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*).

#### 2.2.2. Morning-Eveningness Questionnaire

Participants then completed the 19-item Morning-Eveningness Questionnaire (Horne & Östberg, 1976), which assesses time-of-day preference. Responses were multiple choice (e.g., *very tired*, *fairly tired*, *fairly refreshed*, *very refreshed*) or were made on a response continuum (e.g., a 24-hour continuum ranging from 12 am to 11 pm). Scores on this measure can range from 16 (*strong evening preference*) to 86 (*strong morning preference*). In these data, scores ranged from 26 to 76 ( $M = 49.23$ ,  $SD = 9.33$ ,  $\alpha = .82$ ).

#### 2.2.3. Breakfast Eating Habits Questionnaire

Next, participants completed the Breakfast Eating Habits Questionnaire (Reeves et al., 2013). This questionnaire assessed subjective attitudes about breakfast, as well as actual breakfast behaviors. Subscale items in this questionnaire are: *breakfast frequency* during the last week ( $\alpha = .85$ ; 7-items); health-related reasons for eating breakfast, such as believing breakfast manages hunger and provides energy (i.e., *hunger and energy*;  $\alpha = .80$ ; 6-items); believing breakfast helps control weight (i.e., *weight control*;  $\alpha = .80$ ; 2-items); being likely to skip breakfast while being under pressure or anxious (i.e., *mood in relation*;  $\alpha = .55$ ; 4-items<sup>3,4</sup>); believing that breakfast helps alertness (i.e., *alertness in relation*;  $\alpha = .80$ ; 3-items); and believing that daily activities are not affected by breakfast (i.e., *activities not affected*; 1-item). Questions asked participants to check all options that apply (e.g., "Over the past 7 days, on which days did you eat breakfast?") or respond on a 1 (*strongly disagree*) to 5 (*strongly agree*) scale.

<sup>2</sup> Additional demographic information was not collected in this study (e.g., working conditions).

<sup>3</sup> Mood in relation to breakfast is the only subscale in which higher scores indicate healthier attitudes and behaviors.

<sup>4</sup> The internal consistency for mood in relation was not satisfactory and this item should therefore be interpreted with caution.

<sup>1</sup> Conscientiousness tends to be a stronger predictor of morningness than agreeableness.

Because this questionnaire had six different subscales and many of the subscales were correlated, we attempted to reduce the subscales into a smaller number of outcome variables to decrease the likelihood of obtaining a Type I error. We performed a principal components analysis, with an orthogonal varimax rotation. When we entered all six attitudes into the analysis, results revealed two eigenvalues greater than 1.0, which accounted for 62.04% of the variability. However, two of the breakfast attitudes (i.e., weight control and activities not affected) did not load 0.50 or stronger on either factor. We therefore deleted these two attitudes and reran our analysis with the remaining four subscales. The results of this second principal components analysis, which accounted for 85.57% of the variability, appear in Table 1. The first factor, *breakfast is fuel*, was comprised of the subscales breakfast frequency, hunger and energy, and alertness in relation. We defined breakfast is fuel as: eating and believing breakfast jumpstarts the day and provides energy. The second factor, which we renamed *emotional breakfast skipping*, was only comprised of the subscale mood in relation. We defined emotional breakfast skipping as: being likely to skip breakfast while being under pressure or anxious (Reeves et al., 2013). We used standardized factor scores in all analyses.

#### 2.2.4. Demographic questionnaire

Lastly, participants answered demographic questions and were also asked to self-report height and weight, which allowed us to calculate Body Mass Index (BMI) using the formula provided on the World Health Organization (WHO) website (WHO, n.d.).

### 3. Results

#### 3.1. Overview of analyses

Table 2 contains descriptive statistics and zero-order correlations for the Big Five personality traits, time-of-day preference, breakfast eating attitudes and behaviors, and BMI. Following the recommendations of Baron and Kenny (1986), for each mediational model we examined the relation between the predictor and the mediator (A path), the predictor and the outcome (C path), and the mediator and the outcome with the predictor in the model (B path). When the A and B paths were significant, we examined the indirect effect via bootstrapping using PROCESS, an SPSS macro (Hayes, 2008). Because Sobel's test may be biased due to non-normality of the indirect effect, we opted for the bootstrapping strategy (Preacher & Hayes, 2004). When the A and B paths were nonsignificant, the indirect effect was not tested. However, given the recommendations that the requirement of a significant C path be relaxed (Shrout & Bolger, 2002) and that researchers should rely on the indirect effect more than individual paths (Hayes, 2008), the indirect effect was still tested when the C path was not significant. The indirect effect was considered significant if zero was not contained in the 95% confidence interval. As is typical in this line of research, we included age and sex as covariates in the mediation analyses (see Fig. 1 for general mediation model). For ease of interpretation, the six mediation analyses are summarized in Table 3, which contains the unstandardized Betas and *p*-values for the A, B, C, and C' paths, as well as the indirect effects.

**Table 1**  
Principal components analysis on breakfast attitudes subscales.

	Component	
	Breakfast is fuel	Emotional breakfast skipping
Breakfast frequency	.857	-.243
Hunger and energy	.899	.102
Mood in relation	.037	.982
Alertness in relation	.894	.209

#### 3.2. Relationships between the predictors and mediator

As predicted, conscientiousness significantly predicted Time-of-Day (ToD) preference,  $\beta = .18$ ,  $t(274) = 3.09$ ,  $p < .01$  ( $R^2 = .13$ ,  $F[3, 274] = 13.59$ ,  $p < .001$ ), and extraversion significantly predicted ToD preference,  $\beta = .22$ ,  $t(274) = 3.94$ ,  $p < .001$  ( $R^2 = .15$ ,  $F[3, 274] = 15.79$ ,  $p < .001$ ). Also as expected, neuroticism significantly predicted ToD preference,  $\beta = -.22$ ,  $t(274) = -3.60$ ,  $p < .001$  ( $R^2 = .14$ ,  $F[3, 274] = 14.85$ ,  $p < .001$ ). Against hypotheses, agreeableness did not predict ToD preference controlling for age and sex,  $\beta = .06$ ,  $t(274) = .98$ ,  $p = .33$  ( $R^2 = .10$ ,  $F[3, 274] = 10.41$ ,  $p < .001$ ). Thus, no further analyses were conducted on the models with agreeableness. Finally, openness did not predict ToD preference,  $\beta = -.03$ ,  $t(274) = -.54$ ,  $p = .59$  ( $R^2 = .10$ ,  $F[3, 274] = 10.16$ ,  $p < .001$ ), and no further analyses were conducted on this trait.

#### 3.3. Breakfast is fuel

First, models with the outcome variable of breakfast is fuel (i.e., eating and believing breakfast jumpstarts the day and provides energy) were examined. The relationship between conscientiousness and breakfast is fuel was trending towards significance,  $\beta = .10$ ,  $t(267) = 1.56$ ,  $p = .12$ . After ToD preference was added to the model ( $\Delta R^2 = .13$ ,  $F[4, 266] = 13.20$ ,  $p < .001$ ), it related to breakfast is fuel above and beyond conscientiousness,  $\beta = .39$ ,  $t(266) = 6.48$ ,  $p < .001$ , and the relationship between conscientiousness and breakfast is fuel further decreased,  $\beta = .03$ ,  $t(266) = .48$ ,  $p = .63$ . Although the relationship between conscientiousness and breakfast is fuel was not traditionally significant, given the recommendations that the requirement of a significant C path be relaxed (Shrout & Bolger, 2002), the indirect effect was tested. The confidence interval around the indirect effect (.01,  $SE = .003$ ) did not contain zero (95% CI [.0031, .0155]), revealing that ToD preference mediated the relation between conscientiousness and breakfast is fuel.

Extraversion did not predict breakfast is fuel,  $\beta = .08$ ,  $t(267) = 1.30$ ,  $p = .19$ . After adding ToD preference to the model ( $\Delta R^2 = .13$ ,  $F[4, 266] = 13.15$ ,  $p < .001$ ), it related to breakfast is fuel above and beyond extraversion,  $\beta = .40$ ,  $t(266) = 6.53$ ,  $p < .001$ , and the relationship between extraversion and breakfast is fuel remained nonsignificant,  $\beta = -.01$ ,  $t(266) = -.23$ ,  $p = .82$ . The confidence interval around the indirect effect (.01,  $SE = .003$ ) did not contain zero (95% CI [.0055, .0181]), revealing that the indirect effect of extraversion on breakfast is fuel through ToD preference was significant.

Neuroticism did not significantly predict breakfast is fuel,  $\beta = -.09$ ,  $t(267) = -1.32$ ,  $p = .19$ . After ToD preference was added to the model ( $\Delta R^2 = .13$ ,  $F[4, 266] = 13.14$ ,  $p < .001$ ), it related to breakfast is fuel above and beyond neuroticism,  $\beta = .40$ ,  $t(266) = 6.52$ ,  $p < .001$ , and the relationship between neuroticism and breakfast is fuel remained nonsignificant,  $\beta = -.01$ ,  $t(266) = -.12$ ,  $p = .91$ . The confidence interval around the indirect effect (-.01,  $SE = .003$ ) did not contain zero (95% CI [-.0136, -.0027]), revealing that the indirect effect of neuroticism on breakfast is fuel through ToD preference was significant.

#### 3.4. Emotional breakfast skipping

Next, models with the outcome variable of emotional breakfast skipping (i.e., being likely to skip breakfast while being under pressure or anxious) were examined. Conscientiousness significantly predicted emotional breakfast skipping,  $\beta = -.12$ ,  $t(267) = -2.00$ ,  $p < .05$ . After ToD preference was added to the model ( $\Delta R^2 = .01$ ,  $F[4, 266] = 3.63$ ,  $p < .01$ ), it related to emotional breakfast skipping above and beyond conscientiousness,  $\beta = -.13$ ,  $t(266) = -1.98$ ,  $p < .05$ , and the relationship between conscientiousness and emotional breakfast skipping dropped to nonsignificance,  $\beta = -.10$ ,  $t(266) = -1.62$ ,  $p = .11$ . The confidence interval around the indirect effect (-.003,  $SE = .002$ ) did not contain zero (95% CI [-.0077, -.0001]), revealing that ToD

**Table 2**  
Descriptive statistics and correlations between study variables.

	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9
1. Time-of-day preference <sup>a</sup>	49.23	9.33	–								
2. Conscientiousness <sup>b</sup>	45.15	7.82	.23***	–							
3. Agreeableness <sup>b</sup>	43.82	7.48	.15*	.34***	–						
4. Extraversion <sup>b</sup>	36.14	8.33	.23***	.36***	.11	–					
5. Openness <sup>b</sup>	45.24	7.03	–.04	.10	.14*	.09	–				
6. Neuroticism <sup>b</sup>	32.77	10.42	–.28***	–.61***	–.28***	–.51***	–.01	–			
7. Breakfast is fuel <sup>c</sup>	–	–	.39***	.12*	.06	.09	–.07	–.13*	–		
8. Emotional breakfast skipping <sup>c</sup>	–	–	–.18**	–.15*	–.14*	–.06	.06	.17**	.00	–	
9. BMI <sup>d</sup>	26.23	6.92	–.06	–.11	.00	–.09	.01	.05	.06	–.03	–

<sup>a</sup> Higher scores indicate a morning preference; lower scores indicate an evening preference.

<sup>b</sup> Scores on conscientiousness, agreeableness, extraversion, openness and neuroticism range from 12 (*low*) to 60 (*high*).

<sup>c</sup> Scores are standardized.

<sup>d</sup> Categories on BMI (WHO, n.d.): <18.49 (underweight); 18.50–24.99 (normal); 25.00–29.99 (overweight); >30.00 (obese).

\*  $p < 0.05$ .

\*\*  $p < .01$ .

\*\*\*  $p < .001$ .

preference mediated the relation between conscientiousness and emotional breakfast skipping.

Extraversion did not predict emotional breakfast skipping,  $\beta = -.05$ ,  $t(267) = -.86$ ,  $p = .41$ . After ToD preference was added to the model ( $\Delta R^2 = .02$ ,  $F[4, 266] = 2.97$ ,  $p < .05$ ), it related to emotional breakfast skipping above and beyond extraversion,  $\beta = -.14$ ,  $t(266) = -2.16$ ,  $p < .05$ , and the relationship between extraversion and emotional breakfast skipping remained nonsignificant,  $\beta = -.02$ ,  $t(266) = -.29$ ,  $p = .77$ . The confidence interval around the indirect effect ( $-.004$ ,  $SE = .002$ ) did not contain zero (95% CI  $[-.0096, -.0003]$ ), revealing that the indirect effect of extraversion on emotional breakfast skipping through ToD preference was significant.

Neuroticism significantly predicted emotional breakfast skipping,  $\beta = .14$ ,  $t(267) = 2.19$ ,  $p < .05$ . However, after adding ToD preference to the model ( $\Delta R^2 = .01$ ,  $F[4, 266] = 3.78$ ,  $p < .05$ ), it did not relate to emotional breakfast skipping above and beyond neuroticism,  $\beta = -.12$ ,  $t(266) = -1.92$ ,  $p = .06$ . Nonetheless, with ToD preference in the model the relationship between neuroticism and emotional breakfast skipping dropped to nonsignificance,  $\beta = .12$ ,  $t(266) = 1.78$ ,  $p = .08$ . The confidence interval around the indirect effect (.002,  $SE = .002$ ) did not contain zero (95% CI  $[-.0001, .0066]$ ), revealing that ToD preference mediated the relation between neuroticism and emotional breakfast skipping.

#### 4. Discussion

The purpose of this study was to test if time-of-day preference mediates the relationship between personality and breakfast-related attitudes. Similar to previous research (Reeves et al., 2013; Walker et al., 2015), this work revealed that conscientiousness, extraversion,

and agreeableness positively predicted healthy breakfast eating attitudes and behavior (e.g., breakfast is fuel), neuroticism positively predicted unhealthy breakfast eating attitudes and behavior (e.g., emotional breakfast skipping), and that people with a morning preference tend to eat healthier (Meule et al., 2012; Walker et al., 2015). Critically, as predicted, mediation analyses demonstrated that time-of-day preference mediates the relationship between three personality traits (i.e., conscientiousness, neuroticism, and extraversion) and these breakfast attitudes. Together, this research is the first work to empirically demonstrate that personality differences in breakfast attitudes and behavior can be accounted for by time-of-day preference. Additionally, even when the direct effect of a personality trait on the breakfast outcome was not significant, the indirect effects were significant, further suggesting that personality is related to breakfast attitudes and behavior through time-of-day preference.

#### 4.1. Limitations and future research

Although these models demonstrate the mediational role of time-of-day preference, the underlying mechanism remains unclear. In other words, it is not clear if time-of-day preference is a mediator because of biological factors, social factors, or both. For instance, it is possible that evening people simply don't have the time to eat breakfast before leaving for the day (Meule et al., 2012). Another possible explanation is that underlying biological factors (e.g., appetite-regulating peptides) are linked to sleeping behavior (Motivala, Tomiyama, Ziegler, Khandrika, & Irwin, 2009), and these peptides may determine when an individual eats. Finally, it is possible that evening people experience circadian rhythm disruptions during the workweek because they are forced to rise earlier than desired (i.e., *social jet lag*), and this may then

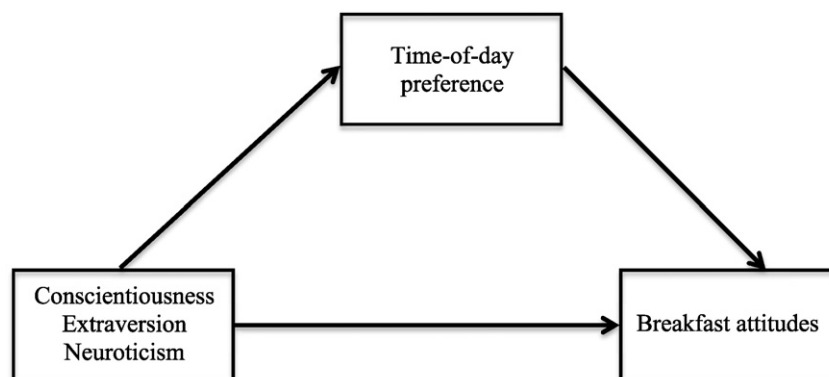


Fig. 1. General mediation model.



**Table 3**

In the table below, we provide the unstandardized  $\beta$  for each of the mediational paths.

	A path	B path	C path	C' path	Indirect effect (95% CI) <sup>a</sup>
Outcome: Breakfast is fuel					
Conscientiousness	.18**	.39***	.10 <sup>†</sup>	.03	(.0031, .0155)
Extraversion	.22***	.40***	.08	-.01	(.0055, .0181)
Neuroticism	-.22***	.40***	-.09	-.01	(-.0136, -.0027)
Agreeableness	.06	–	–	–	–
Openness	-.03	–	–	–	–
Outcome: Emotional breakfast skipping					
Conscientiousness	.18**	-.13*	-.12*	-.10 <sup>†</sup>	(-.0077, -.0001)
Extraversion	.22***	-.14*	-.05	-.02	(-.0096, -.0003)
Neuroticism	-.22***	-.12 <sup>†</sup>	.14*	.12 <sup>†</sup>	(.0001, .0066)
Agreeableness	.06	–	–	–	–
Openness	-.03	–	–	–	–

<sup>a</sup> The indirect effects were considered significant if zero was not contained in the 95% confidence interval.

<sup>†</sup>  $p < .12$ .

\*  $p < .05$ .

\*\*  $p < .01$ .

\*\*\*  $p < .001$ .

negatively influence their appetite (Kanerva et al., 2012; Walker et al., 2015; Wang & Hu, 2015). Research has revealed that this social jet lag negatively influences self-regulation and health, and this is common for individuals with an evening preference (Knutson, Spiegel, Penev, & Van Cauter, 2007; Wang & Hu, 2015). Given the evidence for this social jet lag perspective, we posit that evening people tend to experience circadian rhythm disruptions and these disruptions negatively impact their ability to eat breakfast. Future research should directly investigate this mechanism by assessing if changes in an individual's sleep wake cycle drive the relation between personality and breakfast eating attitudes and behaviors.

The findings involving the trait of extraversion were also somewhat surprising given that some researchers have concluded that extraversion is not typically related to time-of-day preference (Adan et al., 2012). In short, this finding may be attributed to differences in personality inventories (Tsaousis, 2010) or differences in measures of circadian typology (Randler, Gomà-i-Freixanet, Muro, Knauber, & Adan, 2015). Regardless of the underlying cause of this finding, given extraversion was related to morningness in these data (see Walker et al., 2015 for a review of this finding), the fact that the extraversion models were significant is consistent with the past work that has associated extraversion with healthy eating (Elfhag & Morey, 2008). Future work should further investigate the relationship between extraversion and time-of-day preference to further determine exactly how these two constructs are related.

Finally, there are two limitations relating to the sample used in the current study. First, this study used a U.S. sample. Not surprisingly, breakfast attitudes and behaviors differ between cultures (e.g., Unusan, Sanlier, & Danisik, 2006). It is therefore important that future research extend these findings to non-U.S. populations. We also must note that average BMI of this sample was 26.23, which is classified as overweight or pre-obese (WHO, n.d.). However, the variability of BMI in this sample was large ( $SD = 6.92$ ) and this average is slightly below the U.S. national BMI average (Centers for Disease Control and Prevention [CDC], n.d.), which suggests that this sample is representative of the U.S. population. Nevertheless, future work should extend these findings to other samples and should examine samples in which the average BMI is classified as normal. Future research should also include time-of-day preference as a mediator when examining the relationship between individual differences and other eating-related behaviors. For instance, research has revealed that both personality (Cervera et al., 2003) and time-of-day preference (Schmidt & Randler, 2010) are associated with eating disorders, and future work could investigate if time-of-day preference mediates the relation between personality and specific eating disorders.

## 5. Conclusion

Overall, the findings from this research supported the prediction that time-of-day preference would mediate the relation between personality and breakfast attitudes and behaviors. By revealing that personality differences in breakfast eating attitudes and behaviors are accounted for by time-of-day preference, this work demonstrates the importance of assessing time-of-day preference when examining the relation between personality and health-related eating behaviors, particularly breakfast-related behaviors.

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