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# Sexual activity and sexual dysfunction of women in the perinatal period: a longitudinal study

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**Abstract**

*Purpose* Reduced sexual activity and dysfunctional problems are highly prevalent in the perinatal period, and there is a lack of data regarding the degree of normality during pregnancy. Several risk factors have been independently associated with a greater extent of Female Sexual Dysfunction (FSD). Therefore, this study aimed to assess the prevalence of sexual inactivity and sexual dysfunctions in German women during the perinatal period and the verification of potential risk factors.

*Methods* Questionnaires were administered to 315 women prenatally (TI 3rd trimester) and postpartum (TII 1 week, TIII 4 months), including the Female Sexual Function Index (FSFI), the Edinburgh Postnatal Depression Scale (EPDS), and the Questionnaire of Partnership (PFB).

*Results* The frequency of sexual inactivity was 24% (TI), 40.5% (TII), and 19.9% (TIII). Overall, 26.5−34.8% of women were at risk of sexual dysfunction (FSFI score <26.55) at all measurement points. Sexual desire disorder was the most prevalent form of Female sexual dysfunction. Furthermore, especially breastfeeding and low partnership quality were revealed as significant risk factors for sexual dysfunctional problems postpartum. Depressive symptoms having a cesarean section and high maternal education were correlated with dysfunctional problems in several subdomains.

*Conclusions* Findings indicated that women at risk of FSD differed significantly in aspects of partnership quality, breastfeeding, mode of delivery, maternal education, and depressive symptoms. Aspects of perinatal sexuality should be routinely implemented in the counseling of couples in prenatal classes.

**Keywords** Sexual activity · Female sexual dysfunction · Breastfeeding · Delivery · Pregnancy · Partnership satisfaction

## Introduction

Sexual health is an important part of the women's' quality of life and is defined by the World Health Organization as "a state of physical, emotional, mental, and social well-being related to sexuality" [1]. Sexual dysfunctions are defined as disorders related to both, getting sexual desire, and sexual satisfaction for various reasons [2, 3]. The American Psychiatric Association defines Female sexual dysfunction (FSD) as "a disturbance in the process that characterize the sexual response cycle or by pain associated with sexual intercourse" [4]. The previous studies indicated that 30–60% of women have suffered from sexual dysfunction at least once in their lives [5–7].

Pregnancy and especially late pregnancy represent challenging periods for women to preserve sexuality. In the majority of women, sexual desire generally decreases during pregnancy, although there might be a wide range of

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individual responses and fluctuating patterns [8]. Reduced sexual activity and dysfunctional problems are highly prevalent in the perinatal period and independently associated with several risk factors. By the third trimester, between 83 and 100% of primigravidae report a decrease in frequency of sexual intercourse [7, 9] and recent studies reported high rates of FSD above 60% concerning the first year postpartum [10].

Sexual activity and its functional impairment may have substantial impacts on quality of life [11], and the couple's emotional and overall relationship [12]. During and after pregnancy, several factors have been found to be independently associated with a decline in sexual activity, such as marital conflicts, socio-cultural influences, age, parity, breastfeeding, tiredness, history of depression, stressful life events, and socio-economic difficulties [13–15]. In addition, postpartum women experiencing maternal morbidity had more frequently dyspareunia and resumed sexual activity later, when compared to women without morbidity [16]. However, FSFI scores did not differ between these groups [16].

While international studies demonstrated tremendously high rates of perinatal FSD [10, 17, 18], up-to-date data from Europe are missing among the literature. In particular, despite these studies, it is not known how many women of those at risk of FSD are sexually active at all [17, 18]. As female sexual function and the prevalence of sexual disorders highly depend on socio-cultural parameters, other European studies assessing FSD among comparable age groups found similar high prevalence rates above 60% comparable to the perinatal period [19].

Furthermore, few prospective longitudinal studies have focused on short- and long-term sexual activity, including pregnancy and the postpartum period, and many studies on sexual function lack validated measures.

Therefore, we aimed to prospectively examine the frequency of women's sexual activity over a period of 6 months from the third trimester up to 4-month postpartum and to identify the proportion at risk for FSD. Second, we focused on potential socio-demographic, medical, and psychological risk factors for FSD.

## Methods

### Procedure

A longitudinal cohort study was carried out at the Department of Obstetrics and Gynecology of the University Hospital of Heidelberg between January and August 2014. The hospital has a perinatal center of the highest level providing health services to low-, medium-, and high-risk obstetrical patients from an area with approximately 200,000 inhabitants, and performs 1,800 deliveries per year. Pregnant women were recruited at random while waiting for their routine medical check-ups. The eligibility criteria included being 18 years and older, currently pregnant, and having a sufficient knowledge of the German language. Not all eligible women were assessed as recruitment only occurred on certain days of the week. 427 pregnant women were approached, and 315 (73.7%) gave informed consent. Questionnaires were distributed paper based in the third trimester (TI) and postpartum (TII 1 week, TIII 4 months). Ethics approval was granted by the Ethical Committee of the University of Heidelberg.

### Measures

The questionnaires were developed to include a range of validated tools as wells as socio-demographic and medical data.

### Female Sexual Function Index (FSFI)

The FSFI is comprised of 19 questions [20]. We used the German FSFI version validated by Berner et al. [21]. The answers to the questions, reflecting the last 4 weeks, yield a total score composed of sub-scores for desire, arousal, lubrication, orgasm, satisfaction, and pain. Total scores $<26.55$ were considered indicative of at risk for FSD [22]. The following values were used as cut-off scores for potential subdomain dysfunctions [22, 23]: desire $<4.28$, arousal $<5.08$, lubrication $<5.45$, orgasm $<5.05$, satisfaction $<5.04$, and pain $<5.51$. The questionnaire also provides the count of sexually inactive participants. The reliability (Cronbach's α) was good to excellent in all sub-scales at all measurement points for our sample ($\alpha = 0.868–\alpha = 0.984$) except in the sub-scale "satisfaction" at TII (T1: $\alpha = 0.739$, TII: $\alpha = 0.653$, TIII: $\alpha = 0.789$).

### Edinburgh Postnatal Depression Scale

The Edinburgh Postnatal Depressive Scale (EPDS) was used to detect symptoms of depression. Answers are based on the psychological state over the past 7 days. The scale is sensitive to changes in severity of depression and has been shown to have a sensitivity and specificity of 91 and 95% in predicting depressive disorders [24]. Internal consistency revealed as good for our sample (TI: $\alpha = 0.87$, TII: $\alpha = 0.86$, TIII: $\alpha = 0.90$).

### Breastfeeding characteristics

Breastfeeding characteristics included breastfeeding behavior after discharge and 4 month postpartum. Breastfeeding behavior was inversely ordinal coded at TII ("1" =

exclusively breastfeeding, "2" = partly, "3" = no breastfeeding) as well as at TIII ("1" = exclusively breastfeeding, "2" = partly, "3" = ablactated at TIII to "4" = never breastfed).

## Questionnaire of partnership

The Questionnaire of partnership (PFB) assesses general quality of partnership [25, 26] consisting of 30 four-point items, which are categorized into three scales: conflict behavior, tenderness, and communication. The previous analyses have evinced adequate scale reliability, with Cronbach's α ranging from 0.88 to 0.93 and 6-month test–retest reliability ranging from $r = 0.68–0.83$. In our sample, Cronbach's α was α = 0.92.

## Statistical analyses

We used the *Statistical Package for Social Sciences* (IBM® SPSS® v. 23.0.0.0) for all analyses conducted. The valid number of cases $n$ varied depending on the data sub-sets used for the particular test. Preliminary to the main analyses, we evaluated if missing values depended on third variables using Little's MCAR-test [27]. The MCAR test evaluates if the missing-completely-at-random-condition (MCAR) is fulfilled. Sexually inactive women were considered as an independent sub-group. Analyses of FSD and correlating factors were conducted for the overall cohort. The main analyses included descriptive statistics of the FSFI scores, frequencies of sexual inactivity, dysfunctionality, group comparisons according to FSFI sum score cutoffs ($\chi^2$ tests, Kruskal-Wallis-tests and ANOVAs), and associations (Pearson correlations) with other study variables at all three measurement points. In case of significant ANOVA main effects, the Student–Newman–Keuls-Procedure (SNK) was used as post-hoc test due to its economic qualities in multiple testing. Effect sizes of significant ANOVA effects are reported as partial $\eta^2$, which is a sample-based estimator of explained variance. According to Cohen [28], $\eta^2 = 0.01$ or $r = 0.1$ are small, $\eta^2 = 0.06$ or $r = 0.3$ are medium-sized, and $\eta^2 = 0.14$ or $r = 0.5$ are large effects. In all analyses, we set a conventional critical two-sided α-error of α = 0.05. The variables maternal education, income per month, number of pregnancies, and breastfeeding characteristics were treated as ordinal variables. Trends were not interpreted.

## Results

### Preliminary analyses

For the MCAR test, we considered socio-demographic data, pregnancy- and health-related information, delivery characteristics, breastfeeding behavior, and questionnaire data. The test was non-significant ($\chi^2 = 8092.113$, $df = 7949$, $p = 0.13$); thus, pair-wise and list-wise case-exclusions were valid for our sample and the sub-populations were representative for the larger study sample.

### Sample

Mean maternal age of the 315 participants was 32.8 years (SD = 4.6) and mean gestational age at study inclusion was 34.8 weeks of pregnancy (SD = 3.5, Min = 25.0, Max = 42.0). There were 115 vaginal deliveries (49.6% of valid $N = 232$ cases), including 16 (6.9%) vacuum-assisted deliveries, and 117 (50.5%) cesarean sections, 47 (20.3%) of those secondary. Mean birth weight was 3238.4 g (min = 990.0 g to max 4550.0 g, SD = 562.0 g). Mean gestational age at delivery was 39.1 weeks (min = 30.0 weeks to max = 42 weeks, $SD = 1.9$ weeks). Further assessed demographics can be seen in Table 1.

### Descriptive statistics of the FSFI and prevalence of sexual dysfunction

Descriptive characteristics of the FSFI scores and proportions of women at risk of FSD are demonstrated in Table 2.

The prevalence of potential FSD was at least 26.5% throughout all scales and measurement points. Sexual inactivity was highly prevalent with at least 19.6% (TIII) and at maximum 40.5% (TII). As the FSFI evaluates the last 4 weeks of life, this second measurement point (TII, one week postpartum) largely reflected sexuality in late pregnancy and not in the first week after delivery. The FSFI sum score and the sub-scale scores decrease from TI to TII and increase again to TIII. Among those, who were at risk of FSD, sexual desire disorder was the most prevalent form at all three assessment points (86.8–88.3%). The lowest rates of FSD were revealed for TII (26.5–37.2%) regarding the total score as well as the sub-scales, except desire (88.3) and satisfaction (67.3), due to the peak proportion of sexual inactivity after delivery at TII (40.5%). Hence, 1 week after delivery, sexual inactivity and FSD together constituted the largest peak proportion of sexual impairment (see Fig. 1). Only 14 mothers (11.6% of 107 mothers with valid list-wise FSFI-D data throughout the study) did not engage in any sexual activity consistently at all measurement points. Although this potentially high-risk sample is of clinical interest, the cell frequencies were too low to be further analyzed.

Regarding differences in group characteristics, Table 1 demonstrates demographic characteristics and comparisons for all three measurement points.

Breastfeeding characteristics at TII and TIII were significantly associated with sexual inactivity and FSD.

**Table 1** Socio-demographics, birth characteristics, and questionnaire assessment by FSFI subdomain and measurement points (in frequencies and valid percentages, respectively; means and standard deviations where appropriate)

| Education (TI) | No sexual activity in the past 4 weeks | At risk for FSD | Sexual activity and no risk of FSD | Income (TI) | No sexual activity in the past 4 weeks | At risk for FSD | Sexual activity and no risk of FSD |
|---|---|---|---|---|---|---|---|
| Low secondary education | 10 (14.1) | 6 (6.4) | 7 (5.3) | −999 | 13 (18.6) | 9 (5.2) | 13 (10.6) |
| High secondary education | 14 (19.7) | 26 (27.7) | 44 (33.3) | −1.999 | 15 (21.4) | 28 (32.2) | 31 (25.2) |
| University entrance qualification | 17 (23.9) | 21 (22.3) | 24 (18.2) | −2.999 | 12 (17.1) | 17 (19.5) | 26 (21.2) |
| University degree | 30 (42.3) | 41 (43.6) | 57 (43.2) | ≥3.000 | 30 (42.9) | 33 (37.9) | 53 (43.1) |
| Kruskal–Wallis test | $\chi^2 = 0.18$ | $df = 2$ | $P = 0.91$ | Kruskal–Wallis test | $\chi^2 = 0.31$ | $df = 2$ | $P = 0.86$ |
| History of prepartum depression (TI)[a] | | | | History of postpartum depression (TI)[b] | | | |
| False | 42 (93.3) | 48 (90.6) | 72 (96.0) | False | 31 (88.6) | 29 (80.6) | 57 (90.5) |
| True | 3 (6.7) | 5 (9.4) | 3 (4.0) | True | 4 (11.4) | 7 (19.4) | 6 (9.5) |
| $\chi^2$-test | $\chi^2 = 1.55$ | $df = 2$ | $P = 0.46$ | $\chi^2$-test | $\chi^2 = 2.10$ | $df = 2$ | $P = 0.35$ |
| Number of pregnancies (TI) | | | | Mode of delivery (TII) | | | |
| First | 25 (34.7) | 41 (43.6) | 55 (41.4) | Vaginal delivery | 33 (39.3) | 24 (43.6) | 30 (42.9) |
| Second | 24 (33.3) | 32 (34.0) | 40 (30.1) | Primary cesarean section | 27 (32.1) | 16 (29.1) | 18 (25.7) |
| Third | 15 (20.8) | 10 (10.6) | 21 (15.8) | Secondary cesarean section | 20 (23.8) | 10 (18.2) | 15 (21.4) |
| More than three | 8 (11.1) | 11 (11.7) | 8 (6.0) | Ventouse/forceps | 4 (4.8) | 5 (9.1) | 7 (10.0) |
| Kruskal–Wallis test | $\chi^2 = 1.36$ | $df = 2$ | $P = 0.51$ | $\chi^2$-test | $\chi^2 = 2.79$ | $df = 6$ | $P = 0.78$ |
| Breastfeeding characteristics (TII) | | | | Breastfeeding characteristics (TIII) | | | |
| Exclusively | 59 (67.8) | 31 (54.4) | 46 (64.8) | Exclusively | 16 (57.1) | 22 (44.9) | 15 (23.4) |
| Partly | 18 (20.7) | 19 (33.3) | 16 (22.5) | Partly | 5 (17.9) | 13 (26.5) | 16 (25.0) |
| Ablactation/no milk | 10 (11.5) | 7 (12.3) | 9 (12.7) | Ablactation | 5 (17.9) | 11 (22.4) | 25 (39.1) |
| | | | | Not breastfed at all | 2 (7.1) | 3 (6.1) | 8 (12.5) |
| Kruskal–Wallis test | $\chi^2 = 11.65$ | $df = 2$ | **$P = 0.003$** | Kruskal–Wallis test | $\chi^2 = 11.65$ | $df = 2$ | **$P = 0.003$** |
| Maternal age (TI) | 32.8 (4.9) | 33.0 (4.7) | 32.9 (4.4) | Pre-pregnancy BMI (TI) | 25.1 (0.8) | 25.2 (0.7) | 25.5 (0.6) |
| ANOVA | $F = 0.04$ | $df = 2$ | $P = 0.97$ | ANOVA | $F = 0.10$ | $df = 2$ | $P = 0.91$ |
| PFB (TI)[c] | 71.8 (11.1) | 70.3 (12.9) | 75.5 (5.4) | EPDS (TI) | 6.9 (5.5) | 7.0 (5.7) | 6.5 (5.2) |
| ANOVA | $F = 6.63$ | $df = 2$ | **$P = 0.002$** | ANOVA | $F = 0.26$ | $df = 2$ | $P = 0.78$ |
| Birth weight infant (TII) | 3276.3 (553.2) | 3155.9 (657.3) | 3293.4 (487.2) | APGAR 1 (TII) | 8.5 (1.1) | 8.5 (0.9) | 8.5 (1.0) |
| ANOVA | $F = 1.04$ | $df = 2$ | $P = 0.36$ | Kruskal–Wallis test | $\chi^2 = 0.32$ | $df = 2$ | $P = 0.85$ |
| EPDS (TII) | 6.5 (5.1) | 7.9 (5.6) | 6.9 (4.9) | EPDS (TIII) | 5.3 (4.5) | 5.3 (6.1) | 5.0 (5.4) |

**Table 1** (continued)

| Education (TI) | No sexual activity in the past 4 weeks | At risk for FSD | Sexual activity and no risk of FSD | Income (TI) | No sexual activity in the past 4 weeks | At risk for FSD | Sexual activity and no risk of FSD |
|---|---|---|---|---|---|---|---|
| ANOVA | $F = 1.15$ | $df = 2$ | $P = 0.32$ | ANOVA | $F = 0.26$ | $df = 2$ | $P = 0.77$ |

$P$ values in bold print are statistically significant

*FSFI* Female Sexual Function Index, *FSD* female sexual dysfunction, *ANOVA* analysis of variance, *BMI* body mass index, *PFB* Questionnaire on Partnership, *EPDS* Edinburgh Postnatal Depression Scale, *APGAR* score used to evaluate the health of newborns; Edinburgh Postnatal Depression Scale

[a] Valid percent based on subjects with prior pregnancies; 3 cells have expected an count less than 5

[b] Valid percent based on subjects with prior births; 2 cells have an expected count less than 5

[c] $\eta^2 = 0.04$, SNK post-hoc: no activity = dysfunction < functional

**Table 2** Descriptive statistics and proportions of women at risk for FSD based on mean FSFI scores
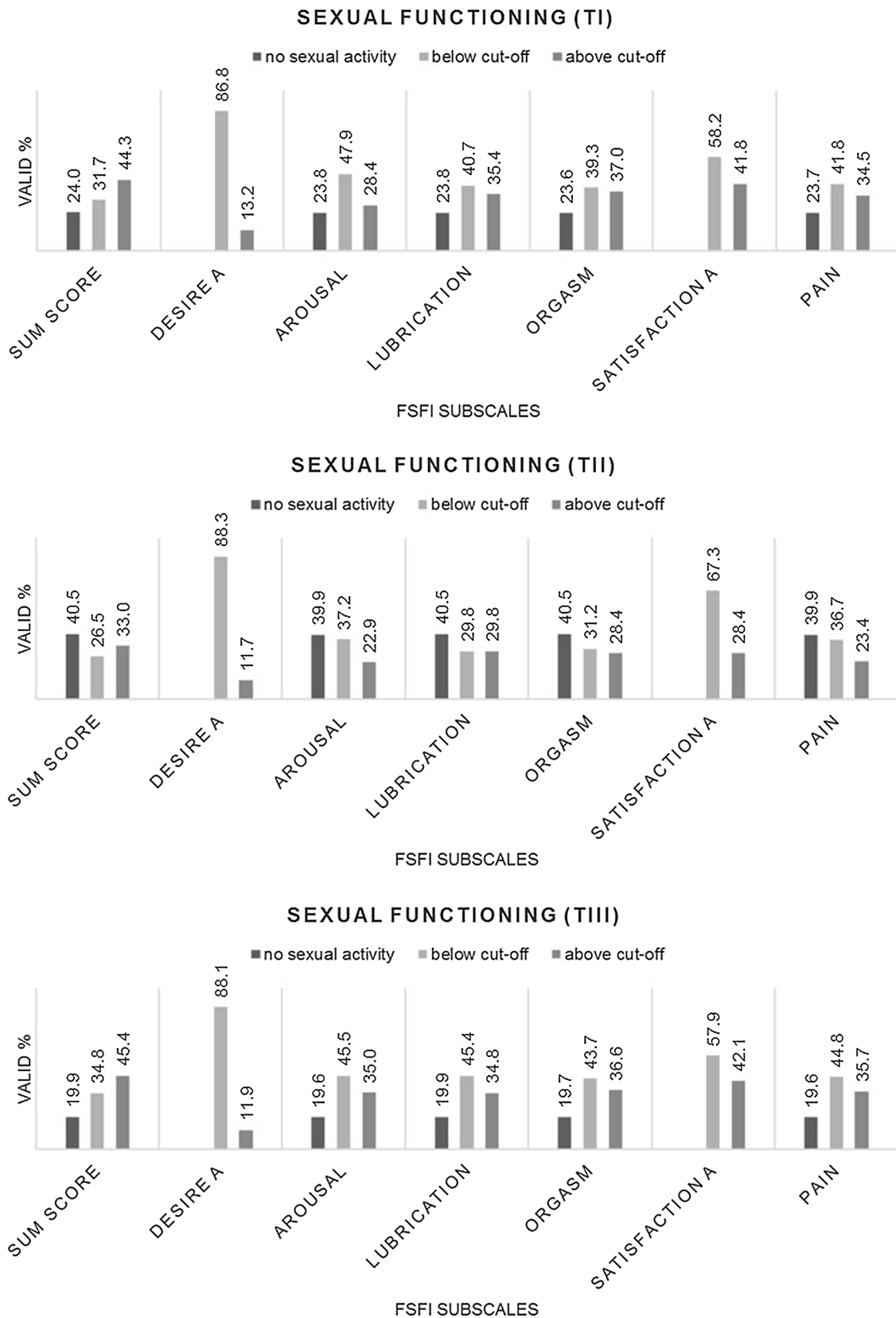
| Scale and cut-off values | TI (third trimester) M (SD) or f (valid %) | TII (1-week postpartum) M (SD) or f (valid %) | TIII (4-month postpartum) M (SD) or f (valid %) |
|---|---|---|---|
| FSFI total score | 21.1 (10.9) | 17.7 (11.4) | 22.4 (10.2) |
| No sexual activity, past 4 weeks | 72 (24.0) | 87 (40.5) | 28 (19.9) |
| At risk for FSD (FSFI <26.55) | 95 (31.7) | 57 (26.5) | 49 (34.8) |
| ≥26.55 | 133 (44.3) | 71 (33.0) | 64 (45.4) |
| Desire[a] | 3.1 (1.2) | 2.8 (1.3) | 3.0 (1.1) |
| <4.28 | 262 (86.8) | 197 (88.3) | 126 (88.1) |
| ≥4.28 | 40 (13.2) | 26 (11.7) | 17 (11.9) |
| Arousal | 3.3 (2.1) | 2.8 (2.2) | 3.7 (2.0) |
| No sexual activity, past 4 weeks | 72 (23.8) | 87 (39.9) | 28 (19.6) |
| <5.08 | 145 (47.9) | 81 (37.2) | 65 (45.5) |
| ≥5.08 | 86 (28.4) | 50 (22.9) | 50 (35.0) |
| Lubrication | 3.7 (2.5) | 3.0 (2.6) | 3.9 (2.3) |
| No sexual activity, past 4 weeks | 72 (23.8) | 87 (40.5) | 28 (19.9) |
| <5.45 | 123 (40.7) | 64 (29.8) | 64 (45.4) |
| ≥5.45 | 107 (35.4) | 64 (29.8) | 49 (34.8) |
| Orgasm | 3.4 (2.4) | 2.7 (2.5) | 3.7 (2.2) |
| No sexual activity, past 4 weeks | 72 (23.6) | 87 (40.5) | 28 (19.7) |
| <5.05 | 120 (39.3) | 67 (31.2) | 62 (43.7) |
| ≥5.05 | 113 (37.0) | 61 (28.4) | 52 (36.6) |
| Satisfaction[a] | 4.3 (1.5) | 4.0 (1.6) | 4.3 (1.5) |
| <5.04 | 166 (58.2) | 140 (67.3) | 81 (57.9) |
| ≥5.04 | 119 (41.8) | 68 (28.4) | 59 (42.1) |
| Pain | 3.3 (2.6) | 2.5 (2.6) | 3.9 (2.3) |
| No sexual activity, past 4 weeks | 72 (23.7) | 87 (39.9) | 28 (19.6) |
| <5.51 | 127 (41.8) | 80 (36.7) | 64 (44.8) |
| ≥5.51 | 105 (34.5) | 51 (23.4) | 51 (35.7) |

*FSD* female sexual dysfunction, *FSFI* Female Sexual Function Index

[a] The scale does not differentiate between sexually inactive and active participants

Breastfeeding women reported more often sexual inactivity or dysfunctional problems. Furthermore, partnership quality was associated to sexual functioning: Sexual inactive or dysfunctional women reported significantly lower partnership quality. The significant association between alcohol consume during pregnancy ($n = 6$ cases) and the distribution of sexual dysfunction ($\chi^2 = 7.84$,

## SEXUAL FUNCTIONING (TI)

■ no sexual activity  ■ below cut-off  ■ above cut-off

VALID %

FSFI SUBSCALES

SUM SCORE — 24.0, 31.7, 44.3
DESIRE A — 86.8, 13.2
AROUSAL — 23.8, 47.9, 28.4
LUBRICATION — 23.8, 40.7, 35.4
ORGASM — 23.6, 39.3, 37.0
SATISFACTION A — 58.2, 41.8
PAIN — 23.7, 41.8, 34.5

## SEXUAL FUNCTIONING (TII)

■ no sexual activity  ■ below cut-off  ■ above cut-off

VALID %

FSFI SUBSCALES

SUM SCORE — 40.5, 26.5, 33.0
DESIRE A — 88.3, 11.7
AROUSAL — 39.9, 37.2, 22.9
LUBRICATION — 40.5, 29.8, 29.8
ORGASM — 40.5, 31.2, 28.4
SATISFACTION A — 67.3, 28.4
PAIN — 39.9, 36.7, 23.4

## SEXUAL FUNCTIONING (TIII)

■ no sexual activity  ■ below cut-off  ■ above cut-off

VALID %

FSFI SUBSCALES

SUM SCORE — 19.9, 34.8, 45.4
DESIRE A — 88.1, 11.9
AROUSAL — 19.6, 45.5, 35.0
LUBRICATION — 19.9, 45.4, 34.8
ORGASM — 19.7, 43.7, 36.6
SATISFACTION A — 57.9, 42.1
PAIN — 19.6, 44.8, 35.7

**Fig. 1** Course of FSFI sum and sub-scale means throughout the measurement points

$p = 0.02$, $df = 2$) was not further investigated due to low cell frequencies.

## Significant association of FSFI sub-scales with factors potentially influencing sexual function

Table 3 demonstrates all significant correlations between the FSFI sub-scales and other considered study variables.

Partnership quality was significantly associated with several subdomains of the FSFI during pregnancy and postpartum. In addition, the sub-scale "satisfaction" was associated with maternal depressive symptoms (EPDS) at TIII: the lesser women felt satisfied with their sexual life, the more severe symptoms of depression they reported. There was also a significant association between having had a cesarean section and lower scores on the sub-scale "satisfaction" at TII. Furthermore, high maternal education was associated to sexual orgasm disorder at TIII: a higher degree of education was significantly correlated with lower scores on the sub-scale "orgasm".

There was no further association ($p > 0.05$) to the FSFI sub-scales for the following variables: health status, maternal smoking ($n = 14$ cases), and infant admission to the NICU ($n = 10$ cases). The significant association between alcohol consume at TI and the sub-scale "lubrication" ($r = -0.14$, $p = 0.04$, $n = 211$) was not further investigated due to low cell frequencies ($n = 6$ cases). Although there was a significant correlation between "History of prepartum depression" and the FSFI sub-scale "desire" ($r = -0.23$, $p = 0.04$, $n = 80$), we desisted from further investigating this association due to the small sample size ($n = 8$ cases); group comparisons for that variable proved not reliable (see Table 2).

## Discussion

### Prevalence of sexual inactivity and FSD

This study investigated sexual functioning over a period of 6 months starting during the third trimester of pregnancy and following women up to 4-month postpartum. We have seen that the majority of women during pregnancy and postpartum were either sexually inactive (20–40%) or showed FSFI scores indicative for FSD (26–35%) at any point of assessment.

Most of our findings are in line with recent literature characterizing the perinatal period by a decline of sexual activity [29, 30]. Women also seem to report higher levels of FSD and reduced sexual desire, potentially associated to overall physical discomfort [8, 31].

In our study, 31.7% of pregnant women showed FSFI scores indicative for FSD. Comparable studies from other countries reported considerably higher prevalence rates of FSD. Güleroglu et al. assessed 63.4% of pregnant Turkish participants to be at risk of FSD during pregnancy [7]. Only a few authors differentiated explicitly between sexual inactivity and being at risk of FSD, e.g., Galazka et al. examined 520 pregnant women and found that the group of women having sexual intercourse only once a month increased from 4.4% before pregnancy to 24.0% during the third trimester [32].

During the third trimester and in the first week postpartum, 67% of our participants respective 54.7% were either sexually inactive or showed FSFI scores indicative for FSD. These results point out especially late pregnancy as a challenging time period for couples and show their adaptive response. Within 4 months, the percentage of women who were sexually inactive decreased by half (40.5–19.9%), while potential FSD increased by one-third (26.5–34.8%). Taking both rates into account, these results confirm reported prevalences found in other studies, e.g., Khajehei et al. reported on rates of 64.3% of sexual dysfunction in Australian women in the first year postpartum [10].

When looking closer, the reported rates of FSD appeared almost double the rates of potential FSD we observed. Hence, this raises the question whether or not perinatal sexual inactivity represents a form of FSD or should rather be distinguished. Lack of sexual activity and desire can also be normative and adaptive responses to a challenging life phase. Pregnancy is a very dynamic process and late pregnancy is known to have a negative impact on sexual activity/function in a very high proportion of women. Our data support a partial overlap between these two groups, as inactive women and women at risk of FSD reported equally low partnership quality in comparison to sexually functioning women.

According to our findings, most women at risk of FSD reported difficulties regarding sexual desire. It was the most prevalent form of FSD throughout all three assessment points (87–88%), confirming the previous research that difficulties with desire seem to be the most common form during the perinatal period. This observation is supported by a Turkish study in which 88.9% of pregnant women reported on low desire [7] as well as through Khajehei's data for the first postpartum year with 81.2% of women having difficulties in this domain [10].

Contrariwise, the sexually inactive group reported by Galezka et al. named concerns for the baby's well-being and not reduced desire as the main reason for abstaining from sexual intercourse. Von Sydow also states that the fear of harming the baby during sexual activity might inhibit about one quarter of the expectant mothers and fathers [12].

To conclude, the prevalence of women at risk of FSD might be overestimated in many studies due to not

**Table 3** FSFI sub-scales: significant correlations with study variables

|  | Desire | Arousal | Lubrication | Orgasm | Satisfaction | Pain |
|---|---|---|---|---|---|---|
| **TI (third trimester)** | | | | | | |
| PFB sum score (TI) | | | | | | |
| $r$ | 0.09 | **0.17** | **0.12** | 0.07 | **0.28** | 0.10 |
| $P_{(2-tailed)}$ | 0.14 | **0.00** | **0.04** | 0.26 | **<0.001** | 0.08 |
| $n$ | 294 | **295** | **294** | 297 | **279** | 293 |
| Breastfeeding characteristics (TIII) | | | | | | |
| $r$ | **0.24** | 0.14 | 0.16 | 0.11 | 0.06 | 0.12 |
| $P_{(2-tailed)}$ | **0.00** | 0.08 | 0.05 | 0.18 | 0.46 | 0.14 |
| $n$ | **155** | 155 | 155 | 156 | 148 | 155 |
| **TII (1-week postpartum)** | | | | | | |
| PFB sum score (TI) | | | | | | |
| $r$ | **0.15** | 0.12 | 0.10 | 0.12 | **0.24** | 0.11 |
| $P_{(2-tailed)}$ | **0.03** | 0.07 | 0.15 | 0.10 | **0.00** | 0.12 |
| $n$ | **215** | 211 | 208 | 209 | **202** | 211 |
| Cesarean section (TII) | | | | | | |
| $r$ | −0.01 | −0.06 | −0.08 | −0.09 | **−0.22** | −0.10 |
| $P_{(2-tailed)}$ | 0.93 | 0.39 | 0.24 | 0.18 | **0.00** | 0.17 |
| $n$ | 217 | 211 | 209 | 209 | **202** | 212 |
| Breastfeeding characteristics (TIII) | | | | | | |
| $r$ | **0.20** | 0.11 | 0.13 | 0.13 | 0.07 | 0.10 |
| $P_{(2-tailed)}$ | **0.02** | 0.21 | 0.13 | 0.14 | 0.41 | 0.27 |
| $n$ | **141** | 140 | 136 | 137 | 131 | 139 |
| **TIII (4-month postpartum)** | | | | | | |
| High maternal education TI | | | | | | |
| $r$ | −0.13 | −0.11 | −0.14 | **−0.18** | −0.10 | −0.12 |
| $P_{(2-tailed)}$ | 0.12 | 0.21 | 0.10 | **0.03** | 0.25 | 0.15 |
| $n$ | 142 | 141 | 140 | **141** | 139 | 142 |
| PFB sum score TI | | | | | | |
| $r$ | **0.29** | **0.20** | 0.16 | 0.12 | **0.20** | 0.09 |
| $P_{(2-tailed)}$ | **<0.001** | **0.02** | 0.06 | 0.16 | **0.02** | 0.29 |
| $n$ | **142** | **141** | 140 | 141 | **139** | 142 |
| EPDS TIII | | | | | | |
| $r$ | −0.05 | −0.14 | −0.07 | −0.13 | **−0.21** | −0.06 |
| $P_{(2-tailed)}$ | 0.55 | 0.11 | 0.45 | 0.14 | **0.01** | 0.47 |
| $n$ | 141 | 141 | 139 | 140 | **138** | 141 |
| Breastfeeding characteristics TIII | | | | | | |
| $r$ | **0.25** | **0.26** | **0.24** | **0.18** | 0.16 | **0.26** |
| $P_{(2-tailed)}$ | **0.00** | **0.00** | **0.01** | **0.04** | 0.06 | **0.00** |
| $n$ | **143** | **142** | **141** | **142** | 140 | **143** |

Bold print indicates statistically significant correlations

*PFB* Questionnaire on Partnership, *EPDS* Edinburgh Postnatal Depression Scale

distinguishing sexual inactive women from potential FSD. At least during pregnancy, the motivation to abstain from sexual activity might be different and should be subject to future research with important implications for patient counseling.

**Significant association of FSFI sub-scales with factors potentially influencing sexual function**

Furthermore, this study investigated potential associations between FSD and group characteristics.

According to our results, the group of women at risk of FSD differed most significantly in aspects of breastfeeding behavior and partnership quality. We found significant negative effects of breastfeeding and low partnership quality on most domains of sexual functioning. These findings confirm negative associations between breastfeeding and sexuality found in other studies. Avery et al. reported that women who breastfed for 3 to 6 months experienced decreased arousal and sexual satisfaction in comparison with women who stopped breastfeeding earlier postpartum [33]. Rowland et al. demonstrated a delay in resuming sexual intercourse in exclusively breastfeeding women [34]. Regarding potential explanations, lactating women generally show elevated prolactin levels resulting in decreased ovarian production of androgens and estrogen due to suppressed ovarian activity [35]. Lower androgen levels may lead to decreased sexual desire and low estrogen levels negatively affect vaginal lubrication [33].

Furthermore, we have seen that low partnership quality affected most domains of sexual functioning negatively, and therefore, our findings support the link between partnership quality and reduced measures of women's sexuality [36]. The previous research demonstrated associations between relationship dissatisfaction and reductions in sexual frequency, desire, and enjoyment [8, 37, 38]. Higher levels of self-reported poor communication or conflict during pregnancy have also been found to predict larger declines in relationship functioning postpartum [39]. Galazka et al. showed that especially in pregnant women who reported worsening of their relationship, FSFI scores lowered subsequently [32].

In addition, women at risk of satisfaction disorders postpartum were more likely to have had a cesarean section, and at 4-month postpartum, women with high levels of education and depressive symptoms were more likely to be at risk of female orgasm and satisfaction disorder. When comparing these findings to recent literature, current studies are inconsistent whether or not any form of delivery is protective from impairment of sexual function [6, 40]. While some data pointed out that sexual satisfaction is not related to perineal trauma [41], others reported vaginal delivery to be associated with less sexual satisfaction [42]. Our results support long-term postpartum data that refer to mode of delivery to have no measurable impact on sexual functioning and satisfaction [43, 44] due to loss of significance of the correlation after 4 months.

Regarding the significant association between depressive symptoms and sexual dissatisfaction, our findings support the previous studies. Postnatal depression affects up to 20% of women and is a complex interaction between physical, social, and psychological factors, potentially altering sexuality in affected women [38]. Depressive symptoms appeared to be associated with reduced sexual desire [8]

and sexual dysfunction [10]. In addition, rates of sexual satisfaction were reported to be lower in depressed compared to non-depressed women [40, 45].

Finally, we observed a significant correlation between higher education and potential sexual orgasm disorder after 4-month postpartum. Other studies did not find any group differences between sexually functional and dysfunctional women regarding education [10] which makes an interpretation difficult. One possible explanation could be an interaction with breastfeeding. Higher educated women are potentially more likely to be well informed about the benefits of breastfeeding and are more likely to maintain breastfeeding [46], which was also the case for our sample [47].

## Limitations

Several limitations should be considered. Participants had higher than average educational levels, so generalizing might be limited. Not all eligible women were assessed, so other perspectives might have been missed. Furthermore, analytical bias could have resulted from distortion in our sample due to participant loss after 4 months. The allover cesarean section rate was 50.5% which was increased compared to the national average of approximately 38%. Therefore, generalizability is limited. One explanation could be that patients who delivered spontaneously and experienced fewer problems with sexuality were less likely to continue participation. Means, standard deviations, and correlations to the FSFI-D sub-scale "satisfaction" have to be interpreted with caution as its Cronbach's α was low. In case of non-significant results, the possibility of small effects cannot be fully evaluated as analyses ran out of power. Random results cannot be ruled out, as alpha errors in our analyses were not corrected.

In addition, as the FSFI evaluates the last 4 weeks of life, the second measurement point (TII, 1 week postpartum) largely reflected sexuality in late pregnancy and not in the first week after delivery. We consider it an advantage as we were able to cover both, sexuality during late pregnancy and in the first week postpartum, which is at it's lowest. The first and the second measurement points still represent different phases of pregnancy as the participants' responsiveness differed significantly.

Furthermore, we desisted from isolating the most important risk factors for FSD by means of, e.g., multiple regression for economic reasons. In future re-analyses, this will be encountered. 14 mothers (11.6% of valid 107 cases) did not engage in any sexual activity at each measurement point. Although this potentially high-risk sample is of clinical interest, the cell frequencies were too low to be further analyzed. Future studies might concentrate on this subgroup and analyze risk factors leading to chronical sexual disengagement.

## Conclusions

Sexual inactivity and self-reported FSD were highly prevalent among our study population. Women suffering from dysfunctional problems showed significant characteristics in aspects of partnership quality, breastfeeding, mode of delivery, maternal education, and depressive symptoms.

Despite its limitations, with its prospective character and the use of standardized questionnaires, this study adds to the current body of literature and supports the basis for future research. Our results strongly encourage to differentiate between sexual inactivity and being at risk of FSD and to include an assessment of distress regarding implications for counseling. Addressing sexuality an appropriate preventive programmes should constitute as an obligatory part of prenatal classes.

**Author contribution statement** SW: Project development, Protocol, Data management, Manuscript writing. AD: Data collection, Manuscript editing. RJK: Data collection, Manuscript editing. MM: Data analysis, Data management. MW: Project development, Manuscript writing. CR: Project development, Manuscript writing. KP: Data collection and management. SF: Data collection and management. LM: Data collection. CWW: Project development and manuscript editing.

**Compliance with ethical standards**

**Conflict of interest** All the authors declare that they have no conflict of interest.

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