Sexual Excitation and Sexual Inhibition as Predictors of Sexual Function in Women: A Cross-Sectional and Longitudinal Study

Julia Velten, Saskia Scholten, Cynthia A. Graham & Jürgen Margraf

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Julia Velten and Saskia Scholten

Mental Health Research and Treatment Center, Ruhr-Universität Bochum, Bochum, Germany

Cynthia A. Graham

Department of Psychology, University of Southampton, Southampton, United Kingdom

Jürgen Margraf

Mental Health Research and Treatment Center, Ruhr-Universität Bochum, Bochum, Germany

To date, no longitudinal studies have evaluated the predictive value of the two factors of the dual control model—sexual excitation (SE) and sexual inhibition (SI)—for future sexual function. The aims of the present study were to investigate the associations between SE/SI and sexual function and estimate their predictive value for future sexual function in a sample of women. Overall, 2,214 women participated in a web-based survey that assessed SE, SI, and sexual function as well as symptoms of depression. The one- and two-year follow-up surveys included 396 and 382 participants, respectively. Correlational analyses and hierarchical regression analyses were conducted to analyze the relationships between predictor and outcome variables. Four factors of SE (Arousability, Partner Characteristics, Sexual Power Dynamics, and Setting) and two factors of SI (Concerns about Sexual Function and Arousal Contingency), as well as symptoms of depression and partnership status, were significant predictors of concurrent and future sexual function. Several subscales of SE and SI contributed to the prediction of future sexual function above and beyond prior sexual function levels. Our study provides the first supportive evidence for the assumptions of the dual control model that propensities for low SE and high SI influence future sexual function.

INTRODUCTION

For many women, satisfaction with sexuality and their sexual relationships is associated with quality of life: Sexual satisfaction is related to better self-perceived general physical health, greater psychological well-being and happiness (Davison, Bell, LaChina, Holden, & Davis, 2009; Laumann, Paik, & Rosen, 1999; Laumann et al., 2005; Laumann et al., 2006), lower levels

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Address correspondence to Julia Velten, Ruhr-Universität Bochum, Faculty of Psychology, Department of Clinical Psychology and Psychotherapy, Mental Health Research and Treatment Center, Massenbergstrasse 9–13, D-44787 Bochum, Germany. E-mail: julia.velten@rub.de

of depression and anxiety (Basson, Wierman, van Lankveld, & Brotto, 2010; Hamilton & Julian, 2014; Oliveira & Nobre, 2013), as well as greater partnership satisfaction (Byers, 2005).

Experience of low desire for or interest in sexual activities, difficulties with sexual arousal or orgasm, and genito-pelvic pain during intercourse are common female sexual problems (Lewis et al., 2010). The numerous associations between sexual health and other important aspects of women's well-being underline the relevance of identifying predispositions and risk factors for the development of sexual difficulties.

Unfortunately, there is a lack of theory-driven, longitudinal research that has systematically investigated etiological factors related to sexual problems. The dual control model of sexual response offers such a theoretical framework (Bancroft & Janssen, 2000). According to this model, individuals differ in two propensities that facilitate or diminish sexual response in given situations. Scores on these two factors, called sexual excitation (SE) and sexual inhibition (SI), are proposed to vary across individuals, with a close to normal distribution (Carpenter, Janssen, Graham, Vorst, & Wicherts, 2008; Janssen, Vorst, Finn, & Bancroft, 2002; Pinxten & Lievens, 2014). Most levels of SE and SI are assumed to be related to adaptive sexual behavior or function, but high levels of SI are associated with increased vulnerability for sexual dysfunctions and high SE, especially when combined with low SI, is associated with out-of-control or high-risk sexual behaviors (Bancroft, Graham, Janssen, & Sanders, 2009).

The first studies to assess the proposed relationship between these factors and sexual difficulties utilized the Sexual Excitation Scale/Sexual Inhibition Scales (SIS/SES) in samples of homosexual and heterosexual men (Janssen et al., 2002). This 45-item self-report questionnaire has three subscales, one reflecting aspects of sexual excitation (SES), the other two relating to SI: SI due to threat of performance failure (SIS1) and SI due to threat of performance consequences (SIS2). In a nonclinical sample of heterosexual men, all three subscales were associated with erectile problems, both during the past three months and lifetime problems (Bancroft & Janssen, 2001). In another sample of 2,937 homosexual and heterosexual men, SIS1 (but not SES and SIS2) was strongly related to reports of erectile problems in the past three months. None of the factors were associated with rapid ejaculation, which is the second most common male sexual dysfunction after erectile disorder (Bancroft, Carnes, Janssen, Goodrich, & Long, 2005).

The few studies that have been conducted with women have provided preliminary evidence that different aspects of SE and SI might also be relevant for sexual difficulties in women. Sanders, Graham, and Milhausen (2008) assessed the relation between these factors and current or lifetime sexual problems in a sample of 540 women using the Sexual Excitation/Sexual Inhibition Inventory for Women (SESII-W; Graham, Sanders, & Milhausen, 2006). This 36-item self-report questionnaire was developed based on results of a focus group study to identify topics that are specifically relevant for female sexual arousal and desire (Graham, Sanders, Milhausen, & McBride, 2004). The SESII-W assesses the propensity of SE with five lower order factors and SI with three lower order factors (Graham et al., 2006). The two strongest associations with both current and lifetime sexual problems were the inhibitory factors Arousal Contingency, which describes how everything has to be "just right" for sexual arousal to occur, and Concerns about Sexual Function, which includes items about loss of arousal due to worries about being a good lover or taking too long to reach orgasm. These findings were in line with the theoretical assumption that high SI is linked to vulnerability to sexual problems (Sanders et al., 2008).

A recent study by Bloemendaal and Laan (2015) examined and confirmed the discriminative validity of the SESII-W for sexual problems in a sample of 259 women with and 186 women

without sexual problems. Again, the Arousal Contingency factor discriminated best between these two subsamples. A strength of this study was the use of a semi-structured diagnostic interview based on the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text. rev.; *DSM-IV-TR*; American Psychiatric Association, 2000) criteria of female sexual dysfunctions in a subsample of participants. This procedure enabled conclusions about the relevance of the dual control model for clinically relevant female sexual dysfunctions.

Significant correlations between scores on the Arousal Contingency subscale and different aspects of female sexual function, measured with the Female Sexual Function Index (FSFI) (Rosen et al., 2000), were also found in a small sample of 38 women (Bradford & Meston, 2006). This subscale was negatively correlated with the FSFI domains of desire ($r = -.50$), arousal ($r = -.60$), lubrication ($r = -.34$), and satisfaction ($r = -.36$).

To date, the few studies that have assessed the relationship between sexual excitation, sexual inhibition, and sexual function were cross-sectional, included relatively small sample sizes, did not use or report all subscales of the SESII-W, or did not use validated questionnaires to assess sexual function.

Sexual function is associated with mental health, especially with symptoms of depression. In their review, Atlantis and Sullivan (2012) conclude that the relationship between depression and sexual function is most likely bidirectional and that high levels of depression can be found in sexual dysfunctional populations.

Finally, another gap in the literature is that the temporal stability of sexual function has been assessed in only a few longitudinal studies. Hayes and Dennerstein (2005) concluded in their review that, although a decline of sexual function with age has been found in cross-sectional studies, longitudinal studies have shown a relatively high temporal stability of sexual function in women.

The Present Study

The aim of the present study was to evaluate the associations between SE and SI and sexual function in women by using a longitudinal data set. The use of a longitudinal design allowed us to test the assumptions of the dual control model that low SE and high SI are risk factors for the development of future sexual problems. Firstly, we hypothesized that SE and SI are significant predictors of sexual function at baseline. Secondly, we estimated that SE and SI would also be a significant predictor of future sexual function. Finally, we expected that sexual function at baseline would be a strong predictor of sexual function at follow-up, i.e., that there would be a high temporal stability of sexual function.

METHOD

Participants

German-speaking women above the age of 18 were eligible. At baseline assessment, 2,214 women with an average age of 31 years ($M = 30.65$, $SD = 9.91$) completed all questionnaires reported in this study. To increase sample diversity, participants were recruited through various channels such as online discussion boards and announcements on the home page of the university's website.

TABLE 1
Sample Characteristics at Baseline Assessment for the Complete Sample and the Different Subsamples

	Baseline sample (N = 2,214)	One data point (n = 1,714)	Two data points (n = 222)	Three data points (n = 278)	p value
Age M (SD)	30.65 (9.91)	30.42 (9.81)	31.06 (10.03)	31.74 (10.32)	.105
	n[a] (%)	n[a] (%)	n[a] (%)	n[a] (%)	
Partnership status					.750
Exclusive relationship or marriage	1,422 (64.2)	1,088 (63.5)	146 (65.8)	188 (67.6)	
Nonexclusive relationship	118 (5.3)	96 (5.6)	11 (5.0)	11 (4.0)	
Single with sexual contacts in the last year	421 (19.0)	332 (19.4)	465(20.3)	44 (15.8)	
No sexual contacts in the last year	233 (10.5)	183 (10.7)	19 (8.6)	31 (11.2)	
Partnership duration					.405
Less than 6 months	178 (8.0)	136 (7.9)	22 (9.9)	20 (7.2)	
6 months to 2 years	393 (17.8)	304 (17.7)	42 (18.9)	47 (16.9)	
2 to 5 years	439 (19.8)	341 (19.9)	45 (20.3)	53 (19.1)	
More than 5 years	572 (25.8)	432 (25.2)	56 (25.2)	83 (30.2)	
Number of children					.227
No children	1,782 (80.5)	1,396 (82.8)	175 (79.5)	211 (76.2)	
1 child	172 (7.8)	119 (7.1)	20 (9.1)	33 (11.9)	
More than 1 child	230 (10.4)	172 (10.2)	25 (11.4)	33 (11.9)	
Sexual orientation*					.031
Heterosexual	1,586 (71.6)	1,221 (71.2)	159 (71.6)	206 (74.1)	
Homosexual	296 (13.4)	245 (14.3)	19 (8.6)	32 (11.5)	
Bisexual	279 (12.6)	212 (12.4)	38 (17.1)	29 (10.4)	
Other	50 (2.3)	33 (1.9)	6 (2.7)	11 (4.0)	
Education***					< .001
Primary school	231 (10.4)	188 (13.0)	24 (10.9)	19 (6.9)	
Secondary school	787 (35.5)	612 (42.2)	79 (35.9)	96 (34.9)	
College degree	929 (42.0)	652 (44.9)	117 (53.2)	160 (58.2)	
Occupation					.536
Full-time employment	753 (34.0)	560 (38.2)	92 (41.1)	101 (36.3)	
Part-time employment	270 (12.2)	194 (13.2)	32 (14.4)	44 (15.8)	
Student	770 (34.8)	530 (36.2)	78 (35.1)	105 (37.8)	
Other	173 (7.8)	181 (13.3)	20 (9.2)	28 (10.0)	

Notes. [a]Numbers vary due to missing data.
*p < .05. ***p < .001.

On the first page of the survey, women were informed that they could withdraw from the study at any time without negative consequences. About 64% of the sample were in a monogamous, exclusive relationship or married, and 81% had no children. The sample comprised mainly highly educated women, with almost 36% completing secondary school and 42% reporting a college degree. Just under 35% of the participants were students, and 46% were either in full-time or part-time employment. Table 1 contains a summary of the sample characteristics.

As the survey was not initially designed as a longitudinal study, providing contact information was not especially promoted or incentivized for the participants. Nevertheless, 886 women from the original sample provided their e-mail address and were contacted again for the follow-up

assessments one and two years later. By October 2014, 396 (44.7%) women had completed the first follow-up survey, and by September 2015, 382 (43.1%) women had completed the second follow-up survey.

We investigated if three groups of women (women who participated only at baseline, who completed baseline and one follow-up, and those who participated in baseline and both follow-ups) differed in any of the sociodemographic variables. All subsamples were comparable regarding age, partnership status, relationship duration, number of children, and current occupation. Differences between the three groups were found regarding sexual orientation $\chi^2(4, 2161) = 10.60$, $p = .031$, and education level, $F(2, 1963) = 8.96$, $p < .001$. Post-hoc t tests showed that women who participated at baseline only had lower education levels compared to both women who completed baseline and one follow-up, $t(1687) = -2.00$, $p = .046$, and those who completed all three time points, $t(1742) = -3.95$, $p < .001$.

The relative number of heterosexual and bisexual participants did not differ between the samples. However, the proportion of homosexual women differed between the groups, $F(2, 2211) = 3.27$, $p = .038$, with post-hoc tests indicating that among the women who participated at baseline and one follow-up, the relative number of homosexual women was higher compared to the baseline-only participants.

Procedure

The website that was launched for the initial data assessment had 5,200 visitors between July and November 2013. Of the 2,987 women who started the questionnaire, 2,049 (69%) participants completed it. Participants received no financial compensation. Feedback regarding their sexual function level was given after completion of the questionnaire; their total FSFI score (Rosen et al., 2000) was presented on the last page of the survey. Women were also advised to contact a gynecologist if they felt the need to talk about a potential sexual problem. A reminder e-mail was sent two weeks after the first invitation. In July 2014 and July 2015 the invitations for the one- and two-year follow-up studies were sent to all participants who at baseline had given their consent to be contacted again. The mean duration between the first and second participation was 11.2 months ($M = 339.7$ days, $SD = 37.1$), and the duration between the second and third participation was 11.5 months ($M = 349.5$ days, $SD = 12.29$). The Ethics Committee of the Faculty of Psychology at Ruhr-Universität Bochum approved the study procedures.

Measures

Sexual Excitation and Sexual Inhibition

SE and SI were assessed with the German version of the SESII-W (Graham et al., 2006; Velten, Scholten, Graham, & Margraf, 2016), a 36-item self-report questionnaire that measures proneness for SE and SI in women. Items, a series of statements about factors influencing sexual response, are rated on a scale ranging from 1 (*strongly disagree*) to 4 (*strongly agree*). Via exploratory factor analysis, two higher order factors (SE and SI) and eight lower order factors were identified. Five lower order factors reflect different aspects of SE. The Arousability factor consists of nine items and describes how easily one becomes aroused by sexual fantasies or external sexual stimuli. The Partner Characteristics factor has four items that assess how certain aspects of a potential sexual

partner such as intelligence can boost a woman's sexual excitement. The Sexual Power Dynamics factor assesses, also with four items, how aspects of dominant behavior increase or diminish sexual arousal. The Smell factor has two items measuring how arousing one perceives certain scents, and finally, the Setting (unusual, unconcealed) factor has four items, covering different aspects of the sexual situation, such as being overheard by others or the danger of being caught during sexual activity, and their influence on sexual arousal. Three lower order factors represent different aspects of SI. The Concerns about Sexual Function scale (four items) assesses how concerns about being a good lover or becoming sufficiently aroused impair sexual response and arousal. Relationship Importance (six items) asks how different aspects of a sexual relationship, such as mutual trust or commitment, influence sexual arousal. Lastly, the three-item Arousal Contingency scale assesses how important it is for a woman's arousal that every aspect of the sexual situation be "just right" and how easily she can be "turned off" once arousal is initiated. Validity and reliability of the SESII-W in the original validation study was satisfactory to good (Graham et al., 2006). The German version of the scale also exhibited good construct validity, internal consistency, and one-month test-retest validity (Velten et al., 2015). The questionnaire showed high one-year stability with intercorrelations of, $r = .73$, $p < .001$, for the higher order SE factor and $r = .80$, $p < .001$, for the higher order SI factor. This is in line with the assumption of the dual control model that both propensities are relatively stable individual traits (Bancroft & Janssen, 2000).

Sexual Function

Female sexual function was assessed with the Female Sexual Function Index (Rosen et al., 2000), a self-report questionnaire that measures female sexual functioning over the last four weeks. The FSFI consists of six subscales that reflect different aspects of women's sexual function. The Desire subscale includes two items and assesses the frequency and intensity of sexual interest or desire. The Arousal subscale consists of four items that include frequency and intensity of sexual arousal during sexual activities alone or with a partner, confidence about becoming aroused, and satisfaction with arousal. The Lubrication subscale includes four items covering frequency of lubrication during sexual activities, difficulties with becoming lubricated, and frequency and difficulties with maintaining lubrication. The Orgasm subscale has three items and asks about frequency of orgasms during sex, difficulties with reaching an orgasm, and satisfaction with the ability to reach climax. The Satisfaction subscale includes three items about the emotional closeness to a partner during sexual activities, satisfaction with the sexual relationship with a partner, and satisfaction with sexual life in general. The Pain subscale consists of three items that cover frequency and degree of pain or discomfort during or following vaginal penetration. Items are answered on a 1- to 5-point scale, with higher scores indicating better sexual function. Some questions include the additional answer category of 0, indicating no sexual activity during the last month. Subscales can be combined into one total score, ranging from 2 to 36 points, with a clinical cutoff of 26.55 (Wiegel, Meston, & Rosen, 2005); women scoring below that cutoff are deemed at risk for sexual dysfunction. The validation of the German FSFI yielded good psychometric properties (Berner, Kriston, Zahradnik, Härter, & Rohde, 2004). The FSFI has recently been criticized as a measure of general female functioning because it only assesses proactive and not responsive female sexual desire, does not measure sex-related distress, and might overestimate sexual problems in women

due to its high cutoff-point for healthy sexual function (Forbes, Baillie, & Schniering, 2014). However, these aspects are less relevant for the present study as the total FSFI score was used as a dimensional measure of general female sexual function, and not to discriminate between functional and dysfunctional women or to identify problems related to low sexual desire.

Other Relevant Variables

Partnership status (coded 0 for *steady partnership* and 1 for *no steady partnership*) was assessed and included in the data analyses. Seven items from the Depression Anxiety Stress Scales (DASS; Crawford & Henry, 2003) were used to assess depressive symptoms as a possible predictor of sexual function. Internal consistency of the scale was $\alpha = .90$ in the present study. The DASS has good psychometric properties (Crawford & Henry, 2003) and measures depressive symptoms over the last week, with seven items rated on a 4-point Likert scale ranging from 0 (*did not apply to me at all*) to 3 (*applied to me very much, or most of the time*).

Data Analyses

Data were analyzed using SPSS version 21.0 (IBM, 2012). Zero-order bivariate correlations were calculated to assess the associations between predictor variables—including factors of SE and SI, symptoms of depression, and partnership status—at baseline and sexual function at baseline and follow-up. Group differences were analyzed with *t* tests, univariate analysis of variance, or $\chi 2$ tests. Three hierarchical multiple-regression analyses were conducted to examine the relationship between the predictor and outcome variables. In the first step, the scales of the SESII-W were included to assess the predictive value of SE and SI for sexual function. In the second step, partnership status, depressive symptoms, and prior sexual function levels were added in order to control for their influence on future sexual function.

RESULTS

Descriptive Analyses

Table 2 displays the mean scores for SE, SI, sexual function, and depression for the complete baseline sample and for the three different subsamples, i.e., the groups of women who participated either only at baseline, at baseline and at one follow-up, or at all three time points. With the exception of one SE subscale, the three subsamples showed comparable levels of sexual excitation, sexual inhibition, sexual function, and depression. The only significant group difference emerged on the Sexual Power Dynamics subscale of SE, $F(2, 2211) = 4.38$, $p = .013$. Post-hoc *t* tests showed that women who participated only at baseline had lower levels of Sexual Power Dynamics compared to those who participated at baseline and follow-up 1, $t(1934) = –2.84$, $p = .005$. Cohen's *d* was .02, indicating that the effect size of this group difference was small.

The time course of the FSFI was calculated using the data from the subsample of women who participated at all three time points ($N = 278$). The levels of sexual function were 25.11 (*SD* = 7.58) at baseline, 24.42 (*SD* = 8.35) at follow-up 1, and 24.15 (*SD* = 8.65) at follow-up 2,

TABLE 2
Descriptive Values of Sexual Excitation, Sexual Inhibition, Sexual Function, and Depression at Baseline
Assessement for the Complete Sample and the Different Subsamples

	Baseline sample (N = 2,214)		One data point (n = 1,714)		Two data points (n = 222)		Three data points (n = 278)		
	M	SD	M	SD	M	SD	M	SD	p value
Sexual Excitation (total)	2.77	0.35	2.76	0.36	2.80	0.31	2.78	0.35	.341
Arousability	3.02	0.40	3.02	0.43	3.06	0.36	3.06	0.40	.082
Partner Characteristics	2.81	0.49	2.81	0.50	2.82	0.49	2.84	0.46	.597
Sexual Power Dynamics*	2.70	0.51	2.68	0.51	2.78	0.47	2.72	0.55	.013
Smell	2.94	0.74	2.95	0.74	2.96	0.71	2.90	0.73	.591
Setting	2.36	0.57	2.36	0.58	2.37	0.57	2.35	0.56	.954
Sexual Inhibition (total)	2.56	0.49	2.57	0.49	2.54	0.50	2.56	0.48	.688
Concerns About Sexual Function	2.58	0.62	2.58	0.62	2.56	0.64	2.63	0.61	.394
Arousal Contingency	2.20	0.67	2.21	0.67	2.16	0.66	2.17	0.70	.396
Relationship Importance	2.91	0.56	2.92	0.56	2.90	0.57	2.89	0.60	.726
Female Sexual Function Index (total)	24.55	8.03	24.39	8.14	24.95	7.73	25.11	7.58	.281
Desire	4.16	1.01	4.14	1.01	4.30	0.96	4.14	1.05	.095
Arousal	4.18	1.81	4.14	1.82	4.29	1.77	4.32	1.78	.205
Lubrication	4.62	1.99	4.58	2.01	4.81	1.91	4.70	1.89	.201
Orgasm	3.84	1.98	3.82	1.98	3.79	2.00	3.96	1.96	.494
Satisfaction	4.22	1.39	4.20	1.40	4.23	1.39	4.35	1.33	.288
Pain	3.52	1.54	3.50	1.56	3.54	1.53	3.64	1.45	.352
Depressive Symptoms	11.43	4.47	11.53	4.54	11.28	4.33	11.01	4.17	.179

Note. *p < .05.

indicating no significant differences between the data assessments, Wilks's lambda = 0.99, $F(2, 273) = 1.94$, $p = .178$.

In order to estimate the generalizability of our results, the levels of SE, SI, and sexual function of our baseline sample were compared to those of other relevant study samples. The total scores of SE ($M = 2.77$, $SD = 0.35$) were slightly higher and the total scores of SI ($M = 2.56$, $SD = 0.35$) were marginally lower compared to the SESII-W scores that were reported in the original validation sample by Graham et al. (2006). The effect sizes of these differences were minimal to small, with Cohen's $d = 0.17$ for SE and $d = 0.02$ for SI. Baseline sexual function level, as measured by the FSFI, was 24.55 ($SD = 8.08$), which is significantly lower than the mean score for healthy controls ($M = 30.5$, $SD = 5.29$), but higher than the mean score for women with Female Sexual Arousal Disorder ($M = 19.2$, $SD = 6.63$) reported by Rosen et al. (2000). Forty-four percent of women at baseline had FSFI sexual function scores below the clinical cutoff of 26.55.

Correlational Analyses

Table 3 shows bivariate correlations between the predictors at baseline assessment and sexual function levels at baseline, follow-up 1, and follow-up 2. Being in a steady partnership and having

TABLE 3
Bivariate Correlations Between Predictors at Baseline and Sexual Function at Baseline, Follow-Up 1, and Follow-Up 1

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 Age	1															
2 Partnership Status	-.01	1														
3 Depression	-.13***	-.13***	1													
4 Sexual Excitation (Total)	-.10***	-.11***	-.08***	1												
5 Arousability	-.07**	-.08***	-.07***	.72***	1											
6 Partner Characteristics	-.04	-.10***	-.07***	.60***	.40***	1										
7 Sexual Power Dynamics	-.12***	-.04	-.05*	.64***	.38***	.23***	1									
8 Smell	-.05*	-.07**	-.01	.70***	.41***	.29***	.21***	1								
9 Setting (Unusual/Unconcealed)	-.06**	-.09**	-.07**	.58***	.28***	.12***	.33***	.14***	1							
10 Sexual Inhibition (Total)	-.06**	.10***	.20***	-.27***	-.20***	.02	-.30***	-.06**	-.37**	1						
11 Concerns About Sexual Function	-.10**	.05*	.15***	-.14***	-.11***	.06**	-.17***	-.03	-.23**	.82***	1					
12 Arousal Contingency	-.02	.09***	.23***	-.30***	-.26***	-.06**	-.27***	-.11***	-.32**	.83***	.54***	1				
13 Relationship Importance	-.02	.10***	.09***	-.18***	-.08***	.05*	-.26***	.03	-.34**	.70***	.37***	.35***	1			
14 FSFI Baseline	.01	.30***	-.22***	.27***	.27***	.09***	.25***	.11***	.20**	-.30***	-.26***	-.30***	-.14**	1		
15 FSFI Follow-Up 1	.04	.23***	-.27***	.22***	.19***	.06	.21***	.03	.25***	-.27***	-.24***	-.26***	-.13*	.52***	1	
16 FSFI Follow-Up 2	.01	-.14*	-.13*	.28***	.25***	.13*	.15**	.15*	.22***	-.29***	-.27***	-.31***	-.08	.41***	.49***	1

Notes. FSFI = Female Sexual Function Index.
*p < .05. **p < .01. ***p < .001.

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lower levels of depression at baseline were mainly associated with better sexual function at all time points. The higher and lower order factors of SE were positively associated with sexual function at all time points. Only Partner Characteristics and Smell were not significantly associated with sexual function at follow-up 1. All factors of SI were negatively associated with sexual function with the exception of Relationship Importance, which was not associated with sexual function at follow-up 1. Effect sizes of the correlations between SE, SI, and sexual function were small to medium. Sexual function levels at the different data assessment points were also positively correlated with medium to large effect sizes.

Regression Analyses

Table 4 shows the results from three regression analyses that were conducted to assess the predictive value of the baseline levels of SE and SI for both concurrent and future sexual function.

Several subscales of SE were significant positive predictors of sexual function at all measurement points. Arousability, Sexual Power Dynamics, and Setting (unusual/unconcealed) were all positive predictors of sexual function at baseline and follow-up 1. Partner Characteristics was also a positive predictor of sexual function, but only at follow-up 2. Furthermore, two of these subscales (Arousability and Sexual Power Dynamics) were also predictive of future sexual function, above and beyond the prior sexual function levels. Two subscales of SI also showed significant predictive value for sexual function. Concerns about Sexual Function was a negative predictor for sexual function at all time points and Arousal Contingency was a negative predictor at baseline and follow-up 2. Being in a steady partnership was a positive predictor of sexual function at all time points, and symptoms of depression were a negative predictor at baseline and follow-up 1. Prior sexual function levels were all significantly predictive for future sexual function. The scales of the SESII-W explained about 16%, 13%, and 17% of outcome variance at baseline, follow-up 1, and follow-up 2, respectively. The complete models—including partnership status, depressive symptoms and prior sexual function levels—explained 29%, 33%, and 36% of outcome variance.

DISCUSSION

The primary objective of the current study was to evaluate the associations between the two factors of the dual control model of sexual response—sexual excitation and sexual inhibition—and female sexual function using sufficiently large cross-sectional and longitudinal data sets. Predictor and outcome variables were measured with two well-validated and reliable self-report questionnaires, the SESII-W (Graham et al., 2006) and the FSFI (Rosen et al., 2000). The longitudinal data assessment allowed for a determination of the predictive value of SE and SI for future sexual function.

In line with our first hypothesis, four facets of SE were independently associated with female sexual function. Women who reported high levels of sexual function perceived themselves as responsive or easily aroused by sexual thoughts or external sexual cues. They also reported more sexual excitation due to sexual power dynamics, e.g., being confronted with a dominant sexual partner or being in unusual or unconcealed settings.

TABLE 4
Hierarchical Multiple Regression Analyses Predicting the Sexual Function Level at Baseline, Follow-Up 1, and Follow-Up 2

| | FSFI Baseline | | | | FSFI Follow-Up 1 | | | | FSFI Follow-Up 2 | | | |
| | Step 1 (only SESII-W) | | Step 2 (complete) | | Step 1 (only SESII-W) | | Step 2 (complete) | | Step 1 (only SESII-W) | | Step 2 (complete) | |
	β	t	β	t	β	t	β	t	β	t	β	t
FSFI at Follow-Up 1											.31	5.10***
FSFI at Baseline							.38	7.46***			.20	3.01**
Partnership (No/Yes)			.34	17.39***			.13	2.66**			.10	1.73(*)
Depression			-.10	-5.06***			-.12	-2.65**			.07	1.19
Arousability	.14	5.47***	.15	6.22***	.07	1.24	.11	2.11*	.07	1.01	.04	0.66
Partner Characteristics	-.02	-1.08	.00	-0.17	.02	0.33	.00	0.09	.10	1.65	.13	2.38*
Sexual Power Dynamics	.11	4.72***	.10	4.41***	.12	2.28*	.03	0.62	.02	0.37	-.05	-0.90
Smell	-.01	-0.44	.01	0.36	-.07	-1.37	-.05	-1.09	.06	1.03	.05	0.89
Setting (Unusual/Unconcealed)	.05	2.16*	.06	2.80**	.14	2.54*	.08	1.67(*)	.11	1.70(*)	.07	1.20
Concerns About Sexual Function	-.14	-5.66***	-.13	-5.65***	-.13	-2.15*	-.07	-1.35	-.15	-2.23*	-.09	-1.51
Arousal Contingency	-.16	-6.10***	-.16	-6.42***	-.11	-1.74(*)	-.02	-0.39	-.17	-2.31*	-.10	-1.49
Relationship Importance	.02	0.74	-.02	-0.74	.03	0.62	.02	0.50	.04	0.69	.03	0.54
R^2	.16		.29		.13		.33		.17		.36	

Notes. FSFI = Female Sexual Function Index; SESII-W = Sexual Excitation/Sexual Inhibition Inventory for Women.
(*)$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$.

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Contrary to our first hypothesis, sexual excitation due to certain partner attributes and smells did not predict sexual function at baseline. However, it is possible that this effect was the result of a significant proportion of overlapping variance explained by the substantial intercorrelations of the different lower order factors of SE.

Two aspects of SI were significantly associated with baseline sexual function. Arousal Contingency—reflecting the need for every aspect of a situation to be "just right" for arousal to occur—showed substantial associations with sexual function. This factor has been described as an inhibitory tone that needs to be lowered or overcome to allow the experience of sexual arousal and has been previously identified as a specific correlate of sexual problems in men and women (Bancroft et al., 2009). The second factor of SI, Concerns about Sexual Function, was negatively correlated with sexual function. This finding was unsurprising, as women who experience sexual difficulties, such as arousal difficulties or sexual pain, would be expected to be more prone to worry about their sexuality than women who experience a satisfying or relatively unproblematic sexual life. Higher levels of sexual inhibition due to relationship importance—reflecting the need for a certain level of trust or commitment in order to become sufficiently aroused—were not predictive of sexual function. This result is in line with previous research that found no significant predictive value for the Relationship Importance scale and overall sexual difficulties in women (Sanders et al., 2008).

In line with our second hypothesis, most of the factors of SE and SI were predictive of future sexual function for at least one of the two follow-up assessments. Four subscales of SE were predictive of future sexual function, with two subscales—Arousability and Partner Characteristics—even predicting future sexual function above and beyond prior sexual function levels. Two subscales of SI—Concern about Sexual Function and Arousal Contingency—were also predictive of future sexual function, but not over and above prior sexual function level.

Thus, data from this study support the theoretical assumption of the dual control model that certain characteristics of SE and SI constitute predispositions or risk factors for the occurrence of low sexual function. Our data also underline the multifarious influences on female sexual function and the importance of situational (e.g., Setting subscale), individual (e.g., Arousal Contingency subscale, depressive symptoms), and partner-related (e.g., Partner Characteristic subscale, partnership status) factors, as well as the relevance of both excitatory and inhibitory mechanisms.

Consistent with our third hypothesis, prior sexual function was a significant predictor of sexual function at follow-up 1 and 2. The validation study of the FSFI that indicated a high temporal stability of the measure ($r = .88$, $p < .001$) only covered a relatively short interval (two to four weeks) (Rosen et al., 2000), a period that is usually used to assess the test-retest reliability of a questionnaire. Our findings contribute to the literature by providing evidence of a relatively high stability of female sexual function measured by the FSFI beyond the assessed period of four weeks. Future studies should clarify if methodological aspects, like a lack of sensitivity to change or actual temporal stability of sexual function, are responsible for this finding. The few longitudinal studies that have been conducted to investigate the time course of female sexual function have indicated a pattern of relatively high temporal stability (Hayes & Dennerstein, 2005).

On a cross-sectional and longitudinal basis, our study replicated the association between sexual problems and symptoms of depression. A recent meta-analysis by Atlantis and Sullivan (2012) emphasized the bidirectional nature of depression and sexual dysfunctions in men and women.

There are several limitations that challenge the internal and external validity of the results. Our convenience sample consisted of relatively young and highly educated women. Although previous research has shown that online studies have several benefits compared to personal or telephone interviews, e.g., more honest answers to sensitive questions (Gunter, Nicholas, Huntington, & Williams, 2002), simple administration, and low costs (Evans & Mathur, 2005), online data assessment and our focus on online recruitment strategies precluded participation by women who do not use the Internet regularly. Possible volunteer bias is known in sexuality-related research and is characterized by sexually less traditional and more sexually experienced individuals participating more often in such studies (Wiederman, 1999). However, our sample was comparable to those in other sexuality-related studies regarding our relevant predictor and outcome measures, as well as other sociodemographic variables such as age and education. Additionally, our different subsamples (i.e., women participating once, twice, or at all three time points) were also similar on scores of psychometric measures like the FSFI, as well as on sociodemographic variables such as age or partnership status, indicating that meaningful comparisons between these subsamples were feasible.

A sexual dysfunction is characterized by a specific sexual problem, e.g., difficulty reaching orgasm that has to be present at least 75% of the time for a minimum of six months and has to cause clinically significant distress in the individual (American Psychiatric Association, 2013). Therefore, as we did not assess distress or specific sexual problems, we cannot generalize our findings about female sexual function directly to clinical populations. However, preliminary evidence indicates that the same factors of SI that we found were associated with the FSFI may also be linked to clinically relevant sexual dysfunctions in women (Bloemendaal & Laan, 2015).

CONCLUSION

Sexual excitation and sexual inhibition were both meaningful predictors of concurrent and future sexual function levels in women. Arousability, Partner Characteristics, Sexual Power Dynamics, Setting (unusual/unconcealed), Concerns about Sexual Function, and Arousal Contingency were especially relevant predictors because of their predictive value for future sexual function. Prior sexual function was also a consistent significant predictor of women's future sexual functioning. Our study was the first to test the assumptions of the dual control model with respect to the prediction of sexual problems in a longitudinal data set. If our findings can be replicated in a more heterogeneous sample, this would confirm the conceptualization of SE and SI as predictors of sexual function.

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