

Does the female cycle matter? Looking at aggressive intentions after social exclusion

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Abstract

Excluded people vary in their coping with social pain. The menstrual cycle has shown to moderate experiences related to pain. We therefore investigated the influence of the menstrual cycle on aggressive intentions in response to social exclusion. Results revealed no effect of the menstrual cycle alone. However when exploratory taking dispositional social anxiety into account, we found women low in social phobia to report more aggression in response to social exclusion in the luteal than in the non-luteal phase. In this phase, they indicated a similarly high aggression level than women high in social phobia who did not differ between the luteal and non-luteal phase. These findings are discussed within the framework of evolutionary adaption. (115 words)

Keywords: social exclusion; menstrual cycle; social phobia; aggression

Does the female cycle matter? Looking at aggressive intentions after social exclusion

Social exclusion hurts. In response, some people become obliging, others get violent (see Williams, 2007). The reaction varies depending on the situation, e.g. the availability of potential affiliation sources (DeWall & Bushman, 2011), the threat of specific psychological needs (Williams, 2007), or the type of social exclusion (Smart Richman & Leary, 2009). Other influencing factors are related to the excluded person, e.g. his or her self-esteem (Onoda et al., 2010) or need-to-belong (e.g., Pickett, Gardner, & Knowles, 2004). Therefore, situational as well as dispositional factors can influence the reaction after exclusion. While the latter is true for both sexes, there is a reoccurring biological factor only in women that influences behaviors: the menstrual cycle (e.g. Buser, 2012). Does it also contribute to the type of reaction in response to exclusion?

Social exclusion is a situation in which a person is being kept apart from others (Williams, 2007). It threatens fundamental needs, such as the need to belong which is a strong human motivation (Baumeister & Leary, 1995). This threat is stressful and results in negative emotional, cognitive and behavioral consequences (see Williams, 2007). Harming behavioral reactions after social exclusion include a broad spectrum, from donating less money (Twenge, Baumeister, DeWall, Ciarocco, & Bartels, 2007) to exposing others to aversive noises (Twenge, Baumeister, Tice, & Stucke, 2001).

Women have been shown to display greater stress responses to social exclusion stressors than men (Stroud, Salovey, & Epel, 2002). When investigating reactions of women it should be taken into account that studies have found the menstrual cycle to affect female experience and behavior (e.g., Buser, 2012; Gueguen, 2009; Pearson & Schipper, 2013). An interesting time frame in this regard is the infertile luteal phase, the time between ovulation and menstruation. In this phase, the female body is preparing for pregnancy regardless of an actual conception (Gilbert, 2014). From an evolutionary perspective, several motivations

occur: First, there is motivation to protect the offspring and thus to avert threatening situations (Conway et al., 2007; Flaxman & Sherman, 2000). Secondly, an aroused affiliation motivation emerges which is marked by higher concentration of progesterone (Liening, Stanton, Saini, & Schultheiss, 2010; Schultheiss, Dargel, & Rohde, 2003). It could serve to foster the relationship with a partner and the own social network to guarantee support during pregnancy (Miller, 2011; Taylor et al., 2000).

Social exclusion undermines both motivations: Not only does it threaten safety; it also frustrates the motivation for social contact. Reacting aggressively to the excluding party could endanger a women's offspring (Taylor et al., 2000), and work against establishing a supportive social network. Therefore, it seems plausible to hypothesize that women in the *luteal* phase show *decreased* aggressive intentions after social exclusion compared to women who are in a non-luteal phase. Being in a non-luteal phase, on the other hand, provides no extra motivation to be cautious as no offspring is expected and a support network is not particularly necessary.

However, the opposite pattern may occur as well: Women in the *luteal* phase could *increase* aggressive intentions compared to women in a non-luteal phase as their desire to vigorously protect the offspring is increased and their longing for social contact is especially frustrated. The combined arousal arising from a heightened need for protection and increased frustration could lead to a desire to oppose the perpetrator aggressively. In this line of reasoning, *decreasing* aggressive intentions from women in the *non-luteal* phase could also be reasonably explained: Due to the chance of conception (fertility) in this time period, those women have elevated interest in meeting potential sexual partners (Gangestad, Thornhill, & Garver, 2002; Gangestad, Simpson, Cousins, Garver-Apgar, & Christensen, 2004). As they do not need to safeguard any offspring, their behavior might be less protective and their pursuit of social contact more persistent, even in instances of social threat.

While both outcomes were plausible, we set out to test the prediction of decreased aggressive intentions in the luteal phase compared to the non-luteal phase after social exclusion. To test this hypothesis, we asked participants to report their menstrual cycle phase among a set of questionnaires. After that, exclusionary status was manipulated and participants reported their aggressive intentions. We focused on indirect rather than direct aggression as women tend to prefer this kind of behavior reducing the risk of physical injury (Griskevicius et al., 2009; Hess & Hagen, 2006; but see Archer, 2004).

Exploratory, we also investigated the moderating effect of assessed traits, *inter alia*, social phobia which has been found to moderate the effects of social exclusion: Socially anxious people experience prolonged negative effects of social exclusion (Oaten, Williams, Jones, & Zadro, 2008). After being excluded, they regard social contacts as a source for exclusion rather than social connection (Maner, DeWall, Baumeister, & Schaller, 2007) and even show a drop in progesterone (Maner, Miller, Schmidt, & Eckel, 2010). This disposition could disproportionately boost aggressive intentions towards exclusion, regardless of the menstrual cycle time frame.

In social exclusion research, aggressive and prosocial behaviors are the most studied reactions (see Wesselmann, Ren, & Williams, 2015). Theoretical considerations (e.g., Williams, 2007) and recent meta-analyses (e.g., Gerber & Wheeler, 2009) conclude that these behaviors are determined by different factors why prosocial behavior cannot simply be treated as the opposite of aggressive behavior but instead as a distinct kind of behavior directed at a different psychological goal. Research by Sommer and Bernieri (2014) encourages this view by showing that both reactions can co-occur simultaneously. Therefore, we also investigated prosocial intentions.

Method

We report how we determined our sample size, all data exclusions, all manipulations, and all relevant measures in the study (Simmons, Nelson, & Simonsohn, 2012).

Sample

Two-hundred-and-eighty-one female participants were recruited for research credit and a possibility to win a voucher for volunteering. Of these, 126 participants were on birth control pills and 12 participants could not clearly be assigned to one of the investigated menstrual cycle phases. To ensure sufficient impact of our manipulation, 13 participants who did not work properly on the manipulation task (see below) were not included in the analyses. The resulting sample consisted of 130 participants (age: $M = 25.29$ years, $SD = 6.99$), mostly students (71.5%). We oriented our sample size planning on recent exclusion studies using a similar design (e.g., Pfundmair et al., 2015); we neither did optional stopping nor had a power-based sampling plan.

Design and Procedure

The study was based on a 2 (exclusionary status: exclusion vs. inclusion) \times 2 (menstrual cycle phase: luteal vs. non-luteal) between-subjects design.

Female participants were recruited in social networks and newsletters to participate in an online survey on influences of their menstrual cycle. Participants completed demographic measures including questions about their menstrual cycle and the social phobia scale among a set of other personality questionnaires in the following order: Need to Belong Scale (Leary et al., 2005), Social Phobia Scale and Social Interaction Anxiety Scale (Mattick & Clarke, 1998), Rejection Sensitivity Questionnaire (Berenson et al., 2009), short version of the Big Five Inventory (Rammstedt & John, 2007), Rosenberg Self-Esteem Scale (Rosenberg, 1965), Inclusion of Other in the Self Scale (Aron, Aron, & Smollan, 1992) and parts of the Unified Motive Scales-3 (Schönbrodt & Dieslich, 2012; see our supplemental online material for further details of the assessed personality measures). After that, they were randomly assigned to one of two essay

conditions to manipulate exclusionary status. Subsequently, they completed the survey including items on manipulation checks and aggressive as well as prosocial intentions. The study was part of a larger survey in which variables irrelevant for the present study were assessed. Finally, participants were thanked and debriefed.

Measures

Menstrual cycle phase. To allow splitting the sample into women in the luteal cycle phase versus women in a non-luteal phase, participants were asked to look up the first day of their last menses and indicate how much days have passed since then. For visualization, a regular 28-day menstrual cycle was displayed on the screen. Women who indicated at least 16 days having passed since the onset of their last menses were identified to be in their luteal phase, the others were identified to be in a non-luteal phase (see Maner & Miller, 2014, Pawlowski & Jasienska, 2004, or Gangestad et al., 2004, for a similar classification). To ensure further accuracy, we asked participants how sure they were about their report; those participants were excluded who indicated that they might be more than three days off with their report, as well as subjects who could not be assigned to one of the investigated menstrual cycle phases due to being unsure about the exact day of the onset of their last menses. Fifty-three women (40.8%) were classified as in their luteal phase and 77 women (59.2%) in a non-luteal phase.

Social phobia. Participants answered 20 items of the Social Phobia Scale (Mattick & Clarke, 1998) on a 0 = *not at all* to 4 = *extremely* response scale.

Exclusionary status. Participants were asked to remember vividly and write about a previous exclusion or inclusion experience from their life. This method of creating exclusion is an established social exclusion paradigm and evokes responses comparable to interpersonal ones (e.g., Maner et al., 2007; Pickett et al., 2004). Participants who entered no text or stated that they cannot remember a situation were excluded from the analyses ($n = 13$).

Manipulation checks. Threat of fundamental needs, a typical measure of social exclusion (see Williams, 2007), was assessed by the 20-item Need Threat Scale (Jamieson, Harkins, & Williams, 2010) to be answered on a 1 = *not at all* to 5 = *completely* response scale. Furthermore, participants answered the item “Please indicate how excluded you felt” on a 1 = *not at all* to 5 = *extremely* response scale, as well as items on the severity and pleasantness of the experienced situation on a 1 = *not severe at all / unpleasant* to 5 = *very severe / very pleasant* response scale. These three items were collapsed into a manipulation check scale. Further, mood was assessed by the Self-Assessment Manikin (SAM) from Bradley and Lang (1994). In this non-verbal scale, a manikin depicts five different grades of the mood dimensions valence, arousal and dominance.

Aggressive intentions. In one item, participants were asked to which extent they would show vengeful behavior if they had the chance to change the behavior they had shown after the remembered exclusion/inclusion situation on a 1 = *not at all* to 5 = *definitely* response scale. To ensure that participants were thinking of indirect aggression „vengeful behavior” was specified as aggressive, malicious behavior, e.g. spreading rumors, putting someone in bad light.

Prosocial intentions. In one item, participants were asked to which extent they would show prosocial behavior (i.e., cooperative and positive behavior, e.g. showing willingness to help) if they had the chance to change the behavior they had shown after the remembered exclusion/inclusion situation on a 1 = *not at all* to 5 = *definitely* response scale.

Results

A full reporting of our descriptive statistics and results can be found in Tables 1, 2, 3 and 4. For calculation of many further exploratory analyses, see our supplemental online material. The study’s data file is openly accessible under the following repository:

<https://osf.io/aqrm9/>.

(Table 1 and 2 about here)

Manipulation checks. Participants in the exclusion condition reported feeling more excluded and experiencing their situation to be more severe and less pleasant ($M = 4.13$, $SD = 0.70$) than participants in the inclusion condition ($M = 1.60$, $SD = 0.70$), $t(128) = -20.58$, $p < .001$, $d = -3.61$, 95% $CI_d = [-4.17, -3.06]$. Furthermore, excluded participants felt more threatened in their fundamental needs ($M = 3.57$, $SD = 0.67$) than included participants ($M = 1.98$, $SD = 0.47$), $t(119) = -15.75$, $p < .001$, $d = -2.75$, 95% $CI_d = [-3.23, -2.27]$. Lastly, excluded participants had a worse mood concerning valence ($M = 2.33$, $SD = 0.88$) than included participants ($M = 4.27$, $SD = 0.94$), $t(128) = 12.20$, $p < .001$, $d = 2.13$, 95% $CI_d = [1.70, 2.56]$. There were no significant differences concerning the arousal, $t(118) = -1.45$, $p = .150$, nor the dominance dimension, $t(125) = -0.01$, $p = .993$.

We also conducted multiple linear regressions entering exclusionary status (contrast coded as -1 inclusion and +1 exclusion) and menstrual cycle (contrast coded as -1 non-luteal and +1 luteal) as independent variables, and each of the manipulation check variables as dependent variable. These analyses revealed significant main effects of exclusionary status, all $ps < .001$, for every variable except the dominance and arousal dimension of mood, $ps \geq .214$, but neither a main effect of cycle phase nor significant interaction effects, $ps \geq .333$, see Table 3.

(Table 3 about here)

Interplay of exclusionary status and menstrual cycle on aggressive intentions. To test our hypothesis we calculated a multiple linear regression in SPSS entering exclusionary status (contrast coded as -1 inclusion and +1 exclusion) and menstrual cycle (contrast coded as -1 non-luteal and +1 luteal) as independent variables, and aggressive intentions as dependent variable. There was a significant main effect of exclusionary status, $b = 0.27$, $SE_b = 0.08$, $t(126) = 3.27$, $p = .001$, 95% $CI_b = [0.11, 0.43]$: Excluded participants reported more aggres-

sive intentions ($M = 1.67$, $SD = 1.13$) than included participants ($M = 1.17$, $SD = 0.56$). The analyses, however, neither revealed a significant main effect of menstrual cycle, $b = 0.03$, $SE_b = 0.08$, $t(126) = 0.39$, $p = .696$, 95% $CI_b = [-0.13, 0.19]$, nor an interaction, $b = 0.08$, $SE_b = 0.08$, $t(126) = 0.94$, $p = .349$, 95% $CI_b = [-0.09, 0.24]$.

We also calculated a Bayesian multiple linear regression in ‘JASP’ (JASP Team, 2016) with default settings (prior r scale = 0.354) entering the same variables. The significant main effect of exclusionary status is represented by a BF_{10} of 15.13 suggesting that our data are 15.13 times more likely to be observed under the model including exclusionary status as predictor than under the null model without any predictors; the non-significant main effect of menstrual cycle corresponds to a BF_{10} of 0.19 suggesting that the data is 1:0.19 in favor of a model without including the menstrual cycle as predictor rather than a model with it. Adding the non-significant interaction of exclusionary status and menstrual cycle in the model is represented by a BF_{10} of 1.66 suggesting the data to be 1.66 times more likely observed under a model with the interaction *and* the corresponding main effects than under a model without any predictors. Comparing only the effect of the two-way-interaction with a null-model that includes the corresponding main effects as predictors, the $BF_{Inclusion}$ is 0.44. Averaged over all possible models with the two independent variables, the effect of two-way-interaction has a $BF_{Inclusion}$ of 0.33. These results suggest that null-models with main-effects but without the two-way-interaction are a little bit more likely than models that include the two-way-interaction.

Interplay of exclusionary status and menstrual cycle on prosocial intentions. Exploratory, we calculated another multiple linear regression in SPSS entering exclusionary status (contrast coded as -1 inclusion and +1 exclusion) and menstrual cycle (contrast coded as -1 luteal and +1 non-luteal) as independent variables, but with prosocial behavior as dependent variable. Again there was a significant main effect of exclusionary status, $b = -0.45$,

$SE_b = 0.12$, $t(126) = -3.86$, $p < .001$, 95% $CI_b = [-0.69, -0.22]$: Excluded participants reported less prosocial behavior ($M = 3.18$, $SD = 1.35$) than included participants ($M = 4.10$, $SD = 1.23$). As with aggressive intentions there neither was a main effect of menstrual cycle, $b = 0.08$, $SE_b = 0.12$, $t(126) = 0.70$, $p = .486$, 95% $CI_b = [-0.15, 0.32]$, nor an interaction, $b = -0.05$, $SE_b = 0.12$, $t(126) = -0.39$, $p = .694$, 95% $CI_b = [-0.28, 0.19]$.

Interplay of exclusionary status, menstrual cycle phase, and social phobia on aggressive intentions. In another exploratory analysis, we used Hayes' (2013) PROCESS tool (model 3), entering exclusionary status (contrast coded as -1 inclusion and +1 exclusion), menstrual cycle (contrast coded as -1 non-luteal and +1 luteal), as well as social phobia (standardized) as independent variables and aggressive intentions as dependent variable.

(Table 4 about here)

The regression analysis revealed again the significant main effect of exclusionary status, $b = 0.28$, $SE_b = 0.08$, $t(122) = 3.48$, $p < .001$, 95% $CI_b = [0.12, 0.44]$, $f^2 = 0.10$. Moreover, a significant exclusionary status \times menstrual cycle phase \times social phobia interaction emerged, $b = -0.17$, $SE_b = 0.08$, $t(122) = -2.13$, $p = .035$, 95% $CI_b = [-0.33, -0.01]$, $f^2 = 0.04$. To break down this interaction, we examined the conditional effect of the menstrual cycle phase \times social phobia interaction for the inclusion vs. exclusion condition separately: The conditional effect was not significant for included participants, $b = 0.11$, $SE_b = 0.11$, $t(122) = 1.01$, $p = .316$, 95% $CI_b = [-0.11, 0.33]$, but marginally significant for excluded participants, $b = -0.24$, $SE_b = 0.12$, $t(122) = -1.97$, $p = .052$, 95% $CI_b = [-0.47, 0.002]$. We therefore broke down the conditional effect of cycle phase at 1 SD above and below the mean value of social phobia: In response to exclusion, participants low in social phobia reported an intention to react more aggressively in the luteal phase (predicted $M = 1.89$ for -1 SD below the mean of social phobia) than in a non-luteal phase ($M = 1.21$), $b = 0.34$, $SE_b = 0.17$, $t(122) = 2.02$, $p = .046$, 95% $CI_b = [0.01, 0.68]$. On the other hand, participants high in social phobia did not

differ in their aggressive intentions after social exclusion between the luteal and the non-luteal period, $b = -0.13$, $SE_b = 0.16$, $t(122) = -0.79$, $p = .429$, 95% $CI_b = [-0.45, 0.19]$. We moreover examined the conditional effect of social phobia at the luteal vs. non-luteal phase. During the luteal phase, participants low and high in social phobia did not differ in their aggressive intentions after social exclusion, $b = -0.07$, $SE_b = 0.20$, $t(122) = -0.34$, $p = .731$, 95% $CI_b = [-0.46, 0.32]$. During the non-luteal period, on the other hand, participants low in social phobia showed less aggressive intentions (predicted $M = 1.21$ for -1 SD below the mean of social phobia) in response to exclusion than participants high in social phobia ($M = 2.01$ for 1 SD above the mean of social phobia), $b = 0.40$, $SE_b = 0.14$, $t(122) = 2.97$, $p = .004$, 95% $CI_b = [0.13, 0.67]$, see Figure 1.

(Figure 1 about here)

As p -values are not clearly interpretable in exploratory research (see DeGroot, 1956/2014) we also calculated a Bayesian multiple linear regression with default settings in ‘JASP’ (JASP Team, 2016) entering the same variables. The significant main effect of exclusionary status is again represented by a BF_{10} of 15.13. The significant exclusionary status \times menstrual cycle phase \times social phobia is represented by a BF_{10} of 1.93, suggesting that the data is 1.93 times more likely to be observed under a model including the three-way interaction and the corresponding main effects and lower-order interactions as predictors, than under a null model without any predictors. Averaged over all possible models with the three independent variables, the effect of three-way-interaction has a $BF_{Inclusion}$ of 0.62; however comparing only the effect of the three-way-interaction with a null-model including the corresponding main effects and lower-order interactions as predictors, the $BF_{Inclusion}$ is 2.62.

Discussion

In our study, the menstrual cycle alone did not impact aggressive intentions after exclusion. However, exploratory analyses revealed a combined influence of the menstrual cy-

cle and social phobia: When recalling an exclusion experience, women high in social phobia did not differ in their aggressive intentions between luteal and non-luteal periods; they were overall high in aggressive intentions. Women low in social phobia, however, appeared to be more sensitive to changes in their cycle phase: They indicated more aggressive intentions in their luteal than in their non-luteal phase; this level of aggressive intentions was comparably high than that of women high in social phobia. In their non-luteal phase, on the other hand, women low in social phobia showed less aggression than any of the other groups.

This exploratory result contradicts the assumption that the luteal phase is associated with less aggressive intentions after exclusion but supports the opposite pattern when women have a low level of social phobia, or in other words, when women were not afraid of social encounters. This pattern makes sense under an evolutionary perspective: In the luteal cycle phase, the female body is preparing for pregnancy (Gilbert, 2014) and thus seeks to avert threat for offspring and mother (Conway et al., 2007; Flaxman & Sherman, 2000). Social exclusion is a threatening situation (Williams, 2007). Rather than approaching the excluding party or at least refraining from aggression, women in this cycle phase seem to aggressively oppose social exclusion to protect themselves and their offspring from this threat. In the non-luteal period, on the other hand, women become fertile. The re-establishment of social connection to increase mating possibilities and conception chances (see Gangestad et al., 2002, 2004) may then be more important than opposing against the excluding persons. Further, the pursuit of social contact may be more persistent, even in instances of social threat why less aggression might be displayed. Even if the excluding party is female, encountering potential partners is more probable when having a larger network. This reasoning, though, only applies for women low in social phobia.

Women high in social phobia, on the other hand, particularly suffer from social exclusion (e.g., Oaten et al., 2008). Their tendency to experience fear of social interactions and

judgments by others (Mattick & Clarke, 1998) might superimpose differential reactions with regard to their menstrual cycle because they might appraise exclusion as highly dangerous irrespective of the circumstances. This is in accordance to results from Maner et al. (2010) who observed a drop in progesterone for women high in social phobia after being excluded: Progesterone is closely related to affiliative behavior (Liening et al., 2010; Schultheiss et al., 2003). The drop in progesterone for women high in social phobia matches their pronounced aggressive intentions in this study.

As, however, all of the discussed results are exploratory in nature, they must be interpreted cautiously and further tested in another study with a larger number of participants to achieve needed statistical power. To check if this preliminary finding not only replicates but also generalizes, future studies should be conducted with different types of operationalization of social exclusion. “Cyberball”, for example, would also allow for controlling of gender effects of the excluding party (see Hartgerink, van Beest, Wicherts, & Williams, 2015, for an overview) which might be a key determinant of our findings.

Although our study opens up new perspectives in exclusion research by taking the menstrual cycle into account, some limitations should be addressed: First, some literature shows that the menstrual cycle effect on women’s mate preferences might be due to research artifacts (Wood, Kressel, Joshi, & Louie, 2014). Accordingly, we did not succeed in showing a direct effect of the menstrual cycle on social exclusion. However, other research (Riley III, Robinson, Wise, & Price, 1999) confirms a menstrual cycle effect at least on physical pain perception: Women in the follicular phase demonstrated a higher pain threshold than women in later phases. In this regard studies also find moderating effects of social variables on pain sensitivity variations across the female cycle (Vigil, Strenth, Trujillo, & Gangestad, 2014; Vigil et al., 2015). As social exclusion is highly related to physical pain (Eisenberger, Liebermann, & Williams, 2003), we encourage the examination of the menstrual cycle in

relation with social exclusion, particularly within the context of moderating dispositions. Second, using self-reported menstrual cycle data is not as accurate as measuring actual hormone levels (see Gangestad et al., 2016 for a recent overview of validity of counting methods). Still, this method seems to be valid as it is also used by other researchers (e.g., Buser, 2012; Gueguen, 2009; Pearson & Schipper, 2013). Moreover, the goal was not to discriminate all of the menstrual cycle phases in detail but only between the luteal and the non-luteal period. We, however, urge future research to additionally assess the participants' typical menstrual cycle length to increase validity by estimating progesterone levels (e.g., Puts, 2006; Garver-Apgar, Gangestad, & Thornhill, 2008). Third, the measurement of the participant's aggression was a single-item self-report about how they would behave in the remembered situation if they could change their behavior today. This operationalization could result in overestimation of one's own behavior or social desirability effects. Moreover, the indicated behavior could be influenced by the participants' satisfaction with the real outcome of the situation. As one-item variables usually have low reliability, the use of a multi-item measure of actual behavior in future research would allow for more confidence in the conclusions (e.g. Griskevicius et al., 2009). Future research should also examine possible differences between direct and indirect aggression as well as possible influences of the gender and closeness of the excluding party as, following the evolutionary explanation, exclusion should have a different impact depending on the source's relevance. Fourth, the social phobia scale was originally developed to measure pathological signs of social phobia (Mattick & Clarke, 1998). Consistently, the mean value of social phobia is relatively low in the present sample of (probably predominantly healthy) students ($M = 0.65$, $SD = 0.50$). Still, other research including healthy individuals (Maner et al., 2010) has used the scale in a similar manner. Therefore, we feel confident that the tendency to experience social situations as more or less terrifying – although not pathologic – is being represented in our measure.

In sum, this study contributes to exclusion research taking into account important person and context variables. Understanding the influence of the menstrual cycle in interaction with a disposition might move us to a more holistic biopsychosocial model in the context of social exclusion. Further research needs to carefully assess in which way the associations found in this study can be replicated. The field can then move forward by more closely investigating the underlying processes driving these differences in interpersonal behavior.

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Table 1

Correlations, reliability coefficients and descriptive statistics for the study variables

Variables	1	2	3	4	<i>M</i>	<i>SD</i>
1. Social phobia	(.89)				0.66	0.50
2. Aggressive intentions	.13	—			1.43	0.93
3. Manipulation check scale	.05	.33***	(.91)		2.91	1.45
4. Need threat	.09	.30***	.86***	(.95)	2.80	0.99

Note. $N = 130$. Reliability coefficients (Cronbach's α) are listed in the diagonal.

* $p < .05$, ** $p < .01$, *** $p < .001$.

Table 2

Descriptive statistics for the study variables as a function of exclusionary status and menstrual cycle phase

	Exclusion				Inclusion			
	Non-luteal phase ($n = 45$)		Luteal phase ($n = 22$)		Non-luteal phase ($n = 32$)		Luteal phase ($n = 31$)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Aggressive Intentions	1.60	1.16	1.82	1.10	1.22	0.55	1.13	0.56
Prosocial intentions	3.16	1.38	3.23	1.31	3.97	1.28	4.23	1.18
Mood: Valence	2.36	0.88	2.27	0.88	4.28	0.89	4.26	1.00
Mood: Arousal	3.67	1.00	3.45	1.22	3.38	1.39	3.19	1.33
Mood: Dominance	2.89	1.25	3.14	1.52	3.03	1.06	2.90	1.08
Need Threat	3.55	0.71	3.61	4.08	1.95	0.44	2.02	0.50
Manipulation check	4.16	0.71	4.08	0.67	1.52	0.62	1.69	0.78

Table 3

Results for the multiple regression analysis with exclusionary status, menstrual cycle and the interaction of both as predictors of the manipulation check variables

	Manipulation check scale			Need threat		
	<i>b</i> [95% CI for <i>b</i>] unstandardized	<i>t</i>	<i>p</i>	<i>b</i> [95% CI for <i>b</i>] unstandardized	<i>t</i>	<i>p</i>
Constant	2.860 [2.734, 2.986]	44.996	.000	2.781 [2.676, 2.886]	52.533	.000
Exclusionary status	1.256 [1.130, 1.381]	19.753	.000	0.799 [0.694, 0.904]	15.089	.000
Menstrual cycle phase	0.022 [-0.104, 0.148]	0.344	.731	0.032 [-0.073, 0.137]	0.602	.548
Exclusionary status × menstrual cycle phase	-0.062 [-0.188, 0.064]	-0.972	.333	-0.005 [-0.110, 0.100]	-0.097	.923
<i>R</i> ²	.770			.656		
<i>F</i>	140.5			80.08		
	.000			.000		
	Mood: Pleasure			Mood: Dominance		
	<i>b</i> [95% CI for <i>b</i>] unstandardized	<i>t</i>	<i>p</i>	<i>b</i> [95% CI for <i>b</i>] unstandardized	<i>t</i>	<i>p</i>
Constant	3.292 [3.128, 3.456]	39.810	.000	2.990 [2.772, 3.208]	27.125	.000
Exclusionary status	-0.978 [-1.141, -0.814]	-11.824	.000	0.023 [-0.195, 0.241]	0.206	.837

Menstrual cycle phase	-0.027 [-0.190, 0.137]	-0.321	.749	0.030 [-0.188, 0.248]	0.271	.787
Exclusionary status × menstrual cycle phase	-0.015 [-0.179, 0.149]	-0.180	.857	0.094 [-0.124, 0.312]	0.852	.396
<i>R</i> ²	.538			0.006		
<i>F</i>	48.96	.000		0.262	.853	

Mood: Arousal

	<i>b</i> [95% CI for <i>b</i>] unstandardized	<i>t</i>	<i>p</i>
Constant	3.422 [3.204, 3.641]	30.960	.000
Exclusionary status	0.138 [-0.081, 0.357]	1.250	.214
Menstrual cycle phase	-0.098 [-0.317, 0.120]	-0.890	.375
Exclusionary status × menstrual cycle phase	-0.008 [-0.226, 0.211]	-0.069	.945
<i>R</i> ²	.023		
<i>F</i>	0.968	.410	

Table 4

Results for the multiple regression analysis with exclusionary status, menstrual cycle, social phobia and all interaction terms as predictors of aggressive intentions

	Aggressive intentions		
	<i>b</i> [95% CI for <i>b</i>] unstandardized	<i>t</i>	<i>p</i>
Constant	1.436 [1.277, 1.596]	17.834	.000
Exclusionary status	0.280 [0.121, 0.440]	3.478	.001
Menstrual cycle phase	0.033 [-0.127, 0.192]	0.405	.687
Social phobia	0.073 [-0.089, 0.234]	0.893	.374
Exclusionary status × menstrual cycle phase	0.074 [-0.086, 0.233]	0.914	.363
Exclusionary status × social phobia	0.095 [-0.067, 0.256]	1.163	.247
Menstrual cycle phase × social phobia	-0.062 [-0.223, 0.099]	-0.761	.448
Exclusionary status × menstrual cycle phase × social phobia	-0.173 [-0.334, -0.012]	-2.127	.035
<i>R</i> ²	.149		
<i>F</i>	3.042	.006	

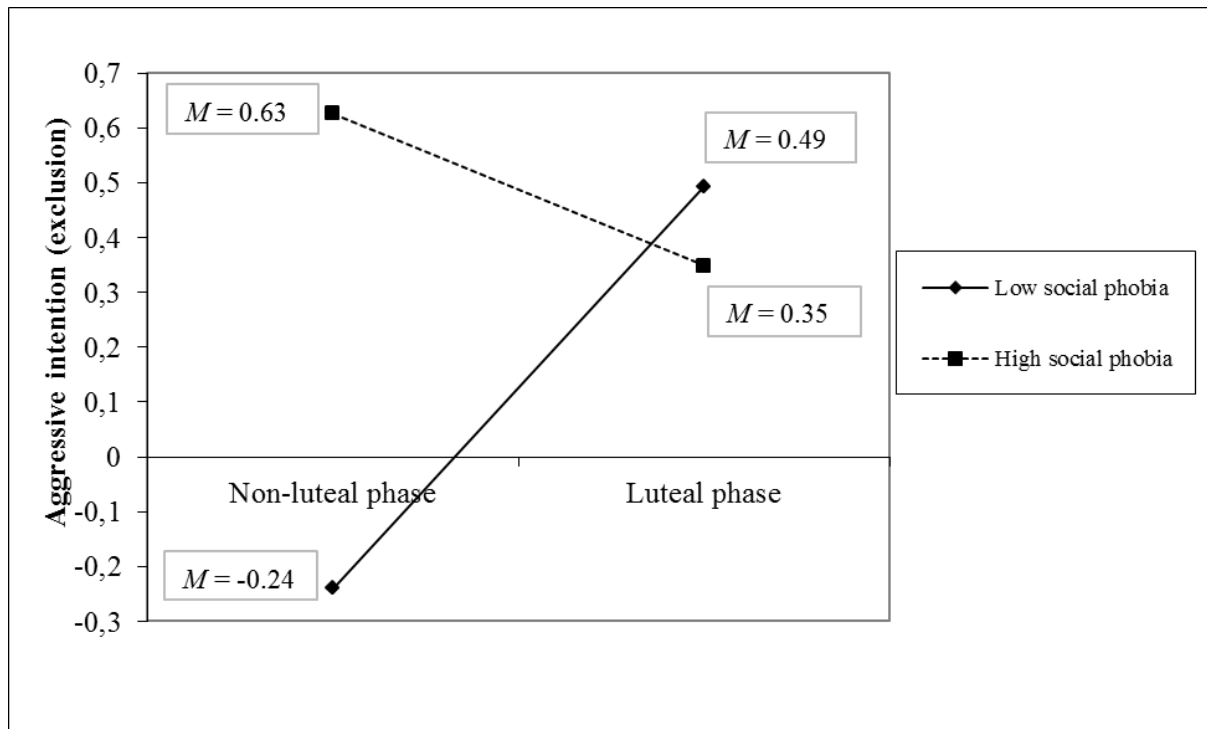


Figure 1. Aggressive intentions (standardized) in response to social exclusion as a function of menstrual cycle phase and social phobia (plotted at 1 *SD* above vs. below the mean).

Does the female cycle matter? Looking at aggressive intentions after social exclusion

Electronic Supplementary Material

Electronic Supplementary Material

The following supplementary material includes information on additionally surveyed questionnaires mentioned in the original manuscript and further exploratory analyses on these measures.

Additional measures

Big five personality traits. Participants answered 11 items of the short version of the Big Five Inventory (Rammstedt & John, 2007) on a 1 = *disagree strongly* to 5 = *agree strongly* response scale.

Closeness to friends and family. To assess closeness to others, the Inclusion of Other in the Self scale (Aron, Aron & Smollan, 1992) was adapted: Participant should pick one out of seven pictures (circles more or less overlapping which represented them and their friends or family) to answer eight items that were cumulated: “How close are you to your family?”, “How close are you to your friends?”, “How much do you have in common with your family?”, “How much do you have in common with your friends?”, “How important is your family to you?”, “How important are your friends to you?”, “How similar are you to your family?“, “How similar are you to your friends?“.

Explicit motives. To assess their explicit affiliation and power motive participants answered 11 items of the Unified Motive Scales-3 on a 6-point response scale with 1 = *strongly disagree* or *not important to me* and 6 = *strongly agree* or *extremely important to me* depending on the item (Schönbrodt & Dieslich, 2012).

Need to belong. Participants answered 10 items of the Need to Belong Scale (Leary, Kelly, Cottrell, & Schreindorfer, 2013) on a 1 = *strongly disagree* to 5 = *strongly agree* response scale.

Rejection sensitivity. Participants answered 18 items of the Rejection Sensitivity Questionnaire (Berenson et al., 2009) on a 6-point response scale with 1 = *not concerned at all* or *very unlikely* to 6 = *very concerned* or *very likely* depending on the item.

Self-esteem. Participants answered 10 items of the Rosenberg Self-Esteem Scale (Rosenberg, 1965) on a 0 = *strongly disagree* to 3 = *strongly agree* response scale.

Social interaction anxiety. Participants answered 20 items of the Social Interaction Scale (Mattick & Clarke, 1998) on a 0 = *not at all* to 4 = *extremely* response scale.

Results of further exploratory analyses: Interplay of exclusionary status, menstrual cycle phase, and other variables.

A full reporting of the descriptive statistics for all study variables can be found in Tables 1 and 2, the results of the additional exploratory analyses are shown in Tables 3 and 4.

We used Hayes' (2013) PROCESS tool entering exclusionary status (contrast coded as -1 inclusion and +1 exclusion), menstrual cycle (contrast coded as -1 fertile and +1 infertile), as well as the other measures (standardized) as independent variables and aggressive behavior or prosocial behavior as dependent variable. We are aware of the multiple testing problem that comes with the great number of tests performed and the subsequent problem of false-positives not being controlled in the long run. Still we report uncorrected p -values, as it is unclear for how many tests one would have to correct as exploratory analyses have no pre-determined number of tests to correct for. For this reason, p -values are not sensible to interpret in exploratory research (see DeGroot, 1956/2014) and we do not recommend interpreting the reported uncorrected p -values, but rather examine the parameter estimates to get an idea about possible hypotheses for further studies.

Table 1
Correlations and reliability coefficients for the study variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Dependent variables																				
1. Aggressive intentions	–																			
2. Prosocial intentions	-.27**	–																		
3. Mood: Valence	-.24**	.23**	–																	
4. Mood: Arousal	.03	-.16	-.02	–																
5. Mood: Dominance	-.03	-.06	.07	.07	–															
6. Need Threat	.30***	-.33***	-.76***	.03	-.08	(.95)														
7. Manipulation check scale	.33***	-.36***	-.79***	.02	-.03	.86***	(.91)													
Other variables																				
8. Agreeableness	-.13	.02	-.02	.07	.00	-.07	.03	(.44)												
9. Conscientiousness	-.01	.12	-.00	.03	-.07	-.09	-.10	.08	(.50)											
10. Extraversion	-.16	.03	.03	-.06	.10	-.04	.04	.28**	.20	(.83)										
11. Neuroticism	.07	-.06	-.10	-.00	-.12	.28**	.18*	-.03	-.09	-.29***	(.73)									
12. Openness	-.17*	.06	.08	-.15	.02	-.11	-.08	.20*	.06	.06	-.03	(.70)								
13. Closeness (IOS)	-.06	.02	-.16	-.03	.00	-.01	.08	.29***	.21*	.16	-.22*	.10	(.83)							
14. Affiliation motive	.02	.10	-.13	-.25**	-.10	.05	.14	.17	.12	.22*	.12	.13	.31***	(.64)						
15. Power motive	.06	.05	.01	-.02	.05	-.04	.00	-.27**	.10	-.00	.17	-.08	-.13	-.10	(.65)					
16. Need to belong	.03	-.03	-.24**	-.11	-.24**	.27**	.30***	.09	.02	.09	.33***	-.00	.13	.61***	.00	(.82)				
17. Rejection Sensitivity	.07	-.05	-.02	.05	-.29***	.10	.02	-.04	-.20*	-.27**	.33***	-.03	-.27**	-.12	.08	.20*	(.83)			
18. Self-esteem	-.06	.05	.02	.01	-.29***	-.15	-.10	.08	.26**	.19*	-.55***	.05	.35***	-.01	-.13	-.29**	-.47**	(.91)		
19. Social phobia	.13	-.04	-.02	-.01	-.23**	.09	.05	.07	-.25**	-.38***	.55***	.06	-.10	.02	.06	.21*	.51***	-.53***	(.89)	
20. Social interaction anxiety	.12	.01	.06	-.05	-.22*	.00	-.04	-.21	-.30***	-.65***	.47***	-.01	-.27**	-.06	.12	.12	.52***	-.46***	.74***	(.85)

Note. $N = 130$. Reliability coefficients (Cronbach's α) are listed in the diagonal.

* $p < .05$, ** $p < .01$, *** $p < .001$.

Table 2

Descriptive statistics for the study variables as a function of exclusionary status and menstrual cycle phase

Variablen	Exclusion				Inclusion			
	Non-luteal phase (<i>n</i> = 45)		Luteal phase (<i>n</i> = 22)		Non-luteal phase (<i>n</i> = 32)		Luteal phase (<i>n</i> = 31)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Dependent variables								
1. Aggressive intentions	1.60	1.16	1.82	1.10	1.22	0.55	1.13	0.56
2. Prosocial intentions	3.16	1.38	3.23	1.31	3.97	1.28	4.23	1.18
3. Mood: Valence	2.36	0.88	2.27	0.88	4.28	0.89	4.26	1.00
4. Mood: Arousal	3.67	1.00	3.45	1.22	3.38	1.39	3.19	1.33
5. Mood: Dominance	2.89	1.25	3.14	1.52	3.03	1.06	2.90	1.08
6. Need Threat	3.55	0.71	3.61	4.08	1.95	0.44	2.02	0.50
7. Manipulation check	4.16	0.71	4.08	0.67	1.52	0.62	1.69	0.78
Other variables								
8. Agreeableness	3.63	0.78	3.62	0.59	3.38	0.73	3.85	0.64
9. Conscientiousness	3.32	0.90	3.50	0.82	3.52	0.63	3.39	0.81
10. Extraversion	3.07	1.15	3.16	0.98	2.92	1.04	2.97	1.07
11. Neuroticism	3.17	1.12	3.57	0.86	3.00	0.90	2.89	1.08
12. Openness	3.80	1.06	3.84	1.08	3.64	1.07	4.21	0.86
13. Closeness (IOS)	5.16	0.93	5.06	0.89	4.81	1.13	5.12	0.82
14. Affiliation motive	4.20	0.65	4.44	0.54	3.92	0.71	4.43	0.68
15. Power motive	3.18	0.69	3.44	0.69	3.59	0.90	2.85	0.67
16. Need to belong	3.45	0.56	3.60	0.63	3.14	0.58	3.42	0.54
17. Rejection Sensitivity	8.19	3.62	8.02	3.93	8.01	4.51	8.69	3.76
18. Self-esteem	3.04	0.59	3.04	0.66	3.06	0.58	3.05	0.60
19. Social phobia	0.64	0.49	0.69	0.49	0.58	0.48	0.73	0.55
20. Social interaction anxiety	2.02	0.69	2.05	0.65	2.16	0.69	2.17	0.69

Note. *N* = 130.

Table 3

Results for the multiple regression analysis with exclusionary status, menstrual cycle, other variables and all interaction terms as predictors of aggressive behavior

	Aggressive intentions		
	<i>b</i> [95% CI for <i>b</i>] unstandardized	<i>t</i>	<i>p</i>
Agreeableness			
Constant	1.439 [1.274, 1.604]	17.273	.000
Exclusionary status	0.273 [0.108, 0.438]	3.279	.001
Menstrual cycle phase	0.028 [-0.137, 0.192]	0.330	.742
Agreeableness	-0.162 [-0.340, 0.015]	-1.810	.073
Exclusionary status × menstrual cycle phase	0.081 [-0.084, 0.246]	0.977	.330
Exclusionary status × agreeableness	-0.190 [-0.368, -0.013]	-2.121	.036
Menstrual cycle phase × agreeableness	-0.078 [-0.255, 0.100]	-0.865	.389
Exclusionary status × menstrual cycle phase × social phobia	-0.104 [-0.281, 0.074]	-1.156	.250
<i>R</i> ²	.130		
<i>F</i>	2.605		.015
Conscientiousness			
Constant	1.448 [1.284, 1.611]	17.498	.000
Exclusionary status	0.278 [0.114, 0.442]	3.362	.001
Menstrual cycle phase	0.032 [-0.131, 0.196]	0.389	.698
Conscientiousness	-0.045 [-0.218, 0.128]	-0.511	.610
Exclusionary status × menstrual cycle phase	0.078 [-0.085, 0.242]	0.947	.346
Exclusionary status × conscientiousness	0.024 [-0.149, 0.197]	0.276	.783
Menstrual cycle phase × conscientiousness	-0.123 [-0.296, 0.050]	-1.403	.163
Exclusionary status × menstrual cycle phase × conscientiousness	-0.028 [-0.201, 0.145]	-0.324	.747
<i>R</i> ²	.101		
<i>F</i>	1.954		.067

Table 3 continued

Extraversion			
Constant	1.465 [1.309, 1.622]	18.540	.000
Exclusionary status	0.286 [0.129, 0.442]	3.616	.000
Menstrual cycle phase	0.041 [-0.115, 0.198]	0.524	.601
Extraversion	-0.195 [-0.358, -0.033]	-2.378	.019
Exclusionary status × menstrual cycle phase	0.099 [-0.058, 0.255]	1.251	.213
Exclusionary status × extraversion	-0.224 [-0.386, -0.061]	-2.725	.007
Menstrual cycle phase × extraversion	-0.159 [-0.322, 0.003]	-1.942	.055
Exclusionary status × menstrual cycle phase × extraversion	0.004 [-0.158, 0.167]	0.053	.958
<i>R</i> ²		.178	
<i>F</i>		3.766	.001
Neuroticism			
Constant	1.441 [1.272, 1.609]	16.941	.000
Exclusionary status	0.295 [0.126, 0.463]	3.465	.001
Menstrual cycle phase	0.056 [-0.113, 0.224]	0.652	.516
Neuroticism	-0.068 [-0.245, 0.109]	-0.762	.448
Exclusionary status × menstrual cycle phase	0.090 [-0.078, 0.258]	1.059	.292
Exclusionary status × neuroticism	0.125 [-0.052, 0.301]	1.398	.165
Menstrual cycle phase × neuroticism	-0.043 [-0.220, 0.133]	-0.485	.628
Exclusionary status × menstrual cycle phase × neuroticism	-0.161 [-0.337, 0.016]	-1.798	.075
<i>R</i> ²		.135	
<i>F</i>		2.727	.012

Table 3 continued

Openness			
Constant	1.432 [1.276, 1.587]	12.238	.000
Exclusionary status	0.263 [0.107, 0.418]	3.344	.001
Menstrual cycle phase	0.012 [-0.143, 0.168]	0.157	.875
Openness	-0.168 [-0.325, 0.010]	-2.103	.038
Exclusionary status × menstrual cycle phase	0.094 [-0.062, 0.249]	1.191	.236
Exclusionary status × openness	-0.302 [-0.459, -0.144]	-3.784	.000
Menstrual cycle phase × openness	-0.150 [-0.308, 0.008]	-1.883	.062
Exclusionary status × menstrual cycle phase × openness	-0.139 [-0.297, 0.019]	-1.741	.084
<i>R</i> ²		.221	
<i>F</i>		4.938	.000
Closeness (IOS)			
Constant	1.454 [1.292, 1.617]	17.698	.000
Exclusionary status	0.272 [0.110, 0.435]	3.314	.001
Menstrual cycle phase	0.018 [-0.120, 0.222]	0.596	.552
Closeness (IOS)	-0.058 [-0.229, 0.113]	-0.673	.502
Exclusionary status × menstrual cycle phase	0.074 [-0.089, 0.236]	0.896	.372
Exclusionary status × closeness (IOS)	-0.112 [-0.283, 0.059]	-1.298	.197
Menstrual cycle phase × closeness (IOS)	0.051 [-0.120, 0.222]	0.596	.552
Exclusionary status × menstrual cycle phase × closeness (IOS)	0.074 [-0.097, 0.245]	0.857	.393
<i>R</i> ²		.115	
<i>F</i>		2.264	.034

Table 3 continued

Affiliation motive			
Constant	1.486 [1.315, 1.658]	17.188	.000
Exclusionary status	0.298 [0.126, 0.469]	3.441	.001
Menstrual cycle phase	0.063 [-0.108, 0.235]	0.732	.466
Affiliation motive	-0.076 [-0.256, 0.103]	-0.841	.402
Exclusionary status × menstrual cycle phase	0.115 [-0.057, 0.286]	1.326	.187
Exclusionary status × affiliation motive	-0.086 [-0.266, 0.093]	-0.953	.342
Menstrual cycle phase × affiliation motive	-0.170 [-0.350, 0.009]	-1.877	.063
Exclusionary status × menstrual cycle phase × affiliation motive	-0.132 [-0.312, 0.047]	-1.457	.148
<i>R</i> ²		.113	
<i>F</i>		2.223	.037
Power motive			
Constant	1.470 [1.294, 1.645]	16.566	.000
Exclusionary status	0.257 [0.082, 0.433]	2.901	.004
Menstrual cycle phase	0.034 [-0.142, 0.209]	0.381	.704
Power motive	0.029 [-0.152, 0.210]	0.319	.751
Exclusionary status × menstrual cycle phase	0.077 [-0.099, 0.252]	0.866	.388
Exclusionary status × power motive	0.031 [-0.150, 0.212]	0.342	.733
Menstrual cycle phase × power motive	-0.029 [-0.210, 0.152]	-0.313	.755
Exclusionary status × menstrual cycle phase × power motive	-0.110 [-0.291, 0.072]	-1.197	.234
<i>R</i> ²		.096	
<i>F</i>		1.845	.085

Table 3 continued

Need to belong			
Constant	1.455 [1.287, 1.622]	17.206	.000
Exclusionary status	0.297 [0.130, 0.465]	3.518	.001
Menstrual cycle phase	0.077 [-0.091, 0.244]	0.909	.365
Need to belong	-0.063 [-0.228, 0.102]	-0.755	.452
Exclusionary status × menstrual cycle phase	0.101 [-0.067, 0.268]	1.189	.237
Exclusionary status × need to belong	0.024 [-0.141, 0.189]	0.286	.775
Menstrual cycle phase × need to belong	-0.141 [-0.306, 0.024]	-1.692	.093
Exclusionary status × menstrual cycle phase × need to belong	-0.142 [-0.307, 0.023]	-1.699	.092
<i>R</i> ²		.126	
<i>F</i>		2.521	.019
Rejection sensitivity			
Constant	1.443 [1.283, 1.602]	17.919	.000
Exclusionary status	0.274 [0.114, 0.433]	3.397	.001
Menstrual cycle phase	0.036 [-0.123, 0.196]	0.450	.653
Rejection sensitivity	0.088 [-0.072, 0.248]	1.085	.280
Exclusionary status × menstrual cycle phase	0.075 [-0.084, 0.235]	0.937	.351
Exclusionary status × rejection sensitivity	0.183 [0.023, 0.343]	2.261	.026
Menstrual cycle phase × rejection sensitivity	-0.004 [-0.165, 0.156]	-0.054	.957
Exclusionary status × menstrual cycle phase × rejection sensitivity	-0.091 [-0.251, 0.070]	-1.119	.266
<i>R</i> ²		.142	
<i>F</i>		2.894	.008

Table 3 continued

Self-esteem			
Constant	1.440 [1.281, 1.599]	17.890	.000
Exclusionary status	0.268 [0.109, 0.427]	3.327	.001
Menstrual cycle phase	0.035 [-0.125, 0.194]	0.432	.666
Self-esteem	-0.006 [-0.164, 0.152]	-0.076	.940
Exclusionary status × menstrual cycle phase	0.078 [-0.082, 0.237]	0.966	.336
Exclusionary status × self-esteem	-0.075 [-0.233, 0.083]	-0.943	.348
Menstrual cycle phase × self-esteem	0.077 [-0.082, 0.235]	0.960	.339
Exclusionary status × menstrual cycle phase × self-esteem	0.179 [0.021, 0.337]	2.241	.027
<i>R</i> ²		.139	
<i>F</i>		2.801	.010
Social interaction anxiety			
Constant	1.457 [1.297, 1.617]	18.032	.000
Exclusionary status	0.279 [0.119, 0.439]	3.456	.001
Menstrual cycle phase	0.024 [-0.136, 0.184]	0.297	.767
Social interaction anxiety	0.129 [-0.034, 0.292]	1.567	.120
Exclusionary status × menstrual cycle phase	0.078 [-0.082, 0.238]	0.965	.336
Exclusionary status × social interaction anxiety	0.174 [0.011, 0.338]	2.115	.036
Menstrual cycle phase × social interaction anxiety	0.045 [-0.119, 0.208]	0.541	.590
Exclusionary status × menstrual cycle phase × social interaction anxiety	-0.049 [-0.212, 0.114]	-0.597	.552
<i>R</i> ²		.140	
<i>F</i>		2.827	.009

Table 4

Results for the multiple regression analysis with exclusionary status, menstrual cycle, other variables and all interaction terms as predictors of prosocial behavior

	Prosocial intentions		
	<i>b</i> [95% CI for <i>b</i>] unstandardized	<i>t</i>	<i>p</i>
Agreeableness			
Constant	3.646 [3.404, 3.888]	29.776	.000
Exclusionary status	-0.456 [-0.698, -0.213]	-3.721	.000
Menstrual cycle phase	0.102 [-0.141, 0.344]	0.832	.407
Agreeableness	-0.025 [-0.286, 0.236]	-0.189	.850
Exclusionary status × menstrual cycle phase	-0.065 [-0.307, 0.178]	-0.530	.597
Exclusionary status × agreeableness	0.091 [-0.170, 0.352]	0.689	.492
Menstrual cycle phase × agreeableness	-0.046 [-0.307, 0.178]	-0.065	.597
Exclusionary status × menstrual cycle phase × social phobia	-0.030 [-0.292, 0.231]	-0.229	.819
<i>R</i> ²	.126		
<i>F</i>	2.498		.020
Conscientiousness			
Constant	3.629 [3.394, 3.864]	30.551	.000
Exclusionary status	-0.452 [-0.688, -0.217]	-3.808	.000
Menstrual cycle phase	0.078 [-0.157, 0.314]	0.660	.510
Conscientiousness	0.188 [-0.061, 0.436]	1.494	.138
Exclusionary status × menstrual cycle phase	-0.067 [-0.302, 0.168]	-0.565	.573
Exclusionary status × conscientiousness	0.040 [-0.208, 0.289]	0.322	.748
Menstrual cycle phase × conscientiousness	0.014 [-0.234, 0.263]	0.113	.910
Exclusionary status × menstrual cycle phase × conscientiousness	0.130 [-0.119, 0.378]	1.032	.304
<i>R</i> ²	.138		
<i>F</i>	2.784		.010

Table 4 continued

Extraversion			
Constant	3.610 [3.382, 3.837]	31.407	.000
Exclusionary status	-0.465 [-0.693, -0.238]	-4.046	.000
Menstrual cycle phase	0.076 [-0.152, 0.303]	0.659	.511
Extraversion	0.104 [-0.133, 0.340]	0.867	.388
Exclusionary status \times menstrual cycle phase	-0.079 [-0.306, 0.149]	-0.686	.494
Exclusionary status \times extraversion	0.325 [0.088, 0.561]	2.719	.008
Menstrual cycle phase \times extraversion	0.267 [0.030, 0.503]	2.232	.027
Exclusionary status \times menstrual cycle phase \times extraversion	-0.024 [-0.260, 0.213]	-0.197	.844
R^2		.191	
F		4.116	.000
Neuroticism			
Constant	3.686 [3.438, 3.934]	29.411	.000
Exclusionary status	-0.432 [-0.680, -0.184]	-3.450	.001
Menstrual cycle phase	0.120 [-0.128, 0.368]	0.960	.339
Neuroticism	-0.032 [-0.293, 0.228]	-0.245	.807
Exclusionary status \times menstrual cycle phase	-0.024 [-0.272, 0.224]	-0.191	.849
Exclusionary status \times neuroticism	-0.131 [-0.392, 0.129]	-0.998	.320
Menstrual cycle phase \times neuroticism	-0.033 [-0.293, 0.228]	-0.249	.804
Exclusionary status \times menstrual cycle phase \times neuroticism	-0.090 [-0.351, 0.170]	-0.688	.493
R^2		.127	
F		2.531	.018

Table 4 continued

Openness			
Constant	3.628 [3.388, 3.868]	29.968	.000
Exclusionary status	-0.439 [-0.679, -0.199]	-3.627	.000
Menstrual cycle phase	0.063 [-0.176, 0.303]	0.524	.602
Openness	0.100 [-0.143, 0.344]	0.817	.416
Exclusionary status × menstrual cycle phase	-0.018 [-0.258, 0.222]	-0.150	.881
Exclusionary status × openness	-0.054 [-0.297, 0.190]	-0.438	.662
Menstrual cycle phase × openness	0.158 [-0.086, 0.401]	1.282	.202
Exclusionary status × menstrual cycle phase × openness	0.080 [-0.164, 0.323]	0.650	.517
R^2		.138	
F		2.796	.010
Closeness (IOS)			
Constant	3.636 [3.400, 3.871]	30.591	.000
Exclusionary status	-0.458 [-0.693, -0.223]	-3.852	.000
Menstrual cycle phase	0.096 [-0.139, 0.331]	0.807	.421
Closeness (IOS)	0.070 [-0.177, 0.317]	0.559	.577
Exclusionary status × menstrual cycle phase	-0.051 [-0.286, 0.185]	-0.425	.672
Exclusionary status × closeness (IOS)	0.208 [-0.039, 0.455]	1.666	.098
Menstrual cycle phase × closeness (IOS)	0.016 [-0.231, 0.263]	0.128	.898
Exclusionary status × menstrual cycle phase × closeness (IOS)	0.066 [-0.181, 0.313]	0.527	.599
R^2		.139	
F		2.816	.009

Table 4 continued

Affiliation motive			
Constant	3.610 [3.364, 3.855]	29.146	.000
Exclusionary status	-0.440 [-0.685, -0.195]	-3.554	.001
Menstrual cycle phase	0.069 [-0.177, 0.314]	0.553	.581
Affiliation motive	0.150 [-0.107, 0.407]	1.158	.249
Exclusionary status × menstrual cycle phase	-0.072 [-0.317, 0.173]	-0.583	.561
Exclusionary status × affiliation motive	0.159 [-0.098, 0.416]	1.221	.224
Menstrual cycle phase × affiliation motive	0.008 [-0.249, 0.265]	0.064	.949
Exclusionary status × menstrual cycle phase × affiliation motive	-0.118 [-0.375, 0.139]	-0.910	.365
<i>R</i> ²		.154	
<i>F</i>		3.170	.004
Power motive			
Constant	3.561 [3.313, 3.809]	28.440	.000
Exclusionary status	-0.387 [-0.635, -0.139]	-3.092	.003
Menstrual cycle phase	0.109 [-0.139, 0.357]	0.874	.384
Power motive	0.075 [-0.181, 0.330]	0.579	.564
Exclusionary status × menstrual cycle phase	-0.082 [-0.329, 0.166]	-0.651	.516
Exclusionary status × power motive	-0.081 [-0.336, 0.175]	-0.624	.534
Menstrual cycle phase × power motive	-0.108 [-0.364, 0.147]	-0.838	.384
Exclusionary status × menstrual cycle phase × power motive	0.216 [-0.040, 0.472]	1.673	.097
<i>R</i> ²		.162	
<i>F</i>		3.372	.003

Table 4 continued

Need to belong			
Constant	3.634 [3.391, 3.877]	29.556	.000
Exclusionary status	-0.420 [-0.664, -0.177]	-3.419	.001
Menstrual cycle phase	0.123 [-0.120, 0.367]	1.003	.318
Need to belong	0.014 [-0.226, 0.254]	0.116	.908
Exclusionary status × menstrual cycle phase	-0.039 [-0.282, 0.205]	-0.316	.753
Exclusionary status × need to belong	0.011 [-0.229, 0.251]	0.090	.929
Menstrual cycle phase × need to belong	-0.025 [-0.265, 0.215]	-0.206	.837
Exclusionary status × menstrual cycle phase × need to belong	-0.205 [-0.445, 0.035]	-1.690	.094
<i>R</i> ²		.141	
<i>F</i>		2.849	.009
Rejection sensitivity			
Constant	3.634 [3.400, 3.868]	30.751	.000
Exclusionary status	-0.454 [-0.688, -0.221]	-3.846	.000
Menstrual cycle phase	0.075 [-0.159, 0.309]	0.638	.525
Rejection sensitivity	-0.111 [-0.346, 0.124]	-0.933	.353
Exclusionary status × menstrual cycle phase	-0.052 [-0.286, 0.182]	-0.443	.658
Exclusionary status × rejection sensitivity	-0.081 [-0.316, 0.155]	-0.679	.498
Menstrual cycle phase × rejection sensitivity	-0.072 [-0.307, 0.164]	-0.602	.548
Exclusionary status × menstrual cycle phase × rejection sensitivity	-0.186 [-0.421, 0.050]	-1.563	.121
<i>R</i> ²		.141	
<i>F</i>		2.858	.008

Table 4 continued

Self-esteem			
Constant	3.644 [3.409, 3.879]	30.719	.000
Exclusionary status	-0.451 [-0.686, -0.217]	-3.805	.000
Menstrual cycle phase	0.084 [-0.151, 0.319]	0.711	.478
Self-esteem	0.083 [-0.150, 0.316]	0.705	.482
Exclusionary status × menstrual cycle phase	-0.047 [-0.282, 0.188]	-0.395	.693
Exclusionary status × self-esteem	-0.010 [-0.242, 0.223]	-0.081	.936
Menstrual cycle phase × self-esteem	-0.010 [-0.243, 0.223]	-0.083	.934
Exclusionary status × menstrual cycle phase × self-esteem	0.135 [-0.098, 0.368]	1.148	.253
<i>R</i> ²		.123	
<i>F</i>		2.601	.016
Social interaction anxiety			
Constant	3.628 [3.395, 3.860]	30.890	.000
Exclusionary status	-0.457 [-0.689, -0.224]	-3.890	.000
Menstrual cycle phase	0.071 [-0.162, 0.303]	0.603	.548
Social interaction anxiety	-0.094 [-0.332, 0.143]	-0.788	.433
Exclusionary status × menstrual cycle phase	-0.057 [-0.289, 0.176]	-0.483	.630
Exclusionary status × social interaction anxiety	-0.218 [-0.455, 0.019]	-1.819	.071
Menstrual cycle phase × social interaction anxiety	-0.163 [-0.400, 0.075]	-1.358	.177
Exclusionary status × menstrual cycle phase × social interaction anxiety	-0.161 [-0.398, 0.076]	-1.345	.181
<i>R</i> ²		.154	
<i>F</i>		3.179	.004

Table 4 continued

Social phobia			
Constant	3.638 [3.403, 3.873]	30.637	.000
Exclusionary status	-0.432 [-0.667, -0.197]	-3.639	.000
Menstrual cycle phase	0.095 [-0.143, 0.330]	0.798	.426
Social phobia	-0.118 [-0.356, 0.119]	-0.985	.326
Exclusionary status × menstrual cycle phase	-0.046 [-0.281, 0.189]	-0.390	.697
Exclusionary status × social phobia	-0.042 [-0.279, 0.196]	-0.347	.729
Menstrual cycle phase × social phobia	-0.023 [-0.261, 0.214]	-0.194	.847
Exclusionary status × menstrual cycle phase × social phobia	-0.198 [-0.435, 0.040]	-1.646	.102
<i>R</i> ²		.139	
<i>F</i>		2.829	.009

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