



Measuring female intrasexual competition by the scale for intrasexual competition: a validation of the German version

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Received: 30 November 2017 / Accepted: 5 July 2018 / Published online: 25 July 2018
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Abstract

Competitive behaviour amongst members of the same sex is termed intrasexual competition. The tendency to engage in such competition appears to be strongly related to stable individual characteristics such as personality traits. Additionally, recent studies have revealed transient fluctuations in competitiveness according to the female menstrual cycle. To date, no German questionnaire exists to measure intrasexual competition. Our first study aimed to translate and validate the Intrasexual Competition Scale (ICS) by Buunk and Fisher (J Evol Psychol 7:37–48, 2009) in a population of healthy Swiss females ($n = 241$). Our second study applied the validated German ICS in a group of healthy, regularly cycling females ($n = 49$) in order to examine possible associations between the menstrual cycle phase and ICS scores. The psychometric properties suggest that the German ICS is a reliable and valid tool to assess individual differences in female intrasexual competition. Furthermore, our second study demonstrated that on average, women showed higher intrasexual competition scores when tested in the late follicular phase ($M = 35.77 \pm SD = 12.03$) compared to the mid-luteal phase ($M = 30.93 \pm SD = 10.20$). Our studies support previous findings of an association between ICS scores and relatively stable individual characteristics such as personality traits. Furthermore, our research endorses the assumption of cycle-dependent fluctuations in intrasexual competition. Future research should clarify the precise mechanisms underlying these findings and include biomarkers such as oestrogen and testosterone.

Keywords Intrasexual competition · Intrasexual Competition Scale (ICS) · Personality · Menstrual cycle

Introduction

It is the classic Hollywood movie plot: two men are in love with the same woman. The viewer does not require any additional information in order to gain a vivid picture of this situation. We would expect anger and fights. Indeed, Darwin would have described such a scenario as a prototypical example of intrasexual competition (Darwin 1871). But what if we were to modify the plot slightly and imagine two women competing for the love of the same man? The fighting might then appear to be rather innocent at a first glance. We would not expect the two ladies to harm each other physically. What we would probably find is a subtle verbal discrimination of

the competitors, drama and gossiping. These strategies are less violent, but are nonetheless cruel and damaging. What would Darwin have said about this type of competition? In this paper, we investigate female intrasexual competition and potential factors associated with individual differences in competitiveness.

Darwin described two distinct mate selection processes in mammalian species (Darwin 1871). *Intersexual* selection characterises the choice by individuals of one sex for certain qualities of the other sex. *Intrasexual* selection, by contrast, implies engagement in competition with same-sex conspecifics over access to mates (Buss 1988; Buss and Dedden 1990). Due to the observation that females of many species show few signs of violent competitive behaviour towards others of the same sex, it has been assumed that *intrasexual* competition is a primarily male phenomenon. Years of research have established that this assumption is not valid for humans (e.g. Buunk and Fisher 2009; Buunk et al. 2014). However, unlike men, who prefer physically aggressive competition, women use subtle, verbally aggressive strategies (Cashdan 1998; Campbell 2013; Vaillancourt 2013).

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Men and women seem to compete intrasexually in different domains. Whilst men traditionally compete in terms of status, goods or dominance, studies have shown that women generally compete in the domain of physical attractiveness (Cashdan 1998; Buunk and Dijkstra 2002). From an evolutionary perspective, women compete for resources, which enable high reproductive success, such as higher quality food, shelter or the help in rearing the offspring (Campbell 1999; Stockley and Bro-Jørgensen 2011). One method of gaining access to several resources is to compete for men who possess such (Stockley and Bro-Jørgensen 2011). Therefore, modern-day competitive situations in women often involve men, but can generally be found in all kinds of interactions between women (Buunk et al. 2010). The attitude to engage in intrasexual competition seems to be associated with relatively stable characteristics of the individual, such as personality (i.e. Buss and Schmitt 1993; Figueredo et al. 2005; Funder 2006).

Buunk and Fisher (2009) made an initial attempt to systematically investigate interindividual differences in intrasexual competition. Their aim was to measure the extent to which people perceive interactions with individuals of the same sex as a competition. Responses to such interactions may include the desire to outperform individuals of the same sex, a focus on negative attributes of others, feelings of envy or jealousy in the face of perceived inferiority or the sensation of malicious pleasure when demonstrating one's own superiority (Buunk and Fisher 2009). With this concept in mind, Buunk and Fisher (2009) developed a pool of 15 items and applied this preliminary scale in two studies conducted in Canada and the Netherlands, encompassing a total of 706 participants (480 females). Factor analysis resulted in three items being omitted from the scale. The resulting 12-item Intrasexual Competition Scale (ICS) proved to be sex-neutral, with no differences between men and women. Moreover, it revealed a high cross-national equivalence when comparing the two samples (Buunk and Fisher 2009). In order to take into account the assumed association with stable individual characteristics, Buunk and Fisher (2009) compared the ICS scores with personality traits, sociosexual orientation and the orientation to compare oneself with others. The ICS measures proved to be correlated, but sufficiently distinct from the other individual characteristics. The results of the comparisons provided first evidence for the validity of the scale. A recent study replicated the findings on personality traits in a Uruguayan sample (Buunk et al. 2017). So far, no German questionnaire exists to measure intrasexual competition.

As reported above, intrasexual competition is highly influenced by stable characteristics of the individual. However, studies show that the tendency to compete with other women is not stable, but rather changing with respect to the women's fertility (Hahn et al. 2016). During ovulation, women have a stronger desire, feel more attractive (Durante and Li 2009;

Durante et al. 2008) and more frequently choose revealing dresses (Durante 2008; Durante et al. 2011). Moreover, fertile women show more interest towards men, which are not their primary partner (Gangestad et al. 2005; Haselton and Gangestad 2006) as well as towards facial cues of testosterone (Roney et al. 2011) and vocal masculinity (Pisanski et al. 2014). These findings suggest that women have a distinctive sexuality during the fertile phase, resulting in several behavioural and motivational changes, such as varying preferences for mates or the perception of their own attractiveness. Studies moreover show that ovulation goes parallel with a higher tendency to perceive the interaction with other women as a competition. As such, ovulating women rate other women's facial photographs as less attractive, when compared to the ratings of women who were menstruating (Fisher 2004). Such transient increase in intrasexual competition might have beneficial effects in mating success, resulting on a long time in fitness benefits (Hahn et al. 2016). Interestingly, in times of hormonal contraceptive (HC) use, participants had lower levels on the ICS compared to when regularly cycling at a fertile or non-fertile phase (Cobey et al. 2013). Summarising, there seem to be intraindividual differences in competitiveness as a function of the women's fertility and the ICS might be a suitable instrument to capture such differences. To our knowledge, no study has investigated intraindividual differences in ICS scores as a function of the menstrual cycle phase in a group of regular non-HC users.

Based on the literature outlined above, we therefore propose the following research questions: (1) Are there associations between intrasexual competition and stable individual characteristics? To answer this question, our first aim was to develop and validate a German version of Buunk and Fisher's Intrasexual Competition Scale (ICS; study 1). (2) Are there intraindividual variations in intrasexual competition? To answer this question, the validated German ICS was applied at different stages of the menstrual cycle in order to determine whether intraindividual fluctuations could be explained by estimates of the women's fertility (study 2).

In our first study, we expected to find a high degree of cross-national equivalence when comparing the English, Dutch and German versions of the scale. As intrasexual competition is thought to be related to stable individual characteristics, we further hypothesised an association between the ICS and general competition-, comparison- and mating-related constructs. Such constructs proved to be associated with intrasexual competition and the ICS in the validation process of Buunk and Fisher (2009). Therefore, we decided to include the same questionnaires in our investigation and expected to find a positive association with the ICS. In our second study, we hypothesised differences in the ICS score as a function of the menstrual cycle phase. Specifically, we expected to find higher ICS scores before ovulation when compared with the postovulatory phase.

Methods study 1

Participants and data collection

Recruitment was conducted through advertisements in online newspapers, flyers, social media or the psychology mailing list of the University of Zurich. To increase the external validity, we aimed for a diverse sample of women with respect to variables such as age, education and income. We therefore chose not to employ any inclusion or exclusion criteria aside from the requirement of female sex. Potential participants received information material about the study procedures, and all participants who were included in the study provided written informed consent. Participants followed an online link on the study website to access the questionnaires. The survey included demographic information and measures of comparison, mating and competition, which were chosen according to the validation study by Buunk and Fisher (2009). The study was conducted in accordance with the Declaration of Helsinki and was approved by the ethics committee of the Faculty of Arts and Humanities, University of Zurich.

Questionnaires

The ICS is a 12-item self-report instrument. All items are rated on a 7-point scale from (1) ‘not at all applicable’ to (7) ‘completely applicable’ (i.e. “I can’t stand it when I meet another woman who is more attractive than I am”).

To assess the psychometric characteristics of the ICS, we used the Sociosexual Orientation Scale Revised (SOI-R), the Five-Factor Personality Inventory (NEO-FFI) and the scale for Social Comparison Orientation (SCO) as comparison instruments.

The SOI-R is a self-report questionnaire assessing the individual tendency to engage in sexual relationships without deeper emotional interest. The validated 9-item German version includes the three main domains: sociosexual behaviour (“With how many different partners have you had sex in your lifetime?”), sociosexual attitude (“Sex without love is OK”) and sociosexual desire (“How frequently do you think about sex?”). Each item is rated on a 5-point scale from (1) ‘strongly disagree’ to (5) ‘strongly agree’ (Penke and Asendorpf 2008).

The NEO-FFI measures the five personality traits neuroticism (N), extraversion (E), openness to experience (O), agreeableness (A) and conscientiousness (C). A 12-item subscale measures each of the ‘Big Five’ personality dimensions, and each item is rated from (1) ‘strongly disagree’ to (5) ‘strongly agree’ (Costa and McCrae 1985). The validated German version by Borkenau and Ostendorf (1993) was used in the present study.

The SCO measures the individual tendency to compare oneself with others to gain a better understanding about the self. The 11 items are rated on a 5-point scale from (1) strongly disagree to (5) strongly agree. The scale includes items such as

“I often compare myself with others with respect to what I have accomplished in life” (Gibbons and Buunk 1999).

Forward translation

Two unrelated professional interpreters first translated the existing English and Dutch versions of the ICS into two separate German versions. Translation was performed following the Principles of Good Practice for the Translation and Cultural Adaptation Process for Patient-Reported Outcomes (PRO) Measures (Wild et al. 2005). The author of the original version was then consulted for the discussion of the two developed translations, and together, any ambiguities were clarified and the conceptual equivalence of the original and the translated version was maximised (Wild et al. 2005). The two translations were then reconciled into one single translation.

Backward translation

A third interpreter translated the resulting single forward translation back into Dutch. The backward translation provides a control of the translation quality by ensuring the conceptual equivalence (Wild et al. 2005). The author of the original version was again consulted and ultimately approved the final German version.

Analysis

The reliability of the German ICS was determined by calculating Cronbach’s alpha for the total scale. Congruence analyses were run to assess the metric equivalence of the German, English and Dutch versions of the ICS (Cheung and Cheung 2003; Tucker 1951). A coefficient of congruence above 0.95 corresponds to a high equivalence of two scales. Coefficients between 0.85 and 0.94 indicate a fair similarity (Lorenzo-Seva and ten Berge 2006). An exploratory factor analysis (principal component analysis with varimax rotation) was conducted to examine the factor structure of the 12 items. Exploratory analysis was chosen due to missing reports regarding the structure of the original version (Buunk and Fisher 2009). The Kaiser-Meyer-Olkin (KMO) test was used to verify the sampling adequacy for the analysis, with values above the minimum criterion of 0.5 indicating adequate sampling (Field 2013). Furthermore, Bartlett’s test of sphericity was applied to reveal the overall significance of all correlations within the correlation matrix. An initial analysis was run to obtain the eigenvalues of each factor. The scree plot was considered in order to visually analyse the relative importance of the factors, choosing eigenvalues > 1 (Field 2013). Convergent validity was investigated by calculating Pearson’s correlations between the ICS (total score and subscales) and the SOI-R, the NEO-FFI and the SCO. All statistical tests were performed using SPSS, version 22.0 (IBM, Armonk, NY, USA).

Results

Participant characteristics

The final sample consisted of 241 female participants with a mean age of 27.6 years ($SD = 8.3$, range = 19–60). More than half of the women (65.6%) were students, and their level of employment ranged from less than 10.5 h of work per week (33.9%) to 42 h per week (35.7%). Their yearly income ranged from no income to more than 150,000 CHF (Swiss Francs). Nearly half of the participants earned 30,000 CHF per year (48.1%). The majority (86.7%) were unmarried and 27.75% of these participants were not in a relationship.

Item statistics and reliability

The item statistics showed a variation of item difficulty from 1.62 to 4.79. The SD of the items varied from 1.02 to 1.74, and the item discrimination index ranged from 0.32 to 0.65. The ICS showed a good internal consistency (Cronbach's alpha) of 0.85, which could not be enhanced by deleting any item. The Cronbach's alpha values for the other measures were all satisfactory (> 0.70), ranging from 0.72 (O) to 0.85 (SOI-R). Table 1 shows the psychometric properties of the ICS for the Swiss, Canadian and Dutch samples. Congruence analyses revealed coefficients of 0.92 for the German and the English versions and 0.91 for the German and the Dutch versions, indicating a fair similarity.

Factor structure

An exploratory factor analysis (principal components analysis with varimax rotation) was performed on the 12 items. The KMO measure verified the sampling adequacy for the analysis with a score of 0.83, and Bartlett's test was significant ($\chi^2(66) = 1010.22$, $p < 0.001$). Three of the resulting factors had eigenvalues ≥ 1 , accounting for 59.98% of the total variance in items (factor 1 eigenvalue = 4.68, factor 2 eigenvalue = 1.48, factor 3 eigenvalue = 1.04). The three-factor solution was chosen based on the scree plot. The first factor was labelled as *appearance* items, the second factor as *attention/ interpersonal success* items and the third factor as *competence* items. As

Table 1 Psychometric properties of the Dutch, English and German versions of the Intrasexual Competition Scale (ICS) as measured in three independent samples in the Netherlands, Canada and Switzerland

	Netherlands	Canada	Switzerland
Mean (SD)	3.33 (0.92)	3.3 (1.1)	3.02 (0.93)
Skewness	-0.02	0.05	0.18
Kurtosis	0.39	-0.32	0.06
Cronbach's alpha	0.85	0.87	0.86

shown in Table 2, Cronbach's alpha coefficients of the subscales were satisfactory (> 0.70). The appearance subscale had the highest internal consistency of $\alpha = 0.80$. The internal consistencies of the competence subscale and the attention/interpersonal success subscale were $\alpha = 0.71$ and $\alpha = 0.74$, respectively, indicating a fair homogeneity of the items.

Validity

Table 3 summarises the Pearson correlation coefficients between the ICS total score and the SOI-R, the NEO-sub-scales and the SCO. Moreover, the three factors appearance, competence and attention/interpersonal success are included in the correlation matrix.

Methods study 2

Participants and data collection

The following analyses were part of a larger study conducted at the University of Zurich (Ditzen et al. 2017). The main goal of the study was to examine the effect of stress on women's preferences for male facial masculinity (Gangestad et al. 2007; Gangestad and Thornhill 2008). The study had a randomised crossover design, and participants were tested at two stages of their menstrual cycle (late follicular and mid-luteal phase). Participants were recruited through advertisements in the area of University of Zurich (flyers, online newspapers) and e-mails. The final study sample comprised 55 women with a mean age of 28 years ($SD = 3.1$). Exclusion criteria were self-reported medical or psychiatric diseases, substance abuse (more than two standard units of alcohol per day, consumption of other addictive substances), medication intake, smoking (> 5 cigarettes/day), irregular menstrual cycles (cycle length variation of more than 4 days between cycles; Gold et al. 1995), premenstrual syndrome, use of hormonal contraceptives, pregnancy, lactation, a body mass index outside the normal range (< 17.5 or > 25) and homosexual orientation. Information about the exclusion criteria was gathered in a telephone screening. After enrolment in the study, all participants gave their written informed consent and were offered CHF 50 for study participation. The study was conducted in accordance with the Declaration of Helsinki and was approved by the ethics committee of the Faculty of Arts and Humanities, University of Zurich.

Assessments

The German translation of the ICS was used as described above. Ovulation test kits were used to determine the menstrual cycle phase (Clearblue ovulation test, Clearblue International). The test kit measures the luteinizing hormone (LH) surge in urine and is an accurate predictor of ovulation and comparable

Table 2 Item characteristics and factor structure of the German Intrasexual Competition Scale (ICS)

Factor (percent of total variance explained)	Item mean (SD)	Factor loadings		
		F1	F2	F3
F1: appearance (22.80%) ($\alpha = 0.80$)				
1. I cannot stand it when I meet another woman who is more attractive than I am.	3.45 (1.60)		0.77	
2. When I go out, I cannot stand it when men pay more attention to a same-sex friend of mine than to me.	3.51 (1.70)		0.75	
3. I tend to look for negative characteristics in attractive women.	3.83 (1.69)		0.74	
4. When I am at a party, I enjoy it when men pay more attention to me than other women.	4.79 (1.74)		0.63	
F2: competence (17.80%) ($\alpha = 0.71$)				
5. I would not hire a highly competent woman as a colleague.	1.57 (1.03)	0.47		
6. I just do not like very ambitious women.	2.18 (1.32)	0.74		
7. I tend to look for negative characteristics in women who are very successful.	2.88 (1.49)	0.58		
8. I would not hire a very attractive woman as a colleague.	1.86 (1.17)	0.64		
F3: attention/interpersonal success (19.37%) ($\alpha = 0.74$)				
9. I like to be funnier and more quick witted than other women.	3.94 (1.71)			0.79
10. I want to be just a little better than other women.	3.95 (1.72)			0.78
11. I always want to beat other women.	2.66 (1.58)			0.65
12. I do not like seeing other women with a nicer house or a nicer car than mine.	1.62 (1.02)			0.52

An exploratory factor analysis with varimax rotation revealed a three-factor solution. Items were assigned based on factor loadings

with ultrasonography assessments (Guermendi et al. 2001). The LH rises around 24 to 48 h prior to ovulation (Testart and Frydman 1982) and can be detected with the test kit. The participants were instructed on how to use the LH strips. Twenty-eight randomly selected participants started the testing in their late follicular phase. Target testing for the LH surge started about 4 days prior to the expected surge until the actual day of LH surge. The time of testing was estimated by a counting method based on each participant's average menstrual cycle length. Twenty-seven participants targeted the mid-luteal phase and therefore started testing between seven and 10 days after the LH surge had occurred.

Analysis

A one-tailed *t* test was calculated to determine differences between the menstrual cycle phase (late follicular vs. mid-

luteal) and the ICS sum score. Statistical analyses were performed using SPSS, version 22.0 (IBM, Armonk, NY, USA).

Results

Participant characteristics

Participants' mean age was 28.2 years (SD = 3.1, range = 23–33). Nearly half of the participants (48%) had a Bachelor's or Master's degree. The level of employment ranged from less than 10.5 h of work per week (25.9%) to 42 h of work per week (44.4%). The yearly income ranged from no income to more than 150,000 CHF (Swiss Francs). Of the participants, 40.7% earned 30,000 CHF per year. The majority (92.6%) were unmarried and 38.9% were not in a relationship. There were no significant differences in age, job position, income or relationship status between the two tested groups (evaluation

Table 3 Pearson correlation coefficients for the subscales of the German Intrasexual Competition Scale (ICS) and related constructs ($n = 241$)

	F1	F2	F3	SOIR	A	N	O	C	E	SCO
F1: appearance (mean of items = 2.13, SD = 0.93)	–			–0.03	–0.05	0.16**	–0.07	–0.20**	–0.20**	0.19**
F2: competence (mean of items = 3.13, SD = 1.33)	0.49**	–		0.12*	0.81	0.28**	–0.02	–0.14*	–0.07	0.46**
F3: attention/interpersonal success (mean of items = 3.06, SD = 1.15)	0.41**	0.60**	–	0.09	–0.10	0.27**	–0.03	–0.11	–0.12*	0.39**
Total ICS score	0.73**	0.88**	0.83**	0.08	–0.02	0.29**	–0.06	–0.17*	–0.15*	0.41**

SOIR Sociosexual-Orientation Scale Revised, A agreeableness, N neuroticism, O openness, C conscientiousness, E extraversion, SCO social comparison orientation

* $P < 0.05$, ** $P < 0.01$ (one-tailed)

in late follicular vs. mid-luteal phase). Finally, six participants had to be excluded because of a lack of LH surge as determined by the ovulation test kit. The final sample therefore consisted of 49 female participants (Fig. 1).

Cycle-dependent effects

The results demonstrated that on average, women showed higher intrasexual competition scores when tested in the late follicular phase ($M = 35.77 \pm SD = 12.03$) than in the mid-luteal phase ($M = 30.93 \pm SD = 10.20$). This difference of 4.83, BCA 95% $[-9.32, 10.60]$ was significant ($t(58) = 1.68$, $p = 0.05$) and represents a medium-sized effect ($d = 0.47$).

Discussion

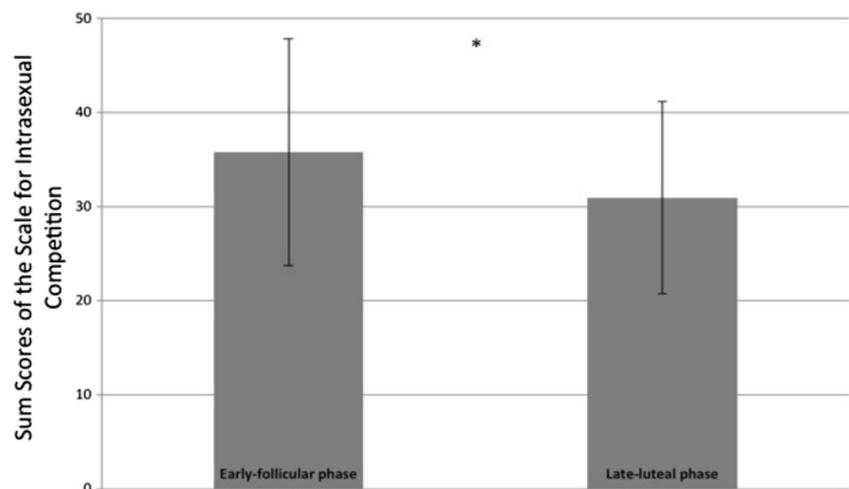
The goal of our first study was to provide a German version of the ICS. Our findings suggest that the German ICS is a reliable and valid instrument to measure female intrasexual competition. Moreover, the scale revealed a high congruence with the English and Dutch versions, supporting the assumption of cross-national applicability. Furthermore, our findings revealed an association between intrasexual competition and stable individual characteristics such as personality traits and social comparison orientation. Our results on neuroticism and social comparison orientation were in line with previous research revealing a positive association with the ICS scores (Buunk et al. 2017; Buunk and Fisher 2009). However, we were only partly able to replicate the findings on conscientiousness, extraversion and sociosexual orientation. These measures were associated with some but not all subscales of intrasexual competition. In the Canadian and Dutch pilot studies by Buunk and Fisher (2009), sociosexual orientation was associated with intrasexual competition, but only in the Dutch sample. In our study, sociosexual orientation revealed a significant positive association, but only when compared with the

competence subscale. These findings highlight the complexity of intrasexual competition and encourage the application of subscales. Further research is needed to replicate these findings.

In our second study, we followed the assumption of intraindividual fluctuations in intrasexual competition. As expected, we found higher levels of intrasexual competition during the late follicular phase than during the mid-luteal phase. Our findings are in line with some other studies that investigated intrasexual competition when the subjects were fertile as compared to non-fertile (Fisher 2004; Durante 2008; Durante et al. 2011). Cobey and colleges (2013) did not find differences in ICS scores between the fertile and non-fertile phase of the menstrual cycle. However, their study investigated regular HC users during HC use and after a brief HC cessation period. Therefore, our findings in regular non-HC users might not be comparable. Moreover, whilst Cobey et al. (2013) applied a within-subject design, our study used a between-subject design, in which participants were investigated either in the late follicular or in the mid-luteal phase of their menstrual cycle. Future studies should use a within-subject design with measurements of the ICS scores at several time points during regular menstrual cycles (late follicular phase, ovulation and mid-luteal phase). Furthermore, our findings provide only limited insights into the underlying hormonal mechanisms. Other authors proposed circulating oestrogen (Fisher 2004) or testosterone levels (Hahn et al. 2016) as possible explanations for within-person differences. Future studies should include multiple sex-hormone measurements to broaden the understanding of the proximate mechanisms.

Both of our studies included relatively young and well-educated females, which might limit the generalizability of our findings (Leung 2015). As the study by Vukovic et al. (2009) in premenopausal and postmenopausal women revealed, it is also necessary to examine female intrasexual competition in older participants. Our research group is currently investigating intrasexual competition as a function of age and

Fig. 1 Results reveal a between-person comparison of the sum score of intrasexual competition for participants investigated either in the early follicular (before ovulation) or the late luteal phase (7–10 days after ovulation) of the menstrual cycle ($n = 49$)



hormonal status in a sample of premenopausal and postmenopausal women (data not yet reported).

In conclusion, our first study provides a reliable and valid instrument to investigate female intrasexual competition in German-speaking samples. Recent studies investigated the influence of the menstrual cycle phase on behavioural alterations. We confirmed some of the previous study findings, which revealed cycle-dependent fluctuations in intrasexual competition. Further research is needed to clarify the precise mechanisms underlying these findings and should include biomarkers such as oestrogen and testosterone. Moreover, women of a higher age should be included in intrasexual competition research.

Acknowledgements We wish to thank Prof. Abraham P. Buunk for his highly valuable contributions on the study design and his support in the translation process.

Compliance with ethical standards

The research involves participants who provided informed consent. The study protocol of both studies was conducted in accordance with the Declaration of Helsinki and was approved by the ethics committee of the Faculty of Arts and Humanities, University of Zurich.

Conflicts of interest The authors declare that they have no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

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