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DYSPAREUNIA AND PELVIC FLOOR MUSCLE FUNCTION BEFORE AND DURING PREGNANCY AND AFTER CHILDBIRTH

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ABSTRACT

Introduction and hypothesis: There is limited knowledge on dyspareunia during pregnancy and postpartum and the role of the pelvic floor muscles (PFM) in women with dyspareunia. Aims of the study were to investigate presence of dyspareunia before, during pregnancy and postpartum and to compare vaginal resting pressure (VRP), PFM strength and endurance between women with and without dyspareunia. It was hypothesized that there is no difference in PFM variables between women with and without dyspareunia.

Methods: Three hundred nulliparous women participated in this prospective cohort and answered questions about dyspareunia and level of bother at gestational weeks 22 and 37, 6 and 12 months postpartum and retrospectively prior to their pregnancies using ICIQ-FLUTSsex. PFM variables were assessed by manometer at gestational week 22, 6 and 12 months postpartum. Comparisons between groups were analyzed using independent-samples t test.

Results: Twenty-eight and 30% of the women reported dyspareunia at pre-pregnancy and at gestational week 22, respectively. At gestational week 37, 6 and 12 months postpartum, the number was 40%, 45% and 33%, respectively. No difference in PFM variables were found between women with or without dyspareunia. Level of bother was higher postpartum than before and during pregnancy.

Conclusion: Symptoms of dyspareunia were common at all time points. No link could be made between PFM function and dyspareunia. Women suffering from dyspareunia postpartum reported it as bothersome. Our findings suggest that women should be asked about symptoms of dyspareunia related to pregnancy, and that future research should aim for preventative and treatment strategies.

Keywords: dyspareunia; level of bother; manometer; pelvic floor; postpartum; pregnancy.

INTRODUCTION Dyspareunia is the "complaint of persistent or recurrent pain or discomfort associated with attempted or complete vaginal penetration" [1]. It has been found in about 15% of women between 30 and 50 years of age [2] and varies between 30 and 60% amongst women postpartum [3,4]. The overall impression from published research is that dyspareunia is prevalent in the first 6 months after childbirth and after this period it gradually declines [5]. Associations between pre-pregnancy and postpartum dyspareunia have been found [3,6], but these results are based on retrospective studies.

The etiology of dyspareunia is considered multifactorial with a combination of biological, psychosexual and contextual factors [7]. Dyspareunia occurring during pregnancy and childbirth may be a result of morphological and hormonal changes of the pelvic floor [8,3,6], and has shown to correlate with delivery mode [6,9]. In women breastfeeding, a reduction in estrogen may lead to reduced vaginal lubrication as a response to sexual stimulation [10]. The relationship between the pelvic floor muscles (PFM) and dyspareunia is poorly understood, and the existing literature in pregnant and postpartum women is sparse. Amongst women in the general population, dyspareunia has been linked to overactivity of the PFM [11,12]. Whether this is a cause or effect is debated [7]. Overactivity of the PFM is defined as a "situation in which the PFM do not relax or may even contract when relaxation is functionally needed" [13]. However, no standardized measurement tool exists to evaluate the resting condition of the PFM [13,14], and poor inter-observer reliability has been reported regarding commonly used methods such as visual observation and vaginal palpation [15]. In addition, there is no cut-off point for classifying the PFM as overactive or underactive [13].

To date there are few studies investigating dyspareunia beyond 6 months post-delivery and studies that compare pre-pregnancy and pregnancy dyspareunia with postpartum symptoms of dyspareunia. Although dyspareunia has received some attention in the existing literature, level of bother in relation to dyspareunia is seldom reported. Furthermore, the extent to which dyspareunia is related to overactive or weak PFM has not been established [11,12]

The aims of the present study were to investigate presence of dyspareunia cross-sectionally and longitudinally, and to study level of bother from before pregnancy until 12 months postpartum. Further to compare vaginal resting pressure (VRP), PFM strength and endurance in women with and without dyspareunia and to assess the impact of confounding variables on dyspareunia and PFM function. Null-hypothesis: there is no difference in VRP, PFM strength and endurance between women with and without dyspareunia.

MATERIALS AND METHODS

This was a prospective cohort study assessing aspects of PFM function and symptoms of PFM dysfunction. The Regional Medical Ethics Committee (2009/170) and the Norwegian Social Science Data Services (2799026) approved the study. The study procedures were in accordance with the Helsinki Declaration (2000). All subjects gave written informed consent before entering the study.

Participants

Women scheduled for delivery at Akershus University Hospital, Norway from January 2010 until April 2011 were invited to participate when they attended their routine ultrasound examination at mid-pregnancy (gestational week 18-22). Background information on presence and level of bother of dyspareunia were collected through an electronic questionnaire at 5 differ-

ent time points; pre-pregnancy, at gestational weeks 22 and 37, and at 6 and 12 months postpartum. The retrospective data for pre-pregnancy were collected at gestational week 22.

Inclusion criteria were being a healthy, nulliparous and singleton pregnant woman able to speak and understand Scandinavian language. Exclusion criteria were multiple pregnancies and previous miscarriage after week 16 of pregnancy. Ongoing exclusion criteria were premature birth < week 32, stillbirth, serious illness to mother or child and subsequent pregnancies within 6 weeks of gestation. Women who were recruited to PFM training in a randomized controlled trial (RCT) starting 6 weeks postpartum were also excluded.

Power calculation
This study is part of a project investigating several questions related to the pelvic floor during pregnancy and postpartum. There was no specific a priori power calculation for questions on dyspareunia.

Outcomes
Dyspareunia was defined as 1 or more episodes of pain during intercourse within the last 3 months before pregnancy, and within the last 4 weeks at gestational weeks 22 and 37, and at 6 and 12 months postpartum. Level of bother was assessed on a scale ranging from 0-10; 0 being no bother and 10 a major bother. A Norwegian translated version of The International Consultation on Incontinence Modular Questionnaire, sexual matters module (ICIQ-FLUTSsex) was used to assess the presence and level of bother of dyspareunia [16]. Questions 4a "do you have pain when you have sexual intercourse?" and 4b "how much does this bother you?" were used. ICIQ-FLUTSsex has shown good construct validity and reliability, excellent stability and acceptable criterion validity [17].

Assessments of VRP, PFM strength and endurance were performed at gestational week 22, and at 6 and 12 months postpartum. During the first clinical visit, women were taught how to perform a correct PFM contraction defined as inward movement and squeeze around the pelvic openings [18,19]. PFM contraction without any movement of the pelvis or visible contraction of the glutei, hip or abdominal muscles was emphasized [19]. Instructions continued during observation and 1 digit vaginal palpation with the participant in a supine position with knees bent. Vaginal palpation was undertaken to evaluate if the women were able to contract their PFM. VRP, PFM strength and endurance were assessed with a high precision pressure transducer connected to a vaginal balloon (Camtech AS, Sandvika, Norway). The device was positioned with the middle of the balloon 3.5 cm internal to the introitus [20]; a method found to be reliable and valid if used with simultaneous observation of inward movement of the perineum/catheter during a contraction [19,21].

VRP was measured as vaginal pressure, with no voluntary PFM activity, and was registered as cmH_2O. PFM strength was reported as the mean of 3 maximum voluntary contractions, and registered as cmH_2O. PFM endurance was defined as a sustained maximum contraction and was quantified as the area under the curve during 10 seconds, measured during 1 attempt and registered as cmH_2Osec [22]. The atmospheric pressure on the balloon was calibrated to 0 cmH_2O for each subject before it was placed in the vagina. The 2 trained female physical therapists measuring the PFM were unaware of the answers provided in the electronic questionnaire, and therefore blinded to the participant's dyspareunia status. The physical therapists were however not blinded to any reactions on discomfort or pain during examination. Data on delivery outcomes including delivery mode (caesarean section, vacuum extraction/forceps), use of episiotomy, length of second stage of labor (>120 minutes), perineal tears (3^{rd} and 4^{th}

degree) and infant birth weight were collected from the women's electronic medical birth records at the hospital. During the examination a towel were put on each woman's stomach in order to blind the investigators for any information related to mode of delivery.

Statistical analysis

Statistical analysis was performed using SPSS version 15. Background and descriptive variables were presented as frequencies with percentages and means with standard deviations (SD). Data showed normal distribution for exposure variables: VRP, PFM strength and endurance. Outcome measures of dyspareunia were dichotomized into dyspareunia or no dyspareunia and women were registered as not having dyspareunia if they answered "not at all" to the question "do you have pain when you have sexual intercourse?" and registered as having dyspareunia if they answered "a little", "somewhat" or "a lot" to the same question. Women who reported that they were not having sexual intercourse were excluded from the analysis. Independent samples t-test was used to analyze differences in PFM function between groups of women with and without dyspareunia. Background factors such as breastfeeding and use of hormonal contraceptives and data on delivery outcomes were considered potential confounders. Chi-square test for independence and independent samples t-test were used to assess the influence of these confounders on dyspareunia. Women who had vaginal births assisted by either vacuum extraction or forceps were pooled together for the analysis. To assess whether breastfeeding influenced PFM variables, independent samples t-test was used. P-values were 2-sided and < 0.05 was considered significant. Missing data were listed in the tables and excluded from the analysis where appropriate.

RESULTS

Participants

Three hundred nulliparous pregnant women were included at gestational week 22. One hundred and ninety-five women were seen at 6 months postpartum and 177 women were seen at 12 months postpartum. At 6 weeks postpartum, 71 women were recruited to an ongoing parallel RCT and excluded from the study. Twelve women were excluded due to subsequent pregnancies, 3 due to stillbirth and 1 due to premature delivery < week 32. Thirty-six women were lost to follow up throughout the study period (12%). One hundred and seventy-seven women attending all time points of the data collection were included in the longitudinal analysis. Background characteristics for the 300 women included at gestational week 22 are presented in Table 1.

Presence of dyspareunia and level of bother

Between 28% and 45% of the women reported symptoms of dyspareunia at the different time points. Most women reported dyspareunia as "a little" (Table 2). Mean level of bother was higher postpartum than prior to and during pregnancy (Table 3).

Dyspareunia and PFM variables

Table 4 shows mean VRP, PFM strength and endurance in women with and without dyspareunia at the different time points. No statistically significant differences were found between the groups in any of the PFM measurements. No significant difference in VRP (95%CI: -0.7, 5.1 and 95%CI: -4.5, 0.9), PFM strength (95%CI: -0.7, 11.9 and 95%CI: -11.3, 0.6) or endurance (95%CI: -22.4, 109.2 and 95%CI: -95.5, 7.1) was found between women breastfeeding or not at 6 or 12 months postpartum, respectively.

Factors related to dyspareunia
Amongst women who were breastfeeding 65 (49%) reported dyspareunia at 6 months postpartum versus 13 (30%) of those not breastfeeding (p=0.05). At 12 months postpartum there was no difference; 22 (38%) versus 32 (30%), respectively (p=0.38). At 6 months postpartum there was no difference between those using contraceptives and those not using contraceptives in relation to symptoms of dyspareunia, 25 (36%) versus 50 (49%), respectively (p=0.12). Nor was there a difference at 12 months postpartum on use of contraceptives in relation to dyspareunia; 21 (28%) using contraceptives versus 34 (37%) not using contraceptives (p=0.317). No statistically significant difference was found for women with and without dyspareunia on delivery mode, use of episiotomy, prolonged second stage of labor (>120 minutes), 3rd and 4th degree perineal tears or infant birth weight at 6 or 12 months postpartum (Table 5).

Longitudinal data
Figure 1 shows longitudinal data on incidence and prevalence of dyspareunia. There was a higher incidence of dyspareunia during pregnancy and at 6 months postpartum compared to 12 months postpartum. For women with dyspareunia prior to pregnancy and for women with new symptoms of dyspareunia during pregnancy and postpartum, there was a decline in prevalence throughout the study.

DISCUSSION

Almost one third of the women reported pre-pregnancy dyspareunia and the prevalence of dyspareunia was high at all time points. No difference was found for VRP, PFM strength or endurance between women with and without dyspareunia. The results support the null-hypothesis that there is no difference in VRP, PFM strength and endurance between women with and without dyspareunia. Dyspareunia was more present amongst women breastfeeding at 6 months postpartum, whilst use of contraceptives, delivery mode, episiotomy, prolonged second stage of labor (>120 minutes), 3rd and 4th degree perineal tears or infant birth weight was no different between the groups. For women with dyspareunia prior to pregnancy and for women with new symptoms of dyspareunia during pregnancy and postpartum, there was a decline in prevalence throughout the study. Women still suffering from dyspareunia postpartum reported it as bothersome.

Other studies report on dyspareunia as common 6 months after childbirth [3,4]. We found that the number of women with dyspareunia was still high at 12 months postpartum. This is higher than previously found by other researchers [23,4]. Connolly et al. [4] had fewer women included in their analysis compared to our study, and Serati et al. [23] investigated new cases of dyspareunia and excluded those with sexual problems prior to and during pregnancy. Interestingly, we found that the number of women reporting dyspareunia before pregnancy was high, but only 14.6% of these had dyspareunia at 12 months postpartum. The results also indicate that the majority of women with new symptoms of dyspareunia during pregnancy were symptom free by 12 months postpartum. Our findings could be interpreted in such a way that most symptoms of dyspareunia occurring during this period resolve naturally. However, an underestimation of the prevalence of dyspareunia could exist. Data from women not having sexual intercourse were excluded from the analysis and it is possible that dyspareunia was a reason for not having intercourse. Our results are lower than a previous study where 60% of the women with pre-pregnancy dyspareunia were still symptomatic at 6 months postpartum [3]. In the present study 89.7% of the women resumed intercourse by 6 months postpartum de-

spite the fact that 44.6% were complaining of dyspareunia. One explanation could be that most symptoms were described as "a little" dyspareunia. Still, level of bother was highest postpartum. Since dyspareunia and sexual dysfunction are strongly associated with personal experiences and relationship factors [2], the question of bother in this study covers just part of this complexity. Few studies address level of bother and the ones which do show conflicting results regarding impact on sexual life in the postpartum months [4,10].

No statistically significant difference in PFM strength and endurance was found between women with and without dyspareunia. Other studies investigating dyspareunia in pregnant and postpartum women found no relationship between weak PFM and dyspareunia [24,25]. Both studies had fewer women in their analysis compared to our study, 68 and 110 respectively. We did see a decline in VRP, PFM strength and endurance following delivery in both groups, which may be seen as a response to the effect of pregnancy and delivery found in our study group [26] and in the study by Elenskaia et al [27]. This did not seem to influence differences between those with or without dyspareunia. Nor did delivery outcomes. This is in contrast to previous studies [6,9]. However, to what extent dyspareunia is related to mode of delivery is not well established [5]. Since we did not select women into low or high risk pregnancies, we cannot rule out that any gestational diseases could affect status of dyspareunia and PFM function in our study. Since 63 to 83% reported dyspareunia as "a little", a difference in PFM function could perhaps be seen if more women reported dyspareunia as "moderate" or "a lot". One conclusion could therefore be that a little dyspareunia was not associated with the PFM in this study. Despite the decline seen in PFM variables at 6 months postpartum, our results indicate that PFM strength and endurance are back to pregnancy levels at 12 months postpartum in both groups. VRP was however lower at 12 months postpartum than at pregnancy levels in both groups. The study by Elenskaia et al [27] reported similar findings, although this study did not look into symptoms of dyspareunia.

This study did not find a statistically significant difference in VRP amongst women with and without dyspareunia. We consider VRP the most important factor as it is a measurement of the resting condition without any voluntary PFM contraction. A post power calculation, based on the SD in the dyspareunia group with 90% power and 5% significance level, showed that a difference in VRP of 4-5 cmH_2O would be needed to demonstrate a statistically significant difference based on the number of women included. The difference in VRP between the groups in our study was about 1 cmH_2O. This difference is neither statistically or clinically relevant. No studies to our knowledge have investigated the resting condition of the PFM in relation to dyspareunia amongst pregnant and postpartum women. Amongst women with symptoms of dyspareunia in the general female population, conflicting results exists regarding higher PFM activity at rest and the presence of dyspareunia [11,12]. The study by Both & Laan [12] found higher PFM activity on vaginal surface electromyography (EMG) in women with dyspareunia compared to women with no dyspareunia. The investigators did not confirm a correct PFM contraction before testing, and the increase in muscle activity might be influenced by extra-pelvic muscle contractions. Vaginal surface EMG might also be biased by cross-talks from nearby muscles [13,14]. The study by Reissing et al. [11] used vaginal palpation to assess overactivity of the PFM in women with dyspareunia, but these findings were not confirmed by vaginal surface EMG. Palpation of PFM overactivity has shown to be unreliable [15]. It remains unclear whether dyspareunia causes muscle changes or whether VRP, PFM strength and endurance may cause dyspareunia. To date, only 1 RCT has investigated effect of PFM training on symptoms of dyspareunia [28]. This study found no statistically significant difference between the group exercising their PFM and the control group. There is a need for high quality RCTs on pelvic floor muscle training in this area.

Significantly more women who were breastfeeding reported dyspareunia at 6 months postpartum, but not at 12 months postpartum. Breastfeeding has previously been identified as a factor associated with dyspareunia [3,6]. The fact that this relationship was not present at 12 months postpartum could be due to fewer women breastfeeding at this point, whilst most who continued had reduced the frequency of feeds between 6 and 12 months postpartum. Use of contraceptives did not seem to influence presence of dyspareunia. This is in line with the report of Barrett et al. [3].

To our knowledge, this is the first prospective study investigating dyspareunia and PFM function longitudinally, including data on several time points, before and during pregnancy, and postpartum. Moreover, we studied a large sample of the cohort longitudinally regarding change in symptoms of dyspareunia. These results contribute to a greater knowledge of symptoms of dyspareunia as we investigated the women from mid-pregnancy till 12 months postpartum, including pre-pregnancy symptoms. This study also assessed level of bother in relation to dyspareunia and relatively few cases were lost to follow up. Further, a PFM contraction without any use of the pelvis or visible contraction of the glutei, hip or abdominal muscles was emphasized, minimizing the influence of intra-abdominal pressure and use of extrapelvic muscle contractions. The use of manometry has shown good to very good reliability for measurement of PFM variables [29]. However, VRP may be influenced by anatomy and altered tissue tension, especially after child birth [8].
A limitation is that there was no a priori power calculation for studying PFM variables in women with and without dyspareunia. As far as we have ascertained, our results represent the largest prospective study in this group of women. However, a type II-error cannot be ruled out. Another limitation is that the ICIQ-FLUTSsex has not yet been validated amongst pregnant and postpartum women. Neither has it been validated into Norwegian language. Although dyspareunia might be a sensitive topic, we believe that the questions on dyspareunia were relatively easy to answer and would not influence the validity of our results to a great extent. In addition, no questions addressed reasons for not having intercourse, if the reported dyspareunia was superficial/introital or deep and if it was present during every intercourse. Moreover, no questions addressed other factors which have been strongly linked with sexual complaints, such as sexual arousal, sexual desire and orgasm [30]. We acknowledge that this information could give a more complete understanding of dyspareunia, as it may be dependent on several organic and psychological mechanisms [7]. Since this cohort was not a select sample of women with dyspareunia, but a cohort investigating other pelvic floor dysfunctions in pregnancy and postpartum as well, no specific palpation was undertaken to elicit pain or diagnose dyspareunia in these women. This makes it difficult to report on underlying causes for dyspareunia and does not allow direct comparisons of studies reported in the general population [11,12]. The amount of women being examined at several time points made it necessary to use 2 examiners to undergo the pelvic floor measurements. However, both physical therapists were experienced and trained prior to the study. Although, the physical therapists were blinded to the dyspareunia status of each participant, the examiners were not blinded to any reactions of pain or discomfort during the examination. However, all women tolerated vaginal palpation at all time points of the data collection. The results on incidence and prevalence should be interpreted with caution since we had several inclusion and exclusion criteria. Women in this study are comparable to other primiparous women delivering at the same hospital with respect to age and body mass index, except that they had a higher level of education. To date, there is limited knowledge to support any suggestion that women with a higher level of education have less sexual complaints than others [2]. Lastly, retrospective questions about the condition prior to pregnancy can be considered a weakness. The inclusion of wom-

en into studies before they get pregnant is a well recognized challenge, and this was not possible in our study.

CONCLUSIONS

The number of women complaining of dyspareunia was high before pregnancy and throughout the follow-up period. No statistically significant difference was found between women with and without dyspareunia in any of the PFM variables. Nor was there a significant relationship with dyspareunia on use of contraceptives, delivery mode, episiotomy, prolonged second stage of labor (>120 minutes), 3rd or 4th degree perineal tears or infant birth weight. Only breastfeeding came out significant as a factor related to dyspareunia at 6 months postpartum. Incidence and prevalence of dyspareunia was lower at 12 months postpartum compared to symptoms before and during pregnancy, but women still suffering from dyspareunia postpartum reported it as bothersome. Our findings suggest that women should be asked about symptoms of dyspareunia prior to and during pregnancy, and that future research should aim for preventative and treatment strategies especially for those still suffering from dyspareunia in the postpartum period. There is also a need to investigate anatomical and morphological changes in women with dyspareunia using ultrasound and magnetic resonance imaging.

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FIGURE LEGENDS

Figure 1. Incidence and prevalence of dyspareunia from pre-pregnancy until 12 months post-partum.

Prevalence of women with dyspareunia is given in the column on the right side. Numbers in brackets are total number of women having sexual intercourse. The encircled figures represent incidence, prevalence is given for pre-pregnancy dyspareunia. Arrows show changes in frequency amongst the same women with dyspareunia through different time points. GW=gestational week, PP= postpartum.

Table 1. Background variables of the study population.

	Pre-preg N=300	GW 22 N= 300	GW 37 N= 277	6 months pp N= 195†	12 months pp N= 177
Age (years) n (SD)	28.7 (SD 4.3)				
BMI (kg/m^2) n (SD)	23.9 (SD 3.9)				
Civil status: n (%) Married/cohabitant Living alone	 287 (95.7) 13 (4.3)				
Educational level: n(%) College/university Primary/high school/other	 226 (75.3) 74 (24.7)				
Breastfeeding: n (%) ≥ once daily < once daily	n.a	n.a	n.a	 147 (75) 5 (2.5)	 61 (34.5) 3 (1.7)
Smoking: n (%)	77 (25.6)	16 (5.3)	12 (4.3)	18 (9)	20 (11.3)
Contraceptives: n (%)	n.a	n.a	n.a	75 (38.5)	77(43.5)

† 3 missing

Results presented as frequency with percentages (%) or standard deviation (SD)

Pre-preg = pre-pregnancy; PP = postpartum; GW = gestational week; BMI = body mass index; n.a = not applicable

Table 2. Presence and severity of dyspareunia

	Pre-preg N=299	GW 22 N= 285	GW 37 N= 227	6 months pp N = 175†	12 months pp N = 166
Not having intercourse: n(%)	1 (0.3)	15 (5)	50 (18.1)	20 (10.3)	11 (6.2)
No dyspareunia: n(%)	216 (72.2)	198 (69.5)	133 (58.6)	97 (55.4)	111 (66.9)
Dyspareunia: n(%)	83 (27.8)	87 (30.5)	94 (41.4)	78 (44.6)	55 (33.1)
- A little: n(%)	69 (83.1)	73 (83.9)	73 (77.7)	59 (75.6)	35 (63.6)
- Somewhat: n(%)	11 (13.3)	11 (12.6)	15 (15.9)	9 (11.5)	14 (25.5)
- A lot: n(%)	3 (3.6)	3 (3.4)	6 (6.4)	10 (12.8)	6 (10.9)

† 3 missing

Severity of dyspareunia (little, somewhat, a lot) represents percentages of those with dyspareunia.

Results presented as frequency with percentages (%)

Pre-preg = pre-pregnancy; PP = postpartum; GW = gestational week

Table 3 Level of bother of women with dyspareunia.

	Mean (SD)
Pre-pregnancy n=83	3.4 (2.5)
Gestational week 22 n=87	3.5 (2.3)
Gestational week 37 n=94	4.0 (2.5)
6 months postpartum n=78†	4.5 (2.9)
12 months postpartum n=55	5.1 (2.9)

† 3 missing

Results presented as mean with standard deviation (SD)