The association between pregnancy-related pelvic and low back pain and lumbar proprioception: an observational study

Research question: The main research question for this observational study is whether women with pelvic and low back pain during and after pregnancy have an impaired lumbar proprioception, in terms of self-reported back-specific awareness. The secondary research question is whether pregnant and postpartum women with pelvic and low back pain have a higher risk for incontinence?

Highlights:

- There is a relation between pelvic and low back pain and back-specific awareness on the three measurement moments: prenatal, six weeks postnatal and 18 weeks postnatal.
- Prenatal urinary incontinence is a predictive factor for having pelvic and low back pain postnatal.
- Women, who followed physiotherapy prenatally, have a higher risk for having pelvic and low back pain postpartum.
- Women who have had a caesarean section have a seven times higher risk for developing pelvic and low back pain postnatal.
- Women who have had a large rupture during delivery have a two times higher risk for developing pelvic and low back pain

Students: Theys Mieke (1234693) and Ramaekers Ingriet (1234982)

Promotor: Dr. Janssens Lotte

Acknowledgment

This master thesis is the last part of our Master in Rehabilitation Science and Physiotherapy. It was not easy to accomplish this task. Luckily we could count on support, guidance and encouragement form different people. (Butler, Colón, Druzin, & Rose, 2006)

First we want to thank our promoter dr. Lotte Janssens for the support and accompaniment during the last two years. Also want to thank the physiotherapists form the maternity department of the University Hospital Leuven, Lizelotte Vandenplas and Zahra Van Veldhoven. Without their passionate participation and input, this research could not have been successful.

We also like to acknowledge the Physical Rehabilitation and Medicine department of the University Hospital Leuven for the possibility to collect and process the data for our master thesis.

Our biggest thanks goes to the women who participated in the study and completed the questionnaires.

Finally, we must express our gratitude to our parents for the patience and support we received from them and the encouraging words. We could share with them the frustrations, which are inevitable when writing a master thesis.

Writing a master thesis is a difficult task, even if it is a duo thesis. So we also want to thank each other for the good cooperation and the motivation that we found in each other.

Research context

This research was conducted in the context of master thesis part two. To describe our findings a central format was used. The study is situated within the domain of Musculoskeletal Rehabilitation. On the one hand, we know from previous studies that low back pain is often associated with proprioceptive impairments. On the other hand, low back pain is a common complaint in pregnant and postpartum women. Therefore, the aim of this study was to investigate whether women with pelvic and low back pain during and after pregnancy have an impaired lumbar proprioception, in terms of self-reported back-specific awareness.

This study is a duo-thesis project that is started in August 2016 and will end in June 2017. The research was conducted under the supervision of Dr. Janssens Lotte at the University of Hasselt. The participants were recruited from the University Hospital Leuven (UZ Leuven). The testing of the individuals also took place at UZ Leuven and was in collaboration with KU Leuven (Prof. M. Van Kampen, Dr. I. Geraerts). Also the perinatal physiotherapists at the maternity department helped with testing of the women and data collection for the study. The study was part of a bigger project in which also two master students of the KU Leuven (Rehabilitation Science and Physiotherapy) were involved with a primary focus on incontinence. So the work could be divided under four students. The four students were especially busy with the data collection by entering the answers of the questionnaires and anamneses in the excel file and by calling the women who forgot to fill in the follow up questionnaires.

The statistic processing of the data was done by dr. Lotte Janssens. The students did under the guidance of the promoter dr. Lotte Janssens the interpretation and writing.

Table of contents

1. Abstract

Background

Many women experience pelvic and low back pain during and after pregnancy. Low back pain is often related to an impaired proprioception, but also other mechanisms could be responsible for low back pain during and after pregnancy. For example there is a higher activity and a decreased motor control of the pelvic floor muscles in women with low back pain compared to healthy subjects.

Objectives

We hypothesized that women with pelvic and low back pain during and after pregnancy have an impaired proprioception, in terms of self-reported back-specific awareness. Furthermore, we assumed that pregnant and postpartum women with pelvic and low back pain have a higher risk for incontinence.

Participants

Female patients (n= 138; 31± 3,4 years) who gave birth to their first child and stayed on the maternity department of UZ Leuven participated in the study.

Measurements

Pelvic and low back pain and urinary incontinence were administered prenatal, six weeks postnatal and 18 weeks postnatal. Potential predictive factors for having pelvic and low back pain postpartum were examined.

Results

We found a relation between pelvic and low back pain and an impaired proprioception in the prenatal and postnatal women. We also could see that women, who followed physiotherapy prenatal, have a higher risk for having pelvic and low back pain postpartum. Another interesting finding was that there is a relation between pelvic and low back pain and urinary incontinence in this population.

Conclusion

The study shows that there is a relation between pelvic and low back pain and having an impaired back-specific awareness.

1. Introduction

Of all pregnant women, 45% suffer from mild low back pain, 25% have serious low back pain and 8% are disabled due to low back pain. Almost 50% of all pregnant women suffer from pelvic and/or low back pain (Fast et al., 1987). Most of the complaints are experienced between weeks 16 and 32 of the pregnancy (Moore, Dumas & Reid, 1990). Low back pain is also present in the postpartum population. More specifically, 80% of the postpartum women have mild symptoms and 7% have severe problems (Wu et al., 2004). Low back pain in pregnant women goes along with negative effects on the quality of life and work absenteeism (Gutke, Östgaard & Öberg, 2006).

Several biomechanical adaptations occur during pregnancy, for example forward tilting of the pelvis, hyperextension of the upper back and accentuated low back curvature (Ireland & Ott, 2000; Casagrande et al., 2015). One of the consequences of these adaptations is a shift in the location of the center of mass (Whitcome, Shapiro & Lieberman, 2007). In order to be able to cope with this shift of the center of mass, optimal postural control is needed. Proprioception is one of the sensory inputs for postural control besides input from the visual and vestibular system (Lackner & DiZio, 2005). Position sense and movement sense are components of proprioception (Ribeiro & Oliveira, 2011). It has been proven that chronic low back pain patients have reduced repositioning error accuracy of the lumbar spine. There is a relation between disturbed lumbar proprioception and low back pain (free from pregnancy). Indeed, in their study Claeys et al. (2015) proved that an increased reliance on ankle muscle proprioception inputs during standing on a stable platform (compensatory to decreased reliance on lumbar proprioception) is an increased risk for developing mild low back pain in young people. Thus, an impaired proprioception in the lumbar region seems to be one of the underlying mechanisms for the development and maintenance of non-specific low back pain (Claeys et al., 2015). Besides the effects on lumbar proprioceptive acuity, also lumbar tactile acuity deficits have been shown in the low back pain population. More specifically, the two-point discrimination threshold in the lumbar region is greater in patients with low back pain than in healthy control subjects. Moreover, this is related to a decreased voluntary lumbopelvic control (Luomajoki & Moseley, 2011). However, it remains unknown whether impaired proprioception is responsible for the development and maintenance of low back pain during pregnancy and the postpartum period.

There is some evidence that lumbosacral proprioception is impaired in pregnant women. Although, this is only measured indirectly through measures of postural balance of pregnant and postpartum women. Butler et al. (2006) studied for example static postural equilibrium during pregnancy. In the second and third trimester of pregnancy there was an impaired postural control in comparison with the first trimester. McCrory, Chambers, Daftary & Redfern (2010), Inanir, Cakmak, Hisim & Demirturk (2014) , Nagai et al. (2009) and Opala-Berdzik et al. (2015) also found that the postural control is impaired in pregnant women compared to non-pregnant women. Most of these studies judged this postural control to be impaired because their postural sway is bigger than in non-pregnant women. However, it must be taken into account that postural balance is only an indirect measurement for proprioception, because it also relies on visual cues and the vestibular system. Therefore, more direct measures of proprioception related to pregnancy are needed to investigate the relationship with low back pain.

We hypothesized that pelvic and low back pain in pregnant and postpartum women can also be attributed to other mechanisms than only an impaired proprioception. Pool-Goudzwaard et al. (2005) showed that there is a higher activity and a decreased motor control of the pelvic floor muscles in women with low back pain compared to healthy subjects. This will influence the voluntary contractions and reflex motor contractions of pelvic floor muscles among those women. The latter can explain the occurrence of incontinence in women with low back pain. Ghaderi et al. (2016) proved that regular exercise and stabilization exercises for the pelvic floor muscles improve functional disability and pain intensity in women with low back pain and urinary incontinence.

Taken together, it's important that back-specific awareness, defined by proprioceptive and tactile acuity, will be investigated in a more direct way to ensure its contribution in the etiology of pregnancy-related pelvic and low back pain. Therefore, the first aim of this study was to investigate whether women with pelvic and low back pain during and after pregnancy have an impaired lumbar proprioception, in terms of self-reported back-specific awareness. We hypothesized that higher pelvic and low back pain rates correlated with impaired back-specific awareness in pregnant and postpartum women. The secondary research question was whether pregnant and postpartum women with pelvic low back pain had a higher risk for urinary incontinence.

2. Method

2.1 Research question

The main research question for this study is: Do pregnant and postpartum women with pregnancy-related pelvic and low back pain have an impaired lumbar back-specific awareness compared to pregnant and postpartum women without pelvic and low back pain? The secondary research question is: is prenatal and postnatal urinary incontinence contributing to this association?

2.2 Study Design

This is an observational study. The primary aim of this study was to measure the prevalence of pre- and postnatal symptoms of lumbopelvic pain and back-specific awareness in primiparae, and the interrelationship between these symptoms. The secondary aim of this study was to investigate whether women with pregnancy-related lumbopelvic pain and impaired back-specific awareness also suffered from urinary incontinence. Primary and secondary outcomes were measured prenatal in the last month of pregnancy (T1) (evaluated retrospectively within 3 days after giving birth at the maternity department of the University Hospitals Leuven (UZ Leuven) in Belgium), 6 weeks postpartum (T2) and 18 weeks postpartum (T3).

2.3 Participants

Female patients (n= 138) who gave birth to their first child (primiparae) and stayed on the maternity department of UZ Leuven participated. The mean age of the women who did participate in the study was 31± 3,4 years (range 28 – 41). In this population 93% never had a miscarriage before the actual pregnancy. Six per cent of the women did already suffer urinary incontinence before the pregnancy. The percentage of participants that already did complain about pelvic pain / low back pain before the pregnancy was 38%. The mean body weight of the women before the pregnancy was 60± 13 kg,

2.4 Inclusion Criteria

1. Women who gave birth to their first child (primiparae)
2. Dutch speaking mothers

2.5 Exclusion criteria

1. Women who did not want to participate

3. Women with one of the conditions below in their medical history
    a. Neurological disorders
    b. Impaired cognition
    c. Pelvic floor surgery
4. Women who gave birth to a stillborn child or a child with a mental or physical disorder

2.6 Recruitment

Two physiotherapists on the maternity department recruited the women. The recruitment did run over 5 months, from August 2016 until December 2016.

2.7 Medical ethics

Before participating in this study, the physiotherapists explained the study to the participants at the maternity department and the participants signed the informed consent. The study conformed to the principles of the Declaration of Helsinki (1964) and was approved by the local Ethics Committee of Biomedical Sciences of KU Leuven (S59108; B322201628881).

2.8 Outcome measures

The prenatal symptoms (i.e., during last month of pregnancy) (T1) were measured postpartum within three days of delivery by oral history taking at the maternity department and through an online program MyNexUZ (to fill out the standardized questionnaires). The postnatal symptoms were measured at 6 weeks (T2) and 18 weeks postpartum (T3) through the online program MyNexUZ.

2.8.1 Low back and pelvic pain

The Oswestry Disability Index (version 2.1.a, adapted Dutch version) (ODI-2) measures the impact of low back pain on the functional level of patients. The functional level is measured in 10 domains of the activities of daily life. The higher the total score, the more the patient is disabled due to low back pain. The ODI- 2 is validated in Dutch and is a valuable tool for measuring the functional status and

disability of patients with chronic low back pain (van Hooff, Spruit, Fairbank, van Limbeek & Jacobs, 2015).

The Numeric Rating Scale (NRS) from 0 ('no pain') to 10 ('worst pain') questioned the severity of pelvic and low back pain. (Farrar, Young, LaMoreaux, Werth & Poole, 2001).

2.8.2 Prenatal physiotherapy

The participants were asked if they followed physiotherapy sessions prenatally. This item is scored with 'yes' if they followed physiotherapy and 'no' if they didn't.

2.8.3 Back-specific awareness

The Fremantle Back Awareness Questionnaire (FreBAQ) is a self-reported questionnaire assessing back-specific body perception in patients with low back pain (Wand et al., 2014). In this questionnaire the patients were questioned about nine items. The patients rated each item in a range from zero (never) to four (always). Item one to three evaluated neglect-like symptoms, item four and five evaluated reduced proprioceptive acuity, item six to nine evaluated perceived body shape and size. The questionnaire was found to be reliable and acceptable in the Dutch version (Janssens et al., 2016).

2.8.4 Urinary incontinence

The International Continence Index Questionnaire- Female Lower Urinary Tract Symptoms (ICIQ-FLUTS) evaluates female lower urinary tracts symptoms and the impact on the quality of life (QoL). The questionnaire is also available in Dutch (Zappavigna & Carr, 2015). Only the specific subscale that scores for incontinence (item 9 – 13) of the ICIQ-FLUTS was used in this study.

The NRS for urinary incontinence from 0 to 10 was also used for assessing the severity of urinary incontinence.

2.8.5 Diastasis

Women with diastasis of the rectus abdominis muscle have a higher risk for developing lumbo-pelvic pain and dysfunction in this region (Dalal, Kaur & Mitra, 2014). Therefore, the women were examined for diastasis during the three days after

having giving birth (yes versus no). If yes, the amount was measured by the number of fingers above the level of the umbilicus and at level of the umbilicus.

2.8.6 Outcomes related to childbirth

Mode of delivery

The women were asked if they have had a cesarean section or a vaginal delivery (0 = vaginal, 1 = cesarean section). In case of a vaginal delivery, they were asked if it was instrumented (for example by forceps or vacuum extractor) or not (0 = no, 1 = yes). If it wasn't clear form the history taking, the information was looked up in the medical records.

Episiotomy

The mother was asked during history taking if she had an episiotomy (0 = no, 1 = yes).

Rupture

The women were asked if they had a rupture during delivery (0 = no, 1 = yes). If it wasn't clear form the history taking, the information was looked up in the medical records. Also the degree of rupture (grade 1 – 3) was an outcome measure.

Duration of labor

This information was looked up in the medical records of the delivery. Especially the duration (in minutes) of the second phase of delivery was recorded.

Weight of child

Also the weight and the circumference of the head of the child were recorded, because there is a relation between a larger head circumference of the newborn and the dysfunction of pelvic floor muscles (Diez-Itza et al., 2011).

2.8.7 Weight of the mother

Regarding maternal weight, two things were evaluated: the prenatal weight and the weight gain during pregnancy. This information was also looked up in the medical file.

2.8.8 Contraction pelvic floor muscles

It is known that a higher activity of pelvic floor muscles and a decreased motor control of those muscles can cause low back pain and incontinence among

postpartum women (Pool-Goudzwaard et al., 2005). Therefore, the contraction of the pelvic floor muscles was checked by a vaginal toucher (0 = no contraction palpable, 1 = light contraction palpable, 2 = clear contraction palpable).

Table 1: Timing of outcomes at T1 (prenatal during last month of pregnancy), T2 (six weeks postpartum and T3 (18 weeks postpartum)

Timing symptoms	T1 (prenatal)	Maternity department	T2 (6 weeks postpartum)	T3 (18 weeks postpartum)
Oral history taking low back and pelvic pain before pregnancy	X			
Oral history taking urinary incontinence before pregnancy	X			
FreBAQ	X		X	X
NRS PLBP	X		X	X
NRS UI	X		X	X
ODI	X		X	X
ICIQ-FLUTS SI	X		X	X
Physiotherapy prenatal	X			
Diastasis		X		
Mode of delivery		X		
Episiotomy		X		

Rupture		X		
Duration of labor		X		
Weight of the mother	X			
Contraction of pelvic floor muscles		X		
Head circumference Child		X		

FreBAQ (Fremental Back Awareness Questionnaire)
NRS PLBP (Numeric Rating Scale for Pelvic and Low Back Pain)
NRS UI (Numeric Rating Scale for Urinary Incontinence)
ODI (Oswestry Disability Index)
ICIQ-FLUTS SI (International Continence Index Questionnaire - Female Lower Urinary Tract Symptoms Subscale Incontinence)

3. Statistical analysis

3.1 Normality

First, the Shapiro Wilk test was used to check the data for normality. If the test was significant, it was concluded that the data were non-normally distributed.

3.2 Repeated measurements

Secondary, differences between the measurement times were calculated. The Wilcoxon signed rank test was used, because the data were non-normally distributed.

3.3 Correlations

The data were also tested for correlations on the three measurement times. The Spearman rank test was used, because the data were of ordinal level and non-normally distributed. The correlations between the variables were assessed on the basis of the basic rules for interpreting the strength of correlations between two variables (0,0 - 0,3= very weak correlation, 0,3 – 0,5= weak correlation, 0,5 – 0,7= moderate correlation, 0,7 – 0,9= high correlation, 0,9 – 1,0= very high correlation) (Rumsey, 2015).

3.3 Logistic regression

To determine predictive factors for having low back pain (score on NRS LBP > 1) on six weeks after giving birth, analysis was done with logistic regression. To execute the logistic regression in SPSS, all variables were first put separately in a univariate regression. The second step was to put all the significant variables ($p < 0.1$) from the univariate analysis in the multivariate regression analysis. Before this step, the Spearman rank correlation was calculated between all variables which were significant in the univariate analysis; if the correlation coefficient was ≥ 0.80, only the most significant univariate predictor was included in the multivariate analysis. The last step was to do the multivariate regression analysis to check the influence of a combination of different predictors together on the outcome.

4. Results

There were initially 138 participants for the prenatal measurements (T1). Fifty-nine participants completed outcome measures six weeks postpartum (T2). Of those 59 participants, 20 completed the outcome measures 18 weeks postpartum (T3).

4.1 Repeated measurements

For the FreBAQ, there was no significant difference between the measurement points (T1 vs T2 p= 0.902, T2 vs T3 p= 0.865, T1 vs T3 p= 0.889), which was also the case for the NRS for pelvic and low back pain (T1 vs T2 p= 0.306, T2 vs T3 p= 0.523, T1 vs T3 p= 0.396) (fig. 2 and 4). The score on the ODI decreased significantly between the prenatal measurement and the six weeks postnatal measurement (p= 0.001) and between the prenatal measurement and 18 weeks postnatal measurement (p= 0.004) (fig. 1). No decline of the score of the NRS for urine incontinence (p= 0.066) and the ICIQ-FLUTS subscale incontinence (p= 0.062), between the prenatal and six weeks postnatal measurement, could be seen (fig. 3 and 5).

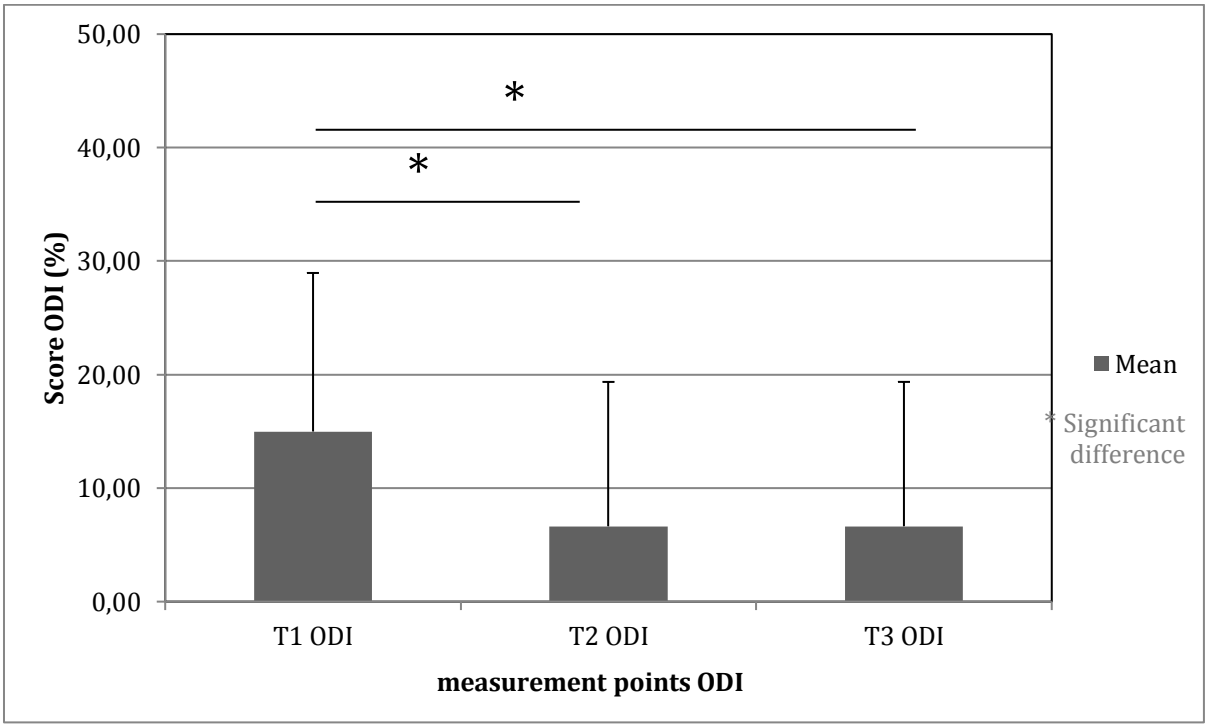

Figure 1: Mean and standard deviations of the Oswestry Disability Index (ODI) prenatal (T1), six weeks postpartum (T2) and 18 weeks postpartum (T3).

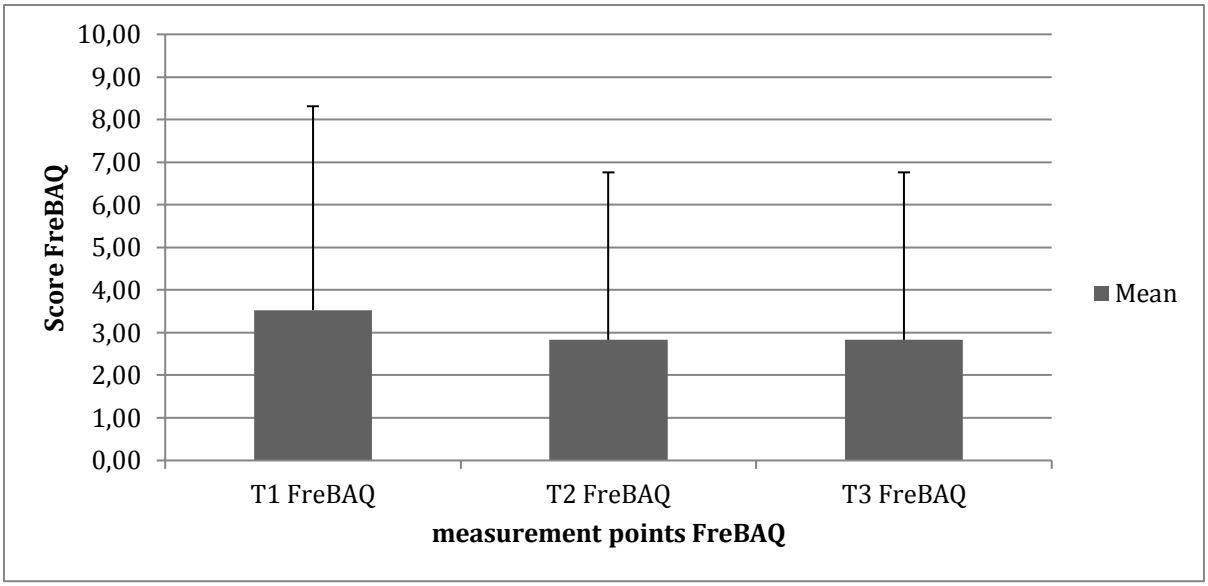

Figure 2: Mean and standard deviations of the Fremantle Back Awareness Questionnaire (FreBAQ) prenatal (T1), six weeks postpartum (T2) and 18 weeks postpartum (T3).

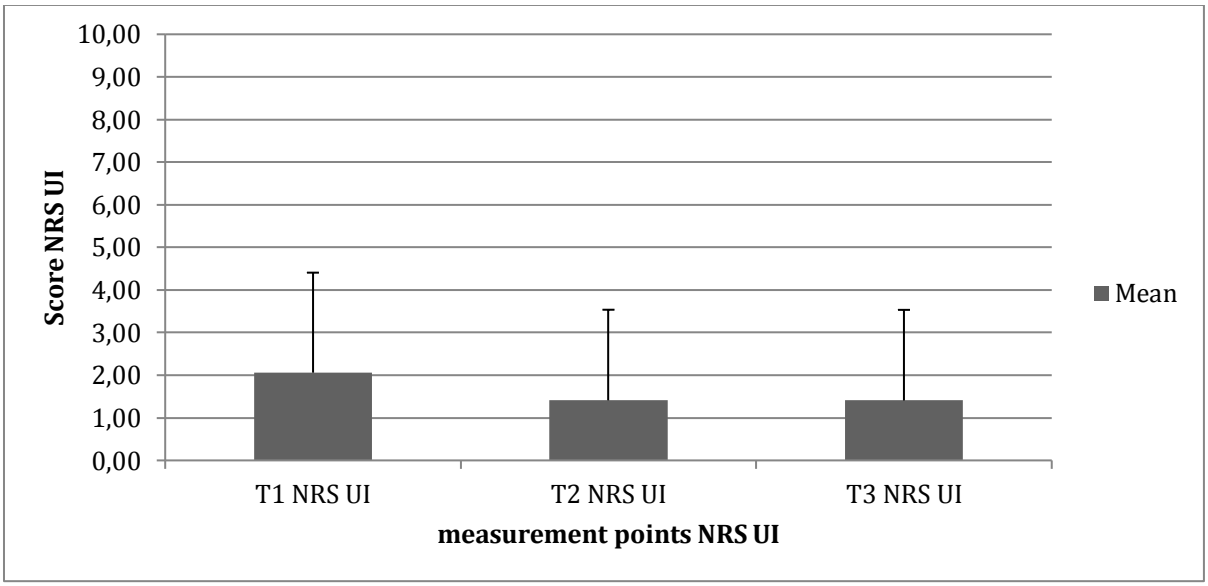

Figure 3: Mean and standard deviations of the Numeric Rating Scale for Urine Incontinence (NRS UI) prenatal (T1), six weeks postpartum (T2) and 18 weeks postpartum (T3).

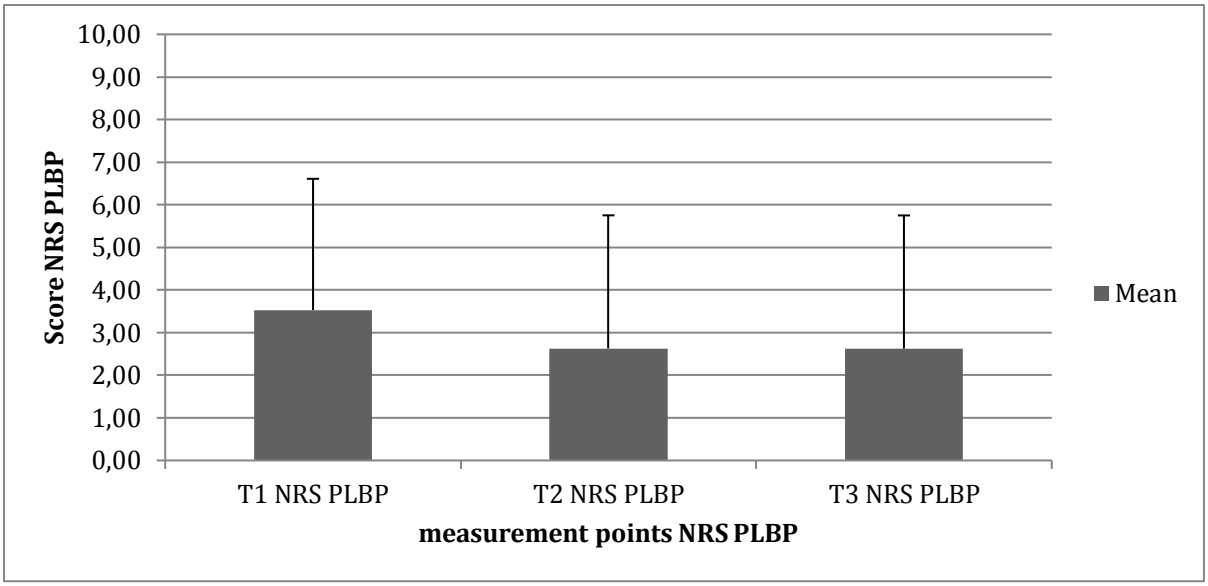

Figure 4: Mean and standard deviations of the Numeric Rating Scale for Pelvic and Low Back Pain (NRS PLBP) prenatal (T1), six weeks postpartum (T2) and 18 weeks postpartum (T3)

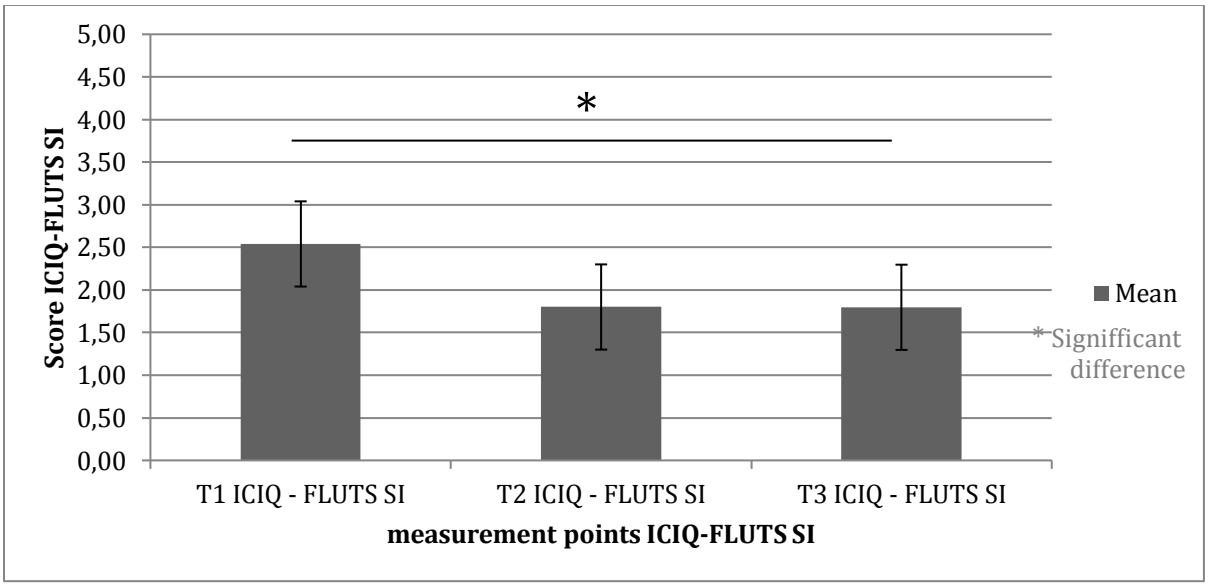

Figure 5: Mean and standard deviations of the International Continence Index Questionnaire - Female Lower Urinary Tract Symptoms Subscale Incontinence (ICIQ-FLUTS SI) prenatal (T1), six weeks postpartum (T2) and 18 weeks postpartum (T3)

4.2 Correlations

There is a correlation between pelvic and low back pain (NRS and ODI) and the FreBAQ. A high score on the FreBAQ is moderatly correlated with a high score on the ODI T1 (p= 0.001, T2 p= 0.006, T3 p= 0.013) and a high score on the NRS for pelvic and low back pain (T1 p= 0.001, T2 p= 0,001, T3 p= 0.010) on the three measurement moments. Following

physiotherapy prenatal is low to moderate correlated with a high score on the NRS for pelvic and low back pain (T1 p= 0.001, T2 p= 0.008) on two measurement points (prenatal and six weeks postnatal). Following physiotherapy prenatal and a high score on the ODI (p= 0.008) are only correlated moderately six weeks postnatal.

There is a correlation between urinary incontinence (ICIQ-FLUTS subscale incontinence and NRS) and pelvic and low back pain. A high score on the ODI is low correlated with a high score on the ICIQ-FLUTS subscale incontinence questionnaire (p= 0.001) at T1. A high score on the NRS for urine incontinence is also low correlated with a high score on the ODI (p= 0.001) at T1. Only one measurement for urine incontinence was highly correlated on three measurement moments: a high score on the NRS for urine incontinence and a high score on the ICIQ-FLUTS subscale incontinence questionnaire (T1 p= 0.001, T2 p= 0.001, T3 p= 0.001). Correlation coefficients can be found in Table 2, 3 and 4.

Table 2: Correlation coefficients on T1

ODI - FreBAQ	**0.542**
ODI – NRS UI	**0.297**
ODI – ICIQ-FLUTS SI	**0.306**
ODI - Physio	-0.157
FreBAQ – NRS PLBP	**0.382**
NRS UI – NRS PLBP	0.133
NRS PLBP – ICIQ – FLUTS SI	0.029
NRS PLBP – Physio	**-0.408**
ICIQ-FLUTS SI - Physio	-0.119
Physio – NRS UI	-0.116
NRS UI – ICIQ FLUTS SI	**0.797**

ODI: Oswestry Disability Index
FreBAQ: Fremantale Back Awareness Questionnaire
NRS UI: Numeric Rating Scale Urinary Continence
ICIQ-FLUTS SI: International Continence Index Questionnaire - Female Lower Urinary Tract Symptoms Subscale Incontinence
Physio: Followed physiotherapy prenatally
NRS PLBP: Numeric Rating Scale pelvic and low back pain
Significant correlation coefficients are marked in bold.

Table 3: Correlation coefficients on T2

ODI - FreBAQ	**0.354**
ODI – NRS UI	0.151
ODI – ICIQ-FLUTS SI	0.226
ODI - Physio	**-0.342**
FreBAQ – NRS PLBP	**0.520**
NRS UI – NRS PLBP	0.185
NRS PLBP – ICIQ – FLUTS SI	0.179
NRS PLBP – Physio	**-0.342**
ICIQ-FLUTS SI - Physio	0.060
Physio – NRS UI	-0.030
NRS UI – ICIQ FLUTS SI	0.778

ODI: Oswestry Disability Index
FreBAQ: Fremantale Back Awareness Questionnaire
NRS UI: Numeric Rating Scale Urinary Continence
ICIQ-FLUTS SI: International Continence Index Questionnaire - Female Lower Urinary Tract Symptoms Subscale Incontinence
Physio: Followed physiotherapy prenatally
NRS PLBP: Numeric Rating Scale pelvic and low back pain
Significant correlation coefficients are marked in bold.

Table 4: Correlation coefficients on T3

ODI - FreBAQ	**0.547**
ODI – NRS UI	0.243
ODI – ICIQ-FLUTS SI	0.011
FreBAQ – NRS PLBP	**0.562**
NRS UI – NRS PLBP	0.257
NRS PLBP – ICIQ – FLUTS SI	-0.047
NRS UI – ICIQ FLUTS SI	**0.806**

ODI: Oswestry Disability Index
FreBAQ: Fremantale Back Awareness Questionnaire
NRS UI: Numeric Rating Scale Urinary Continence
ICIQ-FLUTS SI: International Continence Index Questionnaire - Female Lower Urinary Tract Symptoms Subscale Incontinence
NRS PLBP: Numeric Rating Scale pelvic and low back pain
Significant correlation coefficients are marked in bold.

4.3 Risk factors for having pelvic and low back pain 6 weeks postpartum

Results indicate that the following factors are predictive for having low back pain at six weeks postnatal, independent of each other: a high score on the ODI prenatal (p= 0.005), a high score on the NRS for pelvic and low back pain prenatal (p= 0.003), having followed physiotherapy prenatal (p= 0.037), having a caesarean section (p = 0.006) gives seven times more risk for getting low back pain postnatal, having a rupture postnatal (p= 0.009) and a large rupture (p= 0.018) gives a two times higher change for having low back pain six weeks postnatal.

The following factors appear not to affect the outcome measure of having low back pain six weeks postnatal: weight gain during pregnancy (p = 0,540), the weight of the mother before pregnancy (p = 0,125), the score on the ICIQ-FLUTS subscale incontinence prenatal (p = 0,099), the score on the FreBAQ prenatally (p = 0,086), the age of the mother (p = 0,146), in case of a vaginal delivery that it is instrumentally assisted or not (p = 0,649), if a episiotomy is executed or not (p = 0,069), the duration of the labor (second phase) (p = 0,177), the degree of contraction of the pelvic floor muscles postnatal (p = 0,614), the degree of diastasis above (p = 0,611) and at level (p = 0,644) of the umbilicus, the birth weight of the child (p = 0,444) and the circumference of the head of the child (p = 0,070).
For p-values and odd ratio's (OR) of the risk factors see table 5.

When all the variables which were p< 0.1 in the univariate analyses (also circumference of the head of the child, if an episiotomy is executed or not, the score on the FreBAQ prenatally and the score on the ICIQ-FLUTS prenatally) are put together in a multivariate logistic regression, the data showed that a high score on the ICIQ-FLUTS subscale incontinence is predictive for getting low back pain postnatal (OR= 1.209, p= 0.049).

Table 5: Risk factor analysis for having pelvic and low back pain 6 weeks postpartum

Risk Factors	Odds ratio	P-value
Prenatal ODI	1.075	0.005
Prenatal NRS PLBP	1.384	0.003
Prenatal ICIQ-FLUTS SI	1.209	0.099
Weight gain	1.037	0.540
Weight before pregnancy	1.036	0.129
Physio	0.319	0.037
Prenatal FreBAQ	1.130	0.086
Age mother	1.147	0.146
Caesarean section	7.333	0.006
Instrumentally assisted	1.375	0.649
Episiotomy	3.500	0.069
Rupture	0.156	0.009
Degree of rupture	2.634	0.018
Duration of labor	1.019	0.177
Contraction pelvic floor muscles postnatal	0.774	0.614
Diastasis	0.679	0.552
Degree of diastasis above level of umbilicus	1.112	0.611
Degree of diastasis at level of umbilicus	1.101	0.644
Birth weight child	1.498	0.444
Head circumference child	1.406	0.070

5 Discussion

The current study examined whether pregnant and postpartum women with pelvic and low back pain also suffered from an impaired self-reported back-specific awareness in the low back region in primiparae. The secondary aim of the study was to investigate whether women with pelvic and low back pain had a higher risk for urinary incontinence.

5.1 Reflections about the relation between pelvic and low back pain and impaired back-specific awareness.

There was a moderate correlation between pelvic and low back pain and having an impaired back-specific awareness, of which impaired proprioception is a part, on the three measurement time points. Ersal, McCrory & Sienko (2014) found that pregnant women who fall have less ankle stiffness than pregnant women who do not fall. Claeys et al. (2015) proved that young individuals who do rely more on proprioceptive inputs of the ankle muscles have an increased risk for developing low back pain. This adaptive strategy, of using more proprioceptive feedback form the ankle muscles, could become maladaptive when it is used for a longer time than necessary. So it is possible that women who do suffer from low back pain during the postpartum period use this adaptive strategy too long, so it becomes maladaptive. Besides, it is possible that women who already suffer from pelvic and low back pain before pregnancy already rely more on the ankle muscles for proprioceptive feedback, and that they already have a maladaptive strategy for proprioception before pregnancy. It can also be assumed that pregnant women with a maladaptive use of proprioception (the ankle controlled strategy), have a higher risk for developing low back pain compared with pregnant women who use a good proprioceptive strategy.

5.2 Reflections about the risk factors for developing pelvic and low back pain postpartum

The study showed that there are several risk factors for having pelvic and low back pain postpartum. It was observed that women who did already have low back pain before pregnancy have a higher risk for having pelvic and low back pain after giving birth. Elden, Gutke, Kjellby-Wendt, Fagevik-Olsen & Ostgaard (2016) also concluded in their study that having a history of low back pain before the pregnancy is a risk factor for pelvic and low back pain after giving birth.

Our results showed that women who already followed physiotherapy prenatally are having a higher risk for having pelvic and low back pain after pregnancy. It is possible that women who already suffered from pelvic or low back pain before pregnancy or during pregnancy were more likely to follow physiotherapy prenatal than women who do not suffer from this.

Women who have had a caesarean section had up to seven times more risk for developing pelvic and low back pain postpartum. There is prove that an elective caesarean section is associated with a higher risk for pelvic and low back pain postpartum. This study also showed that women who have undergone an elective caesarean section are more likely to get pelvic and low back pain than women which have had an emergency caesarean section (Mogren, 2006).

They also state that during the local or general anesthesia during caesarean section the women do not receive signals of the position of the lower back and pelvis. Because of this, the women can't correct the wrong position of their lower back and pelvis. This can lead to damage of the joints, ligaments and muscles in the lumbar spine and pelvis.

Hodges & Richardson (1996) have proved with their research that in the general population, there is a delayed contraction of the Transversus Abdominis muscle during limb movements in people with low back pain. This indicates that there is a problem with the motor control of this muscle. The latter could result in an inefficient muscular stabilization of the lumbar spine, which can result in low back pain. This reasoning could also go up for women who have had a caesarean section. It's possible that cutting the abdominal muscles, in particular, the Transversus Abdominis muscle, cause is of an impaired motor control. This in turn may lead to less stabilization of the lumbar spine and can cause low back pain.

A large rupture during the delivery gives a two times higher chance for getting low back pain postpartum. An explanation for this could be that the larger the rupture is, the more damage there is to the pelvic floor muscles. The damage of the pelvic floor muscles could lead to an impaired motor control of this muscles, which can be responsible for pelvic and low back pain postnatal (Sjodahl et al., 2015).

5.3 Reflections about the relation between pelvic and low back pain and urinary incontinence

The data in this study prove that prenatal urinary incontinence is predictive for getting pelvic and low back pain postpartum. Pelvic floor dysfunction is related to a decreased motor control of the pelvic floor muscles and a higher activity of these muscles in the general population with pelvic and low back pain complaints. The higher activity of the pelvic floor muscles can be seen as an increased rest tone but there is less activity during activities like coughing (Pool-Goudzwaard et al., 2005). We hypothesize that this can also be the case in pregnant and postpartum women. That during and after the pregnancy there is a decreased motor control of the pelvic floor muscles, which can cause pelvic and low back pain. It is possible that the increased activity of the pelvic floor muscles is necessary for stabilization of the sacroiliac joints. The increased activity of these muscles and the decreased motor control influences the reflexive movements and the voluntary movements of the pelvic girdle. The latter can explain why this population suffers from urinary incontinence (Pool-Goudzwaard et al., 2005).

5.4 Reflections on strength and weaknesses of the study

The participants in the study were questioned on the maternity department about there prenatal symptoms. The women were asked to fill in their questionnaires like they would have done prenatally, which creates a potential recall bias.

Another weakness of this study is that there was a big loss to follow up between the first measurement point (prenatal) and the second measurement point (six weeks postnatal) and also between the second measurement point and the third (18 weeks postnatal). So the results of the third measurement point could not be generalised to the population of all the primiparae.

The lumbar proprioception (back-specific awareness) was measured with a questionnaire (FreBAQ), which is still a more indirect measurement of proprioception. For further studies, we recommend to investigate the proprioception of the pregnant and postpartum women in a more direct way.

5.5 Clinical relevance of this study

This study shows that there is a relation between an impaired back-specific awareness and low back pain in pregnant and postpartum women and that women with prenatal urinary

incontinence have a higher risk for having postnatal pelvic and low back pain. It's useful for physical therapists that when pregnant and postpartum women complain about low back pain to evaluate proprioception of the pelvis and lumbar spine. In case that this is impaired, it can be useful to target this aspect in the rehabilitation. It can also be recommended to ask in this population about prenatal urinary incontinence, because this is predictive for low back pain postpartum. For this reason it can be useful to target the pelvic floor muscles during rehabilitation in this population because a decreased motor control of the pelvic floor muscles can lead to pelvic and low back pain.

6. Conclusion

This observational study shows that there is a relation between pelvic and low back pain and having an impaired back-specific awareness, of which impaired proprioception in a part. The two major risk factors for having low back pain postpartum are having had a caesarean section and a large rupture during delivery. Furthermore, the data in this study proved that also prenatal urinary incontinence in pregnant and postpartum women is predictive for having low back pain postpartum.

7 Reference list

Butler, E. E., Colón, I., Druzin, M. L., & Rose, J. (2006). Postural equilibrium during pregnancy: decreased stability with an increased reliance on visual cues. *American journal of obstetrics and gynecology, 195*(4), 1104-1108.

Casagrande, D., Gugala, Z., Clark, S. M., & Lindsey, R. W. (2015). Low Back Pain and Pelvic Girdle Pain in Pregnancy. *J Am Acad Orthop Surg, 23*(9), 539-549. doi:10.5435/jaaos-d-14-00248

Claeys, K., Dankaerts, W., Janssens, L., Pijnenburg, M., Goossens, N., & Brumagne, S. (2015). Young individuals with a more ankle-steered proprioceptive control strategy may develop mild non-specific low back pain. *Journal of Electromyography and Kinesiology, 25*(2), 329-338.

Dalal, K., Kaur, A., & Mitra, M. (2014). Correlation between diastasis rectus abdominis and lumbopelvic pain and dysfunction. *Indian Journal of Physiotherapy and Occupational Therapy, 8*(1), 210.

Diez-Itza, I., Arrue, M., Ibañez, L., Paredes, J., Murgiondo, A., & Sarasqueta, C. (2011). Influence of mode of delivery on pelvic organ support 6 months postpartum. *Gynecologic and obstetric investigation, 72*(2), 123-129.

Elden, H., Gutke, A., Kjellby-Wendt, G., Fagevik-Olsen, M., & Ostgaard, H.-C. (2016). Predictors and consequences of long-term pregnancy-related pelvic girdle pain: a longitudinal follow-up study. *BMC Musculoskeletal Disorders, 17*(1), 276.

Ersal, T., McCrory, J. L., & Sienko, K. H. (2014). Theoretical and experimental indicators of falls during pregnancy as assessed by postural perturbations. *Gait & posture, 39*(1), 218-223.

Farrar, J. T., Young, J. P., LaMoreaux, L., Werth, J. L., & Poole, R. M. (2001). Clinical importance of changes in chronic pain intensity measured on an 11-point numerical pain rating scale. *Pain, 94*(2), 149-158.

Fast, A., Shapiro, D., Ducommun, E. J., Friedmann, L. W., Bouklas, T., & Floman, Y. (1987). Low-back pain in pregnancy. *Spine, 12*(4), 368-371.

Ghaderi, F., Mohammadi, K., Amir Sasan, R., Niko Kheslat, S., & Oskouei, A. E. (2016). Effects of Stabilization Exercises Focusing on Pelvic Floor Muscles on Low Back Pain and Urinary Incontinence in Women. *Urology, 93*, 50-54. doi:10.1016/j.urology.2016.03.034

Gutke, A., Östgaard, H. C., & Öberg, B. (2006). Pelvic girdle pain and lumbar pain in pregnancy: a cohort study of the consequences in terms of health and functioning. *Spine, 31*(5), E149-E155.

Hodges, P. W., & Richardson, C. A. (1996). Inefficient muscular stabilization of the lumbar spine associated with low back pain: a motor control evaluation of transversus abdominis. *Spine, 21*(22), 2640-2650.

Inanir, A., Cakmak, B., Hisim, Y., & Demirturk, F. (2014). Evaluation of postural equilibrium and fall risk during pregnancy. *Gait & posture, 39*(4), 1122-1125.

Ireland, M. L., & Ott, S. M. (2000). The effects of pregnancy on the musculoskeletal system. *Clinical orthopaedics and related research, 372*, 169-179.

Janssens, L., Goossens, N., Brumagne, S., Thys, T., Ehrenbrusthoff, K., & Wand, B. (2016). The Dutch version of the Fremantle Back Awareness Questionnaire.

Lackner, J. R., & DiZio, P. (2005). Vestibular, proprioceptive, and haptic contributions to spatial orientation. *Annu. Rev. Psychol., 56*, 115-147.

Luomajoki, H., & Moseley, G. L. (2011). Tactile acuity and lumbopelvic motor control in patients with back pain and healthy controls. *British journal of sports medicine, 45*(5), 437-440.
Mogren, I. M. (2006). BMI, pain and hyper-mobility are determinants of long-term outcome for women with low back pain and pelvic pain during pregnancy. *European Spine Journal, 15*(7), 1093-1102.
Pool-Goudzwaard, A. L., ten Hove, M. C. S., Vierhout, M. E., Mulder, P. H., Pool, J. J., Snijders, C. J., & Stoeckart, R. (2005). Relations between pregnancy-related low back pain, pelvic floor activity and pelvic floor dysfunction. *International Urogynecology Journal, 16*(6), 468-474.
Ribeiro, F., & Oliveira, J. (2011). *Factors influencing proprioception: what do they reveal?* : INTECH Open Access Publisher.
Rumsey, D. J. (2015). *U Can: statistics for dummies*: John Wiley & Sons.
Sjodahl, J., Gutke, A., Ghaffari, G., Stromberg, T., & Oberg, B. (2016). Response of the muscles in the pelvic floor and the lower lateral abdominal wall during the Active Straight Leg Raise in women with and without pelvic girdle pain: An experimental study. *Clin Biomech (Bristol, Avon), 35*, 49-55. doi:10.1016/j.clinbiomech.2016.04.007
van Hooff, M. L., Spruit, M., Fairbank, J. C., van Limbeek, J., & Jacobs, W. C. (2015). The oswestry disability index (version 2.1 a): validation of a Dutch language version. *Spine, 40*(2), E83-E90.
Wand, B. M., James, M., Abbaszadeh, S., George, P. J., Formby, P. M., Smith, A. J., & O'Connell, N. E. (2014). Assessing self-perception in patients with chronic low back pain: Development of a back-specific body-perception questionnaire. *Journal of back and musculoskeletal rehabilitation, 27*(4), 463-473.
Whitcome, K. K., Shapiro, L. J., & Lieberman, D. E. (2007). Fetal load and the evolution of lumbar lordosis in bipedal hominins. *Nature, 450*(7172), 1075-1078.
Wu, W., Meijer, O. G., Uegaki, K., Mens, J., Van Dieen, J., Wuisman, P., & Östgaard, H. (2004). Pregnancy-related pelvic girdle pain (PPP), I: Terminology, clinical presentation, and prevalence. *European Spine Journal, 13*(7), 575-589.
Zappavigna, C., & Carr, L. K. (2015). Validated Questionnaires for the Evaluation of Urinary Incontinence—Which, When and Why? *Current Bladder Dysfunction Reports, 10*(2), 138-142.

Auteursrechtelijke overeenkomst

Ik/wij verlenen het wereldwijde auteursrecht voor de ingediende eindverhandeling:
**The association between pregnancy-related pelvic and low back pain and lumbar proprioception:
an observational study**

Richting: **master in de revalidatiewetenschappen en de kinesitherapie-revalidatiewetenschappen en kinesitherapie bij neurologische aandoeningen**
Jaar: **2017**

in alle mogelijke mediaformaten, - bestaande en in de toekomst te ontwikkelen - , aan de Universiteit Hasselt.

Niet tegenstaand deze toekenning van het auteursrecht aan de Universiteit Hasselt behoud ik als auteur het recht om de eindverhandeling, - in zijn geheel of gedeeltelijk -, vrij te reproduceren, (her)publiceren of distribueren zonder de toelating te moeten verkrijgen van de Universiteit Hasselt.

Ik bevestig dat de eindverhandeling mijn origineel werk is, en dat ik het recht heb om de rechten te verlenen die in deze overeenkomst worden beschreven. Ik verklaar tevens dat de eindverhandeling, naar mijn weten, het auteursrecht van anderen niet overtreedt.

Ik verklaar tevens dat ik voor het materiaal in de eindverhandeling dat beschermd wordt door het auteursrecht, de nodige toelatingen heb verkregen zodat ik deze ook aan de Universiteit Hasselt kan overdragen en dat dit duidelijk in de tekst en inhoud van de eindverhandeling werd genotificeerd.

Universiteit Hasselt zal mij als auteur(s) van de eindverhandeling identificeren en zal geen wijzigingen aanbrengen aan de eindverhandeling, uitgezonderd deze toegelaten door deze overeenkomst.

Voor akkoord,

Ramaekers, Ingriet **Theys, Mieke**