THE EFFECT OF AN ANTENATAL EXERCISE PROGRAMME INCLUDING DIAPHRAGMATIC BREATHING WITH CO-CONTRACTION OF ABDOMINAL AND PELVIC FLOOR MUSCLES ON STRESS URINARY INCONTINENCE POSTPARTUM

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This dissertation is submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, in fulfillment of the requirements for the degree of Master of Science in Physiotherapy (dissertation)

DECLARATION

I, Tasneem Amin Ebrahim, declare that this dissertation is my own work. It is being submitted for the degree of Master of Science in Physiotherapy at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other university.

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_____ day of _____

DEDICATION

To my infinitely supportive parents
and to
my loving and encouraging husband,
I am so grateful for all of you.

ABSTRACT

Background: Stress urinary incontinence is a common problem during and after pregnancy. Pelvic floor muscle exercises have been shown to be an effective means to prevent and treat stress urinary incontinence. The literature has shown that abdominal muscles and the diaphragm work in tandem with pelvic floor muscles and co-contraction of all these muscles results in a stronger pelvic floor muscle contraction. However, this has not been tested in pregnant women with stress urinary incontinence and this relationship will be further investigated in this study. Therefore the overall aim of the study is to determine the effect of an antenatal exercise programme including diaphragmatic breathing with co-contraction of abdominal and pelvic floor muscles on stress urinary incontinence postpartum. The following objectives will be addressed:

1. To determine the influence of urinary incontinence on the prepartum quality of life (QOL) of pregnant women.
2. To establish the effect of antenatal co-contraction of pelvic floor and abdominal muscle exercises with diaphragmatic breathing on the amount of urine lost under stress.
3. To establish the effect of antenatal pelvic floor muscle exercises without diaphragmatic breathing and abdominal muscle co-contraction on the amount of urine lost under stress.
4. To determine the influence of urinary incontinence on QOL of pregnant women after the intervention.
5. To compare the effects of the two exercise programmes on urinary incontinence and QOL of pregnant women postpartum.

Method: The single blind randomised controlled trial was conducted with the help of a research assistant. Once ethical clearance was obtained from the Human Research Ethics Committee, participants were recruited from the antenatal clinic at Rahima Moosa Mother and Child Hospital, Crosby Clinic and Westbury Clinic in Gauteng province, Johannesburg, South Africa. Participants were randomised by computer generated randomisation and concealed allocation into the control group or the intervention group. At baseline all participants were requested to perform a modified 20 minute pad test and complete the King's Health Questionnaire (KHQ). They received an educational talk which included the method of performing Kegel exercises and were given a home exercise programme. Participants in the intervention group were given an exercise diary and taught diaphragmatic breathing as well as co-contraction of the abdominal muscles while doing pelvic floor

exercises. Participants in the intervention group also received telephone calls every two weeks from baseline assessment until follow-up assessment to remind them to do the exercises and record them in their diaries. Re-assessment was conducted at the eight week follow-up assessment where the same questionnaire and pad test was performed again. Telephonic interviews were conducted for those participants who could not attend their follow-up assessments. The significance of the study was set at p=0.05. Two-sample t-tests and the Wilcoxon's Rank Sum test were used to compare variables between groups and the Kendall's Tau Correlation Coefficient and the Spearman's Rank Correlation Coefficient were used to determine correlations between variables.

Results: Fifty-two participants were recruited. Most participants were between the ages of 21 and 30 years (59.6%, n=31) in their second trimester of pregnancy (53.9%, n=28) and most (42.3%, n=22) were experiencing symptoms of stress urinary incontinence for 1 to 2 months. No differences in quality of life were observed between groups at baseline for any part of the King's Health Questionnaire (part one: p=0.31; part two: p= 0.33 and part three: p=0.46).

Stress incontinence score and pad test results were used as measures of urinary incontinence. There was no significant difference in the stress incontinence scores between groups at follow-up (p=0.58), there was also no significant difference in the pad test results between the control and the intervention group at follow-up (p=1.00). Correlations between the pad test results and the KHQ scores showed only weak correlations at baseline for both groups, but a non-significant strong correlation at follow-up for the intervention group for part one (Kendall's tau= 0.83 and p=0.13) and part three (Kendall's tau= 0.83 and p=0.15) of the KHQ. Correlations between the stress incontinence scores and the KHQ also showed weak non-significant correlations for all parts in both groups at baseline, while at follow-up only the intervention group showed a moderate non-significant correlation with part two of the KHQ (Part one: Spearman's Rho=0.35, p=0.03; part two: Spearman's Rho = 0.50, p= 0.25; part three: Spearman's Rho = 0.36, p=0.01).

There were no differences in quality of life between groups at follow-up for any part of the King's Health Questionnaire (part one: p=0.35; part two: p= 0.09 and part three: p=0.18). There was also no evidence that any of the demographic characteristics could be linked to stress incontinence, pad test scores or quality of life.

Conclusion: Although there were improvements in actual scores of the King's Health Questionnaire and stress incontinence scores, there were no differences between the

control group and the intervention group and hence, a combination of diaphragmatic breathing and abdominal co-contraction and pelvic floor muscle exercises was not more effective than pelvic floor muscle exercises alone.

Keywords: : “urinary incontinence”; “pregnancy”; “pelvic floor exercises”; “abdominal and respiratory co-activation”; “abdomino-pelvic synergy”; “antenatal” ; “quality of life”

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LIST OF ABBREVIATIONS

ANC	-	Antenatal Clinic
BFLUTS	-	Bristol Female Lower Urinary Tract Symptoms
BMI	-	Body Mass Index
CATI	-	Computer Assisted Telephone Interview
COPD	-	Chronic Obstructive Pulmonary Disease
DM	-	Diabetes Mellitus
EMG	-	Electromyography
EQ.5D	-	EuroQol-5D
FES	-	Functional Electrical Stimulation
FI	-	Faecal Incontinence
HRQOL	-	Health-related Quality of Life
IAP	-	Intra-abdominal Pressure
IC	-	Iliococcygeus
ICIQ-UI SF	-	International Consultation on Incontinence Questionnaire –Urinary Incontinence Short Form
ICS	-	International Continence Society
I-QOL	-	Urinary Incontinence Quality of Life Scale
IUGA	-	International Urogynecology Association
KHQ	-	King's Health Questionnaire
MRI	-	Magnetic Resonance Imaging
MUI	-	Mixed Urinary Incontinence
PFM	-	Pelvic Floor Muscles
PFME	-	Pelvic Floor Muscle Exercises
PFMT	-	Pelvic Floor Muscle Training
PP	-	Postpartum
PR	-	Puborectalis
PTT	-	Paper Towel Test
RA	-	Research Assistant
RMMCH	-	Rahima Moosa Mother and Child Hospital
SF-12	-	Short-form 12
SF-36	-	Short-form 36
SUI	-	Stress Urinary Incontinence
UDS	-	Urodynamic Studies
UI	-	Urinary Incontinence

US	-	Ultrasound
UUI	-	Urinary Urge Incontinence

CHAPTER 1

1. INTRODUCTION

This chapter provides an introduction to the study by presenting the background, problem statement, aim, objectives and significance of the study.

1.1 BACKGROUND

Stress urinary incontinence (SUI) is the most common type of incontinence and is defined as involuntary leakage of urine related to any abdominal effort such as laughing, coughing or sneezing (Capelini et al., 2006). Pelvic floor musculature and the surrounding connective tissue work in unison to provide support to the pelvic organs. Any defect in this support system may contribute to prolapse, incontinence, voiding, sexual and defaecatory dysfunction (Corton, 2005). According to Wilson et al., (2001) the prevalence of incontinence in the population not currently in a medical institution is between 17-55%. Wesnes et al., (2012) have found that close to 50% of all women experience incontinence during pregnancy. Findings from other countries indicate that 12-53% of women suffer from some form of incontinence (Hunskaar et al., 2000; Onur et al., 2006). There is a lack of current statistics on the prevalence of incontinence in South Africa, but according to results from the 1998 South African Demographic and Health Survey (SADHS) 9.7% of women who have been pregnant have also experienced stress incontinence but it was also mentioned that this number could be affected by the number of women who reported stress incontinence. Results from the survey also indicated that stress incontinence was more common among white and Asian women (South African Demographic and Health Survey, 1998).

The experience of incontinence is both distressing and embarrassing and has far-reaching physical, psychological and social implications (Temml et al., 2000; Ortiz, 2004). Many women choose to absent themselves from society for fear of embarrassing themselves if an “accident” occurs. Women who are incontinent have also expressed concern that they worry about body odour from leaking urine (Kinchin et al., 2003). These effects often result in reclusive or isolatory tendencies (Solens-Domenech et al., 2010). Stach-Lempinen et al., (2004) conducted a study in which the relationship between a number of incontinence parameters and health-related quality of life was investigated. Their findings indicated a positive correlation between incontinence severity measures and health-related quality of life. Women who had

experienced urinary incontinence said that it had had negative effects on one or more of the following factors: household chores; social participation; travelling, entertainment and exercise. They also reported associated feelings of nervousness, depression and frustration (Segedi et al., 2011). According to findings in the study by Diokno (2003), most women predominantly suffer from stress urinary incontinence or mixed urinary incontinence. Diokno (2003) also conducted a meta-analysis of published studies of urinary incontinence epidemiology which indicated that stress urinary incontinence accounted for almost half of the total worldwide prevalence of urinary incontinence.

There are many risk factors associated with stress incontinence. These include smoking, increased body mass index (BMI), age, strenuous physical exercise, chronic diseases (e.g. COPD or diabetes), pregnancy and mode of delivery at birth. Pregnancy and vaginal delivery have been noted as two of the primary risk factors for urinary incontinence. This is due to the trauma and damage to the pelvic structures such as the ligaments, muscles, nerves and fascia supporting the pelvic organs that may occur in the birthing process (Morkved et al., 2003 and Bo et al., 2007).

Many studies have tested the effectiveness of pelvic floor muscle training in preventing urinary incontinence postpartum (Glazener et al., 2001; Chiarelli and Cockburn, 2002; Reilly et al., 2002; Chiarelli 2003; Morkved et al., 2003; Haddow et al., 2005; Morkved and Bo, 2005). All of these studies concluded that pelvic floor muscle exercises were effective in preventing urinary incontinence postpartum, and this was maintained one year after delivery (Morkved and Bo, 2000; Glazener et al., 2004).

There has been much research exploring the relationship between the pelvic floor muscles, abdominal muscles and the diaphragm (Sapsford et al., 2001; Neumann and Gill, 2002; Sanya et al., 2002; Bo et al., 2003; Dumoulin et al., 2004). These muscles are sometimes referred to as the “abdominal canister”. They work together in response to changes in intra-abdominal pressure (IAP) such as coughing or sneezing (Talasz et al., 2011). The pelvic floor, abdominal muscles and diaphragm provide truncal stability and also play a role in continence during increased abdominal pressure. Sapsford et al., (2001) investigated the response of the abdominal muscles to voluntary contraction of the pelvic floor in non-symptomatic women. Muscle activity was recorded using electromyography (EMG) during pelvic floor contractions and results showed that abdominal muscle activity is a normal

response to pelvic floor exercise. Findings also indicated that abdominal exercises activate pelvic floor muscles.

The diaphragm is the primary breathing muscle. Pilates training often uses diaphragmatic breathing while contracting the deep abdominal muscles and the pelvic floor. During inspiration the diaphragm contracts and moves downwards while the abdominal and pelvic floor muscles relax (Talasz et al., 2010). Lee et al., (2008) also explained that the muscles and fascia of the lumbopelvic region play a significant role in musculoskeletal function as well as continence and respiration. Sapsford (2004) demonstrated that diaphragmatic breathing increases the antero-posterior diameter of the abdomen with inspiration. This increase in diameter causes a stretch on the abdominal muscles that may enhance their contraction force during an increase in IAP.

1.2 PROBLEM STATEMENT

The current prevalence of stress incontinence in South Africa is unknown; however from findings in other countries it is evident that the problem of urinary incontinence affects 12-53% of the female population. Weakened pelvic floor muscles during pregnancy and childbirth is a risk factor for the development of urinary incontinence. Keeping this in mind together with the high prevalence rates of stress urinary incontinence globally, it would be useful if intervention is prophylactic as well as curative in nature. As mentioned above, pelvic floor muscle strengthening has been shown to prevent and treat urinary incontinence after childbirth. Also, co-contraction of the abdominal muscles together with diaphragmatic breathing results in a stronger pelvic floor muscle contraction but these studies have been conducted in healthy and asymptomatic women with no experience of urinary incontinence.

1.3 RESEARCH QUESTION

Does an antenatal exercise programme including diaphragmatic breathing with co-contraction of abdominal and pelvic floor muscles affect stress urinary incontinence postpartum?

1.4 AIM

To determine the effect of an antenatal exercise programme including diaphragmatic breathing with co-contraction of abdominal and pelvic floor muscles on urinary incontinence postpartum.

1.5 OBJECTIVES

1. To determine the influence of urinary incontinence on the prepartum quality of life (QOL) of pregnant women.

2. To establish the effect of antenatal co-contraction of pelvic floor and abdominal muscle exercises **with** diaphragmatic breathing on the amount of urine lost under stress.

3. To establish the effect of antenatal pelvic floor muscle exercises **without** diaphragmatic breathing and abdominal muscle co-contraction on the amount of urine lost under stress.

4. To determine the influence of urinary incontinence on QOL of pregnant women after the intervention.

5. To compare the effects of the two exercise programmes on urinary incontinence and QOL of pregnant women postpartum.

1.6 SIGNIFICANCE OF THE STUDY

This study aimed to determine if abdominal and pelvic floor muscle co-contraction with diaphragmatic breathing practiced antenatally, can result in improved continence postpartum, compared with regular pelvic floor muscle exercises only. If the results were positive, abdominal co-contraction and diaphragmatic breathing may be implemented as part of standard physiotherapy intervention of pelvic floor muscle exercise training in antenatal education.

A literature review is presented and discussed in the next chapter.

CHAPTER 2

2. LITERATURE REVIEW

2.1 INTRODUCTION

This review will provide information on the pelvic floor muscles, the effect of pregnancy and childbirth on these muscles, as well as evidence around exercises to prevent and/or treat urinary incontinence associated with pregnancy and childbirth. Literature relating to the outcome measures used in the assessment of urinary incontinence will also be reviewed. The literature search included Pubmed, ScienceDirect and SpringerLink with the keywords: “urinary incontinence”; “pregnancy”; “pelvic floor exercises”; “abdominal and respiratory co-activation”; “abdomino-pelvic synergy”; “antenatal”; “quality of life”. Studies were excluded if they related to faecal incontinence (FI) alone or if they were published before 1990.

2.2 THE GROSS ANATOMY OF THE PELVIC FLOOR REGION

The pelvic floor muscles are a group of muscles which work together with other structures to maintain functions such as stability of the pelvis, support to organs (bladder, bowel, uterus), sexual function and control of bladder and bowel (Corton, 2005). This pelvic system is made up of the bony pelvis, the pelvic organs, the pelvic floor muscles and connective tissue of the pelvis and the above work in unison to maintain healthy pelvic function (Corton, 2005). There are a number of ligaments associated with the pelvis that work with the pelvic floor muscles. For the purposes of this study, only the pelvic floor muscles will be discussed in more detail. The Levator Ani (LA) muscles are the group of muscles that are vital in maintaining continence. They consist of small but strong muscles that always have a higher resting tone than others to maintain support of the organs. The main muscles of the pelvic floor also include Pubococcygeus (PC), Iliococcygeus (IC) and Puborectalis (PR). Pubococcygeus and PR originate from the dorsal surface of the pubis and the fascia of Obturator Internus, while IC originates from the posterior aspect of the Arcus Tendineus Levator Ani and the ischial spine. Pubococcygeus and IC insert into the anococcygeal body and PR culminates in a U- shaped sling around the rectum. The pelvic floor muscles help support the pelvic viscera, they help control bladder and bowel function and play a role in sexual function. Innervations to the pelvic floor include sacral nerve roots S2 to S5 and may also include branches of the pudendal nerve (Corton, 2005). Pelvic floor muscles are made of striated skeletal muscle fibres which are under voluntary control, and they are made up of both Type I and Type II

muscle fibres. This is important in re-education of pelvic floor muscles in the form of strength as well as endurance training (Corton, 2005; Herbert, 2009; Herbert).

Dysfunction of the pelvic floor muscles may affect normal pelvic function which could result in altered mechanisms of continence.

2.3 URINARY INCONTINENCE

Urinary incontinence (UI) has been defined by the International Continence Society as the "complaint of any involuntary loss of urine". The three most common forms of urinary incontinence are stress incontinence, urge incontinence and mixed incontinence. Stress urinary incontinence is the involuntary loss of urine with abdominal effort such as coughing, laughing or sneezing. Stress urinary incontinence (SUI) is the most common form of urinary incontinence (Capelini et al., 2006). Urinary incontinence can be caused by aging, strenuous physical exercise, obesity, chronic diseases as well as pregnancy and childbirth.

2.3.1 Risk Factors for Developing UI

Aging

Hunskaar et al., (2000) in their review article mention potential risk factors for the development of UI and one of these is aging. Eight studies cited in this review have a positive correlation between age and UI and incontinence was found to be caused by primary diseases which are common in the elderly, such as diabetes mellitus (Hunskaar et al., 2000).

Chronic diseases

Lifford et al., (2005) have investigated type 2 diabetes mellitus (DM) to determine if it might be a risk factor for UI. This investigation was carried out by means of a prospective observational study. Questionnaires were mailed to participants who were all married female registered nurses. The initial questionnaire was sent in 1976 and others were mailed every two years to update information until 1996 and thereafter a new questionnaire was sent out in the year 2000 to participants diagnosed with DM. The sample size was 121 700. The questions covering incontinence were not specific to stress/urge/mixed incontinence, but were comprehensive enough to determine prevalence, frequency and quantity. Findings indicated that comparisons between women with DM and those without DM showed that there was an increased risk of incontinence in women with DM (Lifford et al., 2005). These findings are in agreement with the review conducted by Chiarelli and

Weatherall (2010) in which they discussed a number of diseases relating to incontinence such as stroke, dementia, Parkinson's disease, multiple sclerosis, osteoporosis and DM.

Another chronic medical condition examined by Hirayama et al., (2008) is COPD, which was investigated against its effect on incontinence and their findings confirmed that both stress and urge incontinence can be caused by COPD in a sample population of 244 men (Hirayama et al., 2008).

Thom (2008) in a study of white, black and Hispanic men and women reported that coronary heart disease has not been reported to be a risk factor for urinary incontinence in the epidemiology literature. Another study by Shakir et al., (2007) of Swedish women did show significant associations between cardiovascular disease and urinary incontinence. Thom (2008) further notes that in light of the study by Shakir et al., (2007) the association between cardiovascular disease and incontinence may be tenuous and further research is required in this field to reach conclusive results.

Obesity

Studies have shown that weight gain and increased BMI has a definite effect on UI to the extent that "the risk of urinary incontinence may increase by 50%-100% with every 5-point increase in BMI" (Buckley and Lapitan, 2010). The authors also note that the increase in weight during pregnancy is related to the increased risk of UI (Buckley et al., 2008). Similar findings of a positive correlation between BMI and UI were also reported by Segedi et al., (2011).

Strenuous physical exercise

Criner (2001) in her article on UI in female soldiers has cited "intense physical activity" and training as a risk factor for UI together with other factors such as "heavy lifting/pulling, overuse syndrome, unsanitary field conditions" and more. Many studies conducted on female soldiers are also cited in her article as evidence that the strenuous physical exercise and training is a cause of UI in many female soldiers. Some of these studies ranged from 30%-100% prevalence of UI during and/or after training (Criner, 2001).

Menopause

This factor was discussed by Hunskaar et al., (2000) in a review of the literature. Their findings indicated differing information which supported this risk as well as some studies which refuted it. Some studies showed no difference in prevalence rates between pre- and post-menopausal women but did show an increase in severity and frequency of incontinence in postmenopausal women. The relative risk may still be a factor but there is no definite evidence cited by this author for menopause being a direct cause of UI (Hunskaar et al., 2000).

Pregnancy and childbirth

Pregnancy and childbirth have been cited by many studies as a cause or risk factor for the development of UI (Hunskaar et al., 2000; Marshall et al., 2002; Reilly et al., 2002; Stainton et al., 2005; Buckley and Lapitan, 2010 and Solens-Domenech et al., 2010). A look at the anatomy of the pelvic floor and the effect of childbirth on the pelvic floor musculo-fascial complex provides a basis of understanding why this risk is frequently cited as a common causative agent of UI.

Growth of the baby during pregnancy and the associated increase in the weight of the baby produce anatomical changes to the urethra and bladder, according to Herbert (2009). This, coupled with the hormonal changes affecting the properties of collagen and other connective tissues during pregnancy, may cause the mechanisms of continence to be affected (Lal et al., 2003). Stretching and possible tearing of the endopelvic fascia and muscles and any trauma to the pudendal nerves that may occur during childbirth could be a likely cause of pelvic floor dysfunction (Herbert, 2009). Specifically, damage to the peripheral nerves has been identified by many studies in this review to be the cause of stress incontinence. The inherent ability of nerve tissue to withstand less stretch than muscle tissue and elongate before damage is 6-22% of their initial length, whereas skeletal muscle has been shown to stretch up to 200% of its initial length (Herbert, 2009). This poor extensibility of nerves could account for the injury occurring during childbirth.

Hunskaar et al., (2000) as previously mentioned, reviewed the current state of knowledge of the epidemiology of UI. Their review included discussion on evidence regarding the effect of pregnancy and childbirth on UI. Prevalence rates of UI had been reported to be between 31-60% during pregnancy. Ten articles reviewed by these authors had positive links between childbirth and prevalence of UI (Hunskaar et al., 2000). A number of reasons had been cited for this correlation, including laxity

of pelvic structures, stretching and weakening of pelvic musculature as well as damage to soft tissues during labour or by devices used to assist the birthing process. This is in keeping with findings related by Herbert (2009) above.

According to Hvidman et al., (2003) the prevailing hypothesis is that the most potent cause of urinary incontinence thus far is vaginal delivery. In their study of postpartum urinary incontinence they have cited six articles that support this hypothesis due to the patho-physiological evidence of repeated vaginal delivery and its effects on the pelvic floor muscles and innervations. Their cross-sectional survey by means of a questionnaire included 376 women who had delivered over a period of four years. Findings indicated that UI during pregnancy was a highly significant risk for UI postpartum; 62.9% of women in this study who experienced UI during pregnancy and also had vaginal deliveries reported postpartum urinary incontinence. The survey by Hvidman et al., (2003) included questions about UI experienced before pregnancy and during different trimesters as well as the duration of incontinence. Variations in questions about when incontinence was first experienced and about the actual experiences of incontinence yielded more information than fewer and less specific questions. Re-assessment was conducted on participants six months after childbirth and also took into consideration information about the birth, mode of delivery, weight of the baby, instrumentation and other variables that were relevant in seeking factors that affect continence in their sample population.

According to Stainton et al., (2005), four decades ago, approximately 50% of pregnant women experienced UI with one in six reporting persistent UI one year postpartum. The aim of this study was to identify women at risk for developing postnatal UI after their first pregnancy and birth. This longitudinal study including one hundred and twenty four women and was conducted over a period of fifteen months. Six questionnaires were used to assess the relative risk of participants both before and after childbirth. All the questionnaires used were developed for the study with content and face validity being established. There was no mention of construct validity nor inter and intra-rater reliability of these questionnaires. Findings indicated that the most likely cause of postpartum UI was pre-existing UI before pregnancy (Stainton et al., 2005). One of the questions used to identify UI was “are you leaking urine now?” and this might be ambiguous in its meaning in that it could refer to that present moment of answering the question or more generally, to a broader period of time. These questionnaires were not followed by further clinical examination by a professional to validate subjective symptoms of these participants. There was only

brief mention of the type of questions being asked but not which questions were specific to each questionnaire nor when each questionnaire was administered. It was also not stated if any distinction was made between SUI, UUI or mixed urinary incontinence (MUI) which could have altered results if women had their own personal definitions of incontinence and made their choices accordingly.

The study conducted in 2002 by Marshall et al., assessed the specific effect of vaginal delivery on the pelvic floor. As cited in the article, one of the main causes of UI after vaginal delivery is damage to the innervations of the pelvic floor. The experimental group consisted of ten primiparous women who were compared with ten nulliparous women of matched ages. Participants were excluded if they experienced any symptoms of urinary incontinence. Results obtained by using electromyography (EMG), digital assessment and perineometry indicated that nulliparous women had greater pelvic floor muscle strength, with stronger muscle contractions and better endurance than the primiparous group. However, although findings support the notion that pregnancy and childbirth affect pelvic floor integrity, the sample size in this study was very small and not a good representation of the general population. Although the assessor was blinded to group allocation, all participants were healthy physiotherapists or physiotherapy students who might possibly have had prior training in pelvic floor muscle exercises and this could have influenced their results.

Chiarelli (2003), in her review of the literature, discussed prevalence; prevention and exercise intervention in the pre- and postpartum period and states that there is evidence supporting the concept of pelvic floor tissue damage during vaginal delivery which was determined by means of in-vivo physiological studies. The author refers to articles that have shown nerve damage, urethral and pelvic floor muscle damage as well as damage to the soft tissue in the surrounding areas. This view is further supported by Reilly et al., (2002), Solens-Domenech et al., (2010) and Buckley and Lapitan (2010). Chiarelli's (2003) review examined randomised controlled trials with large sample sizes and blinded assessment of outcomes, although the exact number of studies reviewed was not mentioned.

Difficult childbirth and the use of instruments during childbirth were discussed in a study of 2275 Turkish women (Onur et al., 2009). Results obtained from this cross-sectional study indicated that in comparison to women without any UI at all, those women with UI had experienced one or more of the following: difficult labours, use of

devices to aid birthing (e.g. forceps) and pelvic organ prolapse. Mason et al., (2010) who conducted a prospective randomised controlled trial to determine the role of antenatal pelvic floor muscle exercises to prevent stress incontinence also mention that obesity, smoking, vaginal and/or instrumental deliveries as well as parity are risk factors for the development of SUI.

Much investigation has gone into the risk factors that cause UI, as seen in the discussion above. It is important to identify the risk factors in order to reduce prevalence rates.

2.4 PREVALENCE AND INCIDENCE OF UI

The exact number of women who suffer from UI in South Africa is currently unknown, but findings from other countries indicate that between 12-53% of women suffer from some form of incontinence (Hunskaar et al., 2000; Onur et al., 2006). A systematic review of epidemiological studies conducted by Hunskaar et al., (2000) brought to light many variations in the methodologies employed in the studies reviewed. Some such variations include the age span of the sample population, the different types of incontinence and whether studies included validation by urodynamic studies (UDS). It is noted in this review that age span is important to consider in prevalence studies of UI as the incidence of UI was shown to increase later in life. This is in keeping with age being a risk factor of UI as mentioned above.

Some of the studies reviewed showed prevalence rates for UI to lie between 8-48%. This is a large variation and possible reasons for this could be that the lower end of 8% was determined in 1993 in a study evaluating prevalence rates across two groups of subjects, those between the age of 30-59 and 60+. There is, however no mention of the number of participants in this study. The higher end of 48% prevalence was found in 1998 in a survey of a population aged 50-74. This higher prevalence rate is in keeping with the aforementioned risk factor of UI related to increasing age, but again there was no mention of sample size. An average percentage of prevalence obtained from these studies ranging from 1980-1998 was 33% (Hunskaar et al., 2000).

In a large prevalence study conducted by Irwin et al., (2006) a survey of 19 165 people in five different countries was conducted over a period of nine months. The survey was conducted by means of a Computer Assisted Telephone Interview (CATI) which was originally developed in English but translated into the language of each

country surveyed. The large sample number provided for a good representation of the population but the use of self-reported symptoms has been listed as a limitation due to its subjective nature, as opposed to a report by examination by a medical professional (Sandvik et al., 1995). Results from this prevalence study indicate that UI was reported by 13.1% of all women interviewed and that SUI was reportedly the most common type of UI experienced by these women. Using these results of prevalence of UI and other lower urinary tract symptoms, another investigation was conducted in 2011 which aimed to predict the worldwide and regional prevalence of a number of bladder and urinary symptoms over a number of years. Lower urinary tract symptoms, overactive bladder, UI and bladder outlet obstruction rates that were determined in the previous investigation were used to produce estimates of what these rates would be in, 2013 and 2018. The estimated prevalence of UI symptoms was found to increase by 14.4% from 2008 to 2013 in the African continent alone (Irwin et al., 2011).

To determine the prevalence of UI in women living in Eastern Turkey, Onur et al., (2009) conducted a cross-sectional study of 2275 women between the ages of 17-80years. The Turkish version of the Urogenital Distress Inventory Questionnaire-Short form (UDI-6) was used to estimate the prevalence of UI. Risk factors for the development for UI were also assessed by means of other questionnaires. Findings indicated that 46.3% of women reported some “involuntary loss of urine”, with 46% reporting SUI as compared with 43% reporting Urinary Urge Incontinence (UUI). This percentage is much higher than findings from another study conducted on women in Western Turkey which stated that approximately 25% of Turkish women suffered from UI (Kocak et al., 2005; Onur et al., 2009). Risk factors identified by Onur et al., (2009) included age, parity, difficult labour, use of instruments during labour and pelvic organ prolapse. The large sample size included subjects taken from 18 different primary health care centres making results a good representation of the general population in that region (Eastern Turkey). However, the assessment was made on subjective interviews alone without medical investigation/testing and this has been shown to yield less reliable results than if compared and backed up by physical examination or demonstration (Adanu et al., 2006).

Adanu et al., (2006) conducted a study in Ghana in which they aimed to determine the prevalence of the physical signs of stress incontinence in a sample of Ghanaian women. They started by interviewing 200 women by means of a questionnaire followed by assessing the physical finding of stress incontinence using a standard

paper towel test. The sample population had a wide age variance of 17-70 years which made for a good representation of the population. The paper towel test (PTT) has been tested for reliability and validity and has been found to be reliable in previous investigations (Neumann et al., 2004) provided that standardisation of testing procedure and instruments is maintained. The study by Adanu et al., (2006) was conducted at an ultrasound clinic because the women presenting at the clinic were required to have a "full but not uncomfortably full bladder". This bladder capacity was not measured for standardisation and women were reporting their subjective feeling of a full but not uncomfortable bladder which leaves room for wider variations as opposed to standardising the bladder volume prior to performing the PTT. Pregnant women, women with vesicovaginal fistulas and acutely ill women were excluded from the study. There was no mention in the study of the time frame in which testing occurred, apart from the interview and PTT being conducted after the ultrasound. Since the need to void increases with the amount of time the bladder is full, it would be beneficial to note the length of time for which the participants had a full bladder. Results from this study showed that 42% of the women surveyed did have a physical sign of stress incontinence and of these 42% of women, 80.7% reported at least one UI symptom in the interview (Adanu et al., 2006).

Madombwe et al., (2010) conducted a survey in South Africa to determine the prevalence of UI in Ladysmith, KwaZulu Natal. The method employed was an observational descriptive cross-sectional study over three months. Participants were women aged between 21 and 80. There were four interviewers who administered the questionnaires in the language of preference of the participants. Ninety nine women were interviewed and 35% of them reported having some form of UI. Of those expressing having experienced UI, 65.7% reported this to be SUI. Another factor brought to light by this study was that women between the ages of 41-50 years accounted for the largest proportion of women reporting UI, and this is in keeping with the aging factor being a risk for developing UI. The questionnaires used in this survey were validated by means of peer review and there was mention of intra-rater reliability but not of inter-rater reliability. The use of four interviewers could bring about discrepancies in results and for this reason the interviewers had undergone "intensive training" on how to minimise this discrepancy by means of standardised prompts and asking questions exactly as they appeared in the questionnaire (Madombwe et al., 2010). The participants were randomly chosen from the community. The region of Ladysmith, according to the authors, is a very small urban

area with few facilities for health care. This population sample may not, therefore, be comparable to a larger population within South Africa (Madombwe et al., 2010).

Two studies that reported on the incidence of urinary incontinence were discussed by Botlero et al., (2008) who reviewed Australian studies involving prevalence and incidence of UI. One of these studies reported the incidence of incontinence to have increased for each year of the follow-up period of seven years, resulting in an incidence of 46%, while the other study discussed, reported an incidence of 16.5% of stress urinary incontinence. Botlero et al., (2008) also noted that the two studies reporting incidence of UI provided evidence that UI can be transient in nature.

There are no current statistics available on the actual prevalence or incidence of UI in South Africa and not much is known about the burden of UI in this country and the effect it has on the quality of life (QOL) of sufferers.

2.5 TREATMENT

Treatment for UI can either be conservative or surgical in nature. Conservative treatment is usually considered the first line of treatment due to the low risk involved (Robert et al., 2006) and can include pelvic floor muscle exercises, functional electrical stimulation (FES); vaginal cones; mechanical devices like pessaries or bladder training. There may also be lifestyle changes, behavioural therapy, biofeedback and the pharmaceutical approach (Imamura et al., 2013)

Pelvic floor muscle exercises

Pelvic floor muscle exercises are the most commonly used means of treatment for urinary incontinence. Pelvic floor muscle exercises are often referred to as “Kegel exercises” after Arnold Kegel who documented his success in treating women with SUI while using a perineometer as a biofeedback mechanism (Kegel, 1948). In his article, Kegel (1948) explains that pelvic floor exercises can be done by drawing in the perineal region a number of times during training, and the effect of this repeated exercise was measured using a perineometer. These exercises after being shown to be effective in the treatment of UI, were adapted and practiced in many subsequent studies.

Physiotherapy plays a major role in conservative management of UI. A Cochrane review conducted in 2003 evaluated 43 randomised controlled trials to determine the effect of pelvic floor muscle exercises for women with incontinence compared with no

treatment or placebo treatment (Hay-Smith et al., 2008). Findings indicated that pelvic floor muscle exercises were more effective than no treatment. Pelvic floor muscle training (PFMT) exercises and programmes have been shown in previous studies to improve the symptoms of UI (Dumoulin et al., 2014) as well as improve the pelvic floor muscle strength (Morkved and Bo, 2000). Kegel (1948) in his study, reported that the loss of function of the pelvic floor muscles happened as a result of minor nerve damage during childbirth and that pelvic floor exercises assist in the re-innervation of affected muscles. Many studies have described different prescriptions of pelvic floor exercises, for example with regard to the repetitions and frequency. There have also been variances in the means of teaching pelvic floor exercises, such as verbal instruction or practical demonstration with or without biofeedback mechanisms. Verbal instruction has been shown to be less effective when used alone compared with additional means such as individual training, biofeedback or exercise diaries as noted by Chiarelli et al., (2003).

There have also been later studies which have evaluated the use of pelvic floor muscle exercises during pregnancy and in the postpartum period to treat UI. A systematic review conducted by the Joanna Briggs Institute in 2006 looked at six randomised controlled trials and evaluated whether PFME are effective in preventing or treating UI postpartum. Some of the aspects of these studies that were evaluated included the timing and type of the programme (number of instructions received, number of repetitions prescribed and time of the first instruction given); antenatal or postnatal instruction; frequency of exercising; details of the instruction sessions (multiple sessions and home programmes given; two instruction sessions given with home programmes and information booklet, multiple instruction sessions with a training diary and home exercise programme and weekly group programme etc.). Recommendations made from this review showed that it was more beneficial to conduct pelvic floor exercises in the antenatal and postnatal periods with at least two individual sessions and use of more than one aid in teaching would be beneficial (Joanna Briggs Institute, 2006). This finding is in agreement with those mentioned above by Chiarelli et al., (2003). Supervised pelvic floor exercises were also shown to be effective in reducing the incidence of postpartum stress incontinence in the intervention group compared with the control group in the study by Reilly et al., (2002). The participants in the intervention group of the study received supervised pelvic floor exercises by a physiotherapist on a monthly basis from 20 weeks gestation onwards, while the participants in the control group did not receive any intervention.

Some studies have used pelvic floor muscle strengthening alone while others have used co-contraction of other muscle groups to improve continence outcomes as in Sapsford et al., (2004).

Respiratory and abdominal muscle co-contraction with pelvic floor muscle exercises

The role of the pelvic floor muscles in other functions of the human body has been discussed by Sapsford et al., (2004). This means that the pelvic floor muscles while having their most commonly-known function of pelvic support and function (Corton, 2005), are also involved in less common functions that may be useful in the treatment of pelvic floor disorders (Sapsford et al., 2004).

In the study by Newmann and Gill, (2002) it was found that pelvic floor muscle activity when strong, resulted in activation of the muscles of the abdominal wall, with the Transversus Abdominus and Obturator Internus being the most active. It is interesting to note that they were unable to relax the abdominal muscles completely whilst the pelvic floor muscles were being contracted. This was measured using electromyography (EMG-surface, intra-muscular and surface vaginal EMG) and a pressure sensor and these assessments were conducted on four lean nulliparous women. The study concluded that the pelvic floor was recruited in abdominal muscle exercises as well as during increases in intra-abdominal pressure (Newmann and Gill, 2002). This information may be useful when planning an effective rehabilitation programme for women aimed at strengthening of the pelvic floor muscles, however, since the participants in the study were nulliparous and had no history of pelvic floor dysfunction it is not known what the outcomes would be for a different population of pregnant or postpartum women who have urinary incontinence.

Another study that did include women with stress urinary incontinence and the effect of re-training diaphragmatic, deep abdominal and pelvic floor muscle co-ordinated function was done by Hung et al., (2010). Their study showed that significantly more participants in the training group reported either cured or improved symptoms when compared with the control group, but the difference in the amount of urine leaked and the number of episodes of leaks was not significant between the two groups. The study concluded that retraining of diaphragmatic, deep abdominal and pelvic floor muscle co-ordinated function could improve symptoms as well as QOL in women with incontinence (Hung et al., 2010). Sapsford (2004) has outlined a programme for treating pelvic floor muscle dysfunction using “diaphragmatic breathing, tonic activation of pelvic floor muscles, muscle strengthening, functional expiratory

patterns and impact activities". This programme is aimed at using abdominal muscle action to activate tonic PFM tonic activity, then using the abdominal muscles in PFM strengthening, motor learning and impact training with the sequence in the programme only progressing once the first stage is mastered.

Another study conducted by Talasz et al., (2011) examined the physiological movements of the abdominal wall muscles using magnetic resonance imaging (MRI) on eight volunteers. Here, the abdominal muscles, pelvic floor and diaphragm are referred to as the "abdominal canister" and the relationship within this group of muscles is examined during coughing and breathing. Findings indicated that there was a synchronous movement of the diaphragm and the pelvic floor muscles during both quiet as well as forceful breathing and during coughing. This study, using MRI imaging evidence at rest and during increased abdominal pressure has shown that a relationship between the pelvic floor muscles, the abdominal wall muscles and the diaphragm exists (Talasz et al., 2011).

Looking further into the role of the pelvic floor muscles and the diaphragm, Talasz et al., (2010) tested respiratory function using spirometry and also measured PFM strength using vaginal palpation. They found that forced expiration was correlated to PFM function, in that women who had strong PFM contractions were able to exhale better. This study also included only young healthy women who were not pregnant and suggested the use of diaphragmatic training together with pelvic floor muscle exercises be included in the treatment of respiratory conditions (Talasz et al., 2010).

It is clear from the above-mentioned studies that the relationship between the PFMs, abdominal muscles and diaphragm is an important one. However, the studies listed above did not include pregnant women as their participants and it is still largely unknown if this relationship can be extrapolated to a population of pregnant women with urinary incontinence.

Medication

There are a number of drugs which may be used in the treatment of stress incontinence that control urethral tone, increase sphincteric muscle activity or increase bladder capacity as well as other effects depending on the type of drug chosen. The side effects of some of these drugs have also influenced their choice when opting for pharmacological intervention in the treatment of stress incontinence (Andersson et al., 2009). Some of the commonly used medication includes Alpha-

adrenergic agonists which induce muscle contraction, antidepressants which decrease bladder contractility, Duloxitine which suppresses bladder activity, Beta-Adrenergic antagonists and agonists have both shown some effectiveness in treating stress urinary incontinence. Hormonal therapy has also been used in the form of oestrogen as sex hormones can influence continence through oestrogen receptors in the female urinary tract as well as in the brain by means of initiation and control of urination (Rovner et al., 2004).

Behavioural/ Lifestyle changes and bladder training

These factors relate to modifications in the learned activities of daily living of women with urinary incontinence. Imamura et al., (2013) describe some of these changes as being related to adjusting fluid intake, losing excess weight or smoking cessation, but also using relaxation techniques or distraction to delay micturition. This is also mentioned by Robert et al., (2006) in their article which also recommended that a combination of lifestyle changes together with pelvic floor muscle exercises are highly effective in treating urinary incontinence.

Mechanical devices and weights

Vaginal pessaries are often used to support the urethra and prevent incontinence and have been shown to improve incontinence by 24%-50% in the studies mentioned by Robert et al., (2006). Vaginal weights or cones are devices inserted into the vagina and women are encouraged to try and keep them in place, the different weights are used as a progression of muscle strengthening (Imamura et al., 2013).

Surgery

Surgical management of urinary incontinence is usually sought after conservative management has failed or if conservative management is not possible due to the aetiology of the incontinence. With surgical management there are many options and many different approaches to management. Some of these are mentioned by Dmochowski et al., (2009) as mid-urethral taping, colporrhaphy, colposuspension, needle suspension, paravaginal repair, urethral bulking agents and sling procedures. Some of the procedures involve reconstruction of fascia or actual musculature or inserting material into the pelvic region in order to hold organs in place (Dmochowski et al., 2009).

2.6 QUALITY OF LIFE

Results from a SUI treatment study conducted in Germany over 12 months were used for the report by Tincello et al., (2009). The EQ-5D was used to determine the health-related QOL (HRQOL) of 3739 women older than 18 years who reported having SUI and who were seeking or already receiving treatment for SUI. The survey was conducted at baseline and three and six months after baseline. Results showed that pain/ discomfort was reported to be most commonly problematic in participants followed by anxiety/depression, affected mobility, problems with usual activities and lastly problems with self-care. Also, MUI had a greater reported effect on HRQOL than SUI, but co-morbidities together with UI had the greatest effect on HRQOL (Tincello et al., 2009).

Bailey et al., (2010) conducted a study at the Universitas Academic Hospital in Bloemfontein, South Africa. The study population consisted of women working at the Universitas Academic Hospital over a six month period in 2007. Participants were randomly selected and surveyed by means of a questionnaire that included both the Symptom Assessment and Quality of Life questionnaire. Of the 109 questionnaires analysed, 11.5% reported a great extent of interference with their QOL.

According to Segedi et al., (2011) UI influences the QOL of women in respect of both local complications such as skin rash and skin infections, as well as social and psychological influences. In their prospective case-control study they found that these psychosocial limitations include self-isolation, loss of self-respect and depression. UI can cause much inconvenience, embarrassment and worry for women who suffer from it (Erbil et al., 2011). Various areas of life were examined in the study by Erbil et al., (2011), and findings indicated that of all the things that affect women due to their UI, daily tasks were most affected and challenged, followed by discomfort and negative impacts on participants' sexual lives. They also listed having to isolate themselves from others in their environment as one of the problems they are faced with. In their study Howard and Steggall (2010) have also assessed the impact of UI on sexuality and QOL and have found similar correlations.

The effect on QOL of faecal and UI was assessed by Handa et al., (2007) using the SF-12 summary scores obtained from women who had participated in a previous prevalence study (Childbirth and Pelvic Symptoms study-CAPS) of UI and FI. The participants in the CAPS study were 759 primiparous women who had delivered at 37 weeks or later. A telephonic interview was conducted at six months postpartum

(PP). When compared with women without any incontinence, women with UI were found to have poorer scores in the SF-12. There were no correlations between severity of UI symptoms and scores on the SF-12 (Handa et al., 2007). When separating women with SUI, mixed urinary incontinence (MUI) and urge urinary incontinence (UUI) there were no significant differences for their corresponding SF-12 scores. The large number of participants allows for results to be generalised to the wider population and the questionnaires used were validated tools in assessing their outcomes (Handa et al., 2007).

Women who delivered in one of three maternity units between January 1994 and March 1995 were surveyed by means of a questionnaire (Dean et al., 2008). Of these 7879 women who responded to the mailed questionnaire were again surveyed after six years. This survey aimed to determine the relationship between sexual function and mode of delivery; and to investigate whether "current PFME performance and UI faecal incontinence were associated with better sexual function" (Dean et al., 2008).Results indicated that women who did have UI postpartum reported lower scores of sexual function when compared with women who did not experience UI. The large sample size of this study counts in its favour but the questionnaires used were not validated due to the non-availability of a validated questionnaire at the time of initial recruitment (Dean et al., 2008).

2.7 OUTCOME MEASURES

2.7.1 Urinary Incontinence Outcome Measures

There have been a variety of methods used in different studies to evaluate UI. These range from subjective reports by participants themselves in the form of questionnaires and surveys, to objective measures by scientific study, or both. Some of the most commonly utilised outcome measures will be discussed below.

Evaluation by trained professional

This means of evaluation is usually done by a doctor and involves visual assessment, interview and palpation (Culligan and Heit, 2000; Rett et al., 2007). These could be done by visualising the pelvic floor as the participant is asked to cough etc. Palpation involves vaginal and/ or anal palpation to assess the action of the pelvic floor muscles when asking the participant to contract them/ cough, relax etc. This is used to assess if the cause lies with pelvic floor muscle dysfunction. Guidelines set by the International Continence Society (ICS) and the International Urogynecological Association (IUGA) have detailed what the assessment may entail

(Haylen et al., 2010). Vaginal palpation with Magnetic Resonance Imaging (MRI) or Ultrasound (US) would be more reliable in the diagnosis of pelvic floor muscle dysfunction (Ghoniem et al., 2008). Evaluation was conducted by interview for the purposes of the current study as palpation with/ without MRI and US was not viable.

Voiding diary/ bladder diary

This is a written diary kept by the participants in which to record intake and output, at what time of the day they have voided and the quantity of the voiding must be measured and the same for anything drunk over a specified time period. Reliability of the voiding diary has been recorded as better when conducted for more consecutive days (two to seven), however, the increase in the number of days recorded in the bladder diary causes increased rates of non- compliance (Groutz et al., 2000). The IUGA/ICS joint report has also suggested a period of 3 days as reliable in gaining an understanding of the frequency of episodes of UI and the quantity voided (Ghoniem et al., 2008).

A problem with participants not returning their diaries has been noted by Sueppel et al., (2001) who issued bladder charts to participants in their study measuring continence outcomes with preoperative pelvic floor muscle exercises. Participants did not return their charts for assessment due to geographic reasons. Their participants had difficulty returning their charts as their follow-up appointment with the surgeon was in one building while the location required to drop off the charts was in another building on a different floor. The study took place in Iowa, USA and involved 16 male participants.

Stress test/ cough test

This is explained as filling the participant's bladder with a standardised amount of liquid and asking them to forcefully cough while in a standing position. The examiner must then be able to observe what happens during this test by means of direct visualisation of the urethral meatus (Ghoniem et al., 2008; Swift and Yoon, 1999). Loss of urine observed during the test is considered as a positive result. This test has previously been shown to be a reliable tool in the diagnosis of genuine stress urinary incontinence, but has also been shown to be most reliable when combined with other forms of bladder assessment such as cystometry (Swift and Yoon, 1999).

Pad testing

Pad testing has been used in many incontinence studies. There are either short or longer duration testing depending on the clinical setting and study design. The shorter tests can be done for 20 minutes, one hour or two hours, and longer tests can be conducted over a 24 to 48 hour period. Shorter tests can be performed during the consultation time with the assessor while longer tests have to be performed by the participant and reported on thereafter (Ghoniem et al., 2008). Pad testing has been endorsed by the ICS as a reliable tool used to quantify urine loss in incontinent women which may also assist in determining the severity of incontinence (Haylen et al., 2010). The pad tests involve filling of the bladder with a standard volume (by drinking or by catheterised fluid infusion) followed by wearing of a pre-weighed perineal sanitary pad/towel and doing either a specified set of activities (shorter tests) or usual daily tasks (as in 24-48 hour tests). Depending on the duration of tests, the pad is weighed after the activity and an increase in pad weight will indicate a positive test result if there has been significant weight gain (Haylen et al., 2010; Wijma et al., 2008). Significant weight gain has been noted to be different depending on the duration of the test and ranging from 1gram to 8grams or more (Ghoniem et al., 2008). A weight gain of 2grams has been used as an indication of a positive pad test result for the 1 hour pad test (Ghoniem et al., 2008 and Harvey et al., 2001) while 1 gram has also been reported as a positive result for 1 hour and 20 minute pad tests (Ghoniem et al., 2008, Meschia et al., 2006 and Ryhammer et al., 1999).

2.7.2 **Urodynamic Studies and Cystometry**

An extensive review of tools and outcome measures was conducted by Ghoniem et al., (2008) as part of the International Urogynecological Association's (IUGA) guidelines for research and clinical practice. Outcome measures were evaluated by means of a literature review of previous studies, gaining expert opinions, circulating findings amongst members of IUGA, reviewing feedback and reporting on final conclusions. The evaluators themselves were members of the IUGA. Urodynamic studies and cystometry evaluated included pad testing, questionnaires, cough stress test urethral hypermobility and post-void residual. Their review provided guidelines on when these tools and outcome measures would be recommended under different circumstances depending on availability of resources, time and accuracy. Cystometry was noted as the most accurate tool for evaluating the bladder with filling (Ghoniem et al., 2008).

2.7.3 **QOL Measures for Incontinence**

Questionnaires

There are many different questionnaires that have been employed in various studies to measure QOL. Some of these are general questionnaires that may be used to assess the QOL of a person suffering from any type of condition such as the Short Form 36 (SF-36). The other type is disease-specific questionnaires which focus on questions relating to a specific disease or illness. Oh and Ku (2007) compared three disease-specific questionnaires in women with stress urinary incontinence, which were the Bristol Female Lower Urinary Tract Symptoms (BFLUTS); Incontinence Quality of Life (I-QOL) and the King's Health Questionnaire (KHQ) and all of them were proven to be valid and reliable tools (Jackson et al., 1996; Kelleher et al., 1997 and Patrick et al., 1999). They included 28 women who underwent various urodynamic and urological testing followed by the QOL questionnaires. All participants were asked to complete all three questionnaires (BFLUTS, I-QOL and KHQ). An assessment was conducted using Spearman's correlation co-efficient to determine associations between the three questionnaires and findings indicated that there were many areas of each questionnaire which did not correlate with the others and hence it was reported that the population being targeted should guide the choice of questionnaire (Oh and Ku, 2007).

Another questionnaire is the SF-36 which was tested for validity and reliability by Brazier et al., (1992) and which was used together with the KHQ in the study by Reilly et al., (2002). In their study which assessed 268 primigravidae from 20 weeks gestation until birth and comparisons between the two QOL studies were made together with reported stress incontinence at three months postpartum. Results indicated that both questionnaires showed minimal impact of postpartum stress incontinence and while there were no significant differences between the two groups when the KHQ scores were compared, there was a significant difference between the groups for one part (i.e. general health) of the SF-36.

The KHQ was developed by Kelleher et al., (1997) and has been tested for validity and reliability in many different languages and has been more recently validated in the English, Afrikaans and isiXhosa languages for women with urinary incontinence in South Africa by Juul et al., (2012). Availability of the questionnaire in more than one language is useful in the South African multicultural setting with eleven official languages. Afrikaans is the third most common language in South Africa, preceded by isiXhosa as the second most common and isiZulu being the most commonly spoken home language in South Africa (Statistics SA, 2015). The interpretation of the KHQ can be complex. A summary by Hebbar et al., (2015) provided a useful

explanation of the scoring system by noting that the responses in the KHQ have a four-point rating system, the eight “domains” are scored between a zero which is the best score and 100 which is the worst score and therefore decreases in scores indicate an improvement in the QOL (Hebbar et al., 2015).

In this study, the KHQ was administered by means of telephonic interviews for those participants who could not attend follow-up assessments. Hung et al., (2010) investigated the effect of treating SUI in women using diaphragmatic, deep abdominal and PFM co-ordinated function and expressed concerns about the accuracy of self-report. While self-report may allow for an opportunity for the participant to voice their own opinion or feelings, this view is often their own perception of a situation and this perception may not be an accurate reflection of what the situation may be in reality as determined by an objective measure -such as the pad test in this study (Barker et al., 2002). Barker et al., (2002) also report that it would be advisable to supplement self-report data with something more objectively measurable to enhance the validity of the data.

2.8 CONCLUSION

From the literature it is evident that pelvic floor exercises are effective in preventing and treating urinary incontinence in pregnant women. It has also been established that the use of co-contraction of muscle groups and diaphragmatic breathing assists in pelvic function but this has not been tested to be true in pregnant women. There has been no evidence that pelvic floor muscle exercises together with diaphragmatic breathing and abdominal co-contraction can treat or prevent urinary incontinence postpartum and such a study has not been conducted in the South African setting as yet.

The next chapter presents the methodology followed to achieve the aim of this study.

CHAPTER 3

3. METHODOLOGY

3.1 INTRODUCTION

This chapter provides a detailed description of the manner in which the study was conducted. The study design, procedure employed in the study, population sample, sample size, randomisation, pilot study and data collection for the pilot study and main study as well as analysis of results are outlined below. Ethical issues and consideration will also be presented in this chapter.

3.2 STUDY DESIGN

A single blind randomized controlled trial was conducted. This study design was adopted to determine if a cause-effect relationship exists between the outcome measured and the treatment employed in the study.

3.2.1 Study Population

The study population was all pregnant women attending the antenatal clinic (ANC) at Rahima Moosa Mother and Child Hospital (RMMCH), Westbury Clinic and Crosby Clinic.

3.2.2 Sample Selection and Size

Participants were selected from women attending the antenatal clinic at RMMCH, Westbury Clinic and Crosby Clinic. All women attending the clinic on the day of assessment were screened by the researcher and/or research assistant for inclusion in the study. All women who were invited to participate in the study were literate, English-speaking and of various races (black, white, indian and coloured).

3.2.2.1 Inclusion criteria

Participants were included if they were:

- Between 20 and 28 weeks gestation.
- Currently in first, second, third or fourth pregnancy.
- Age 18-40.
- Healthy women with no medical or obstetric complications (this was determined by asking each participant about their past medical history and if they had any complications or co-morbidities such as diabetes, hypertension, asthma or chronic obstructive pulmonary disease).

- Women attending the clinic on the days that were allocated for uncomplicated pregnancies were included.
- Urinary incontinence first experienced during current pregnancy (in cases where women were in their second, third or fourth pregnancy).

3.2.2.2 **Exclusion criteria**

Participants were excluded if they had:

- Uterine, vaginal or rectal prolapse.
- Co-morbidities (as listed in determining a healthy woman in the inclusion criteria).
- Existing neurological conditions e.g. stroke, traumatic and atraumatic spinal injury, paralysis, cauda equina signs.
- Previous urogynaecological surgery as this may have affected the pelvic floor muscles and connective tissue.
- Diagnosed current or recurrent cystitis, vulvovaginitis or urinary tract infection.

3.2.3 **Sample Size Determination**

A sample size of 52 participants (n=52), was calculated using a sample size calculator. Effect size, as obtained from a review of the literature (Ghoniem et al., 2008 and Harvey et al., 2001) was calculated as being two grams (of urine leaked) with a standard deviation of two, power of 90% and allowing for non-compliance and dropouts of 15% each. The number of participants calculated per group was 26.

3.2.4 **Randomisation**

Participants were randomised into either a control or an intervention group by means of computer-generated number randomisation (Appendix H). This was done by the research assistant who printed the group allocation, cut into squares and placed each square into an envelope which was sealed. Each envelope was numbered for each participant accordingly. The envelopes were kept in the possession of the research assistant, ensuring concealed allocation of participants.

3.2.5 **Blinding**

The researcher was blinded to group allocation but the research assistant and participants were not (see 3.5.4.2 for further explanation on how blinding was achieved).

3.3 STUDY VARIABLES AND INSTRUMENTATION

3.3.1 Independent Variable

The independent variable in this study was:

1. The type of exercises done (i.e. Pelvic floor muscle strengthening exercises alone or pelvic floor exercises with abdominal co-contraction and diaphragmatic breathing).

3.3.2 Dependent Variables

The two dependent variables were:

1. Amount of urine leaked (measured by the pad test).
2. Quality of life (which was measured by means of the KHQ).

3.3.3 Measuring Instruments

- Demographic questionnaire (Appendix E)
- This self-developed questionnaire contains participant information about their lifestyle, birthing history of last birth and contact details.
- Modified 20 minute Pad test (Appendix D)
- The King's Health Questionnaire (KHQ-Appendix C)

Table 3.1: Measuring Instruments

Study Instrument	Outcome Variables Tested	Tool/Procedures
King's Health Questionnaire	Quality of life	The KHQ is specific to stress incontinence and overactive bladder. It is used to determine the patient's QOL in relation to their bladder symptoms. This questionnaire has been used in South Africa, and has been translated into English as well as Afrikaans and isiXhosa for South Africa. The KHQ is divided into nine sections: 1. General Health Perceptions 2. Incontinence Impact 3. Role Limitations 4. Physical Limitations 5. Social Limitations 6. Personal Relationships 7. Emotions 8. Sleep/ Energy 9. Severity Measures Calculation of scores can be found together with the questionnaire in Appendix C

Study Instrument	Outcome Variables Tested	Tool/Procedures
Modified 20 minute Pad Test	Amount of urine leaked in grams (Stress incontinence)	As per the International Continence Society: This test is used to measure the amount of urine lost under standard pre-set conditions. The 20-min modified pad test was used by Wu et al. (2008) and the bladder was filled transurethrally with 250ml of water. Participants are not required to void completely for this test but for the purposes of this study they were asked to void before the test to standardize the bladder volume as far as possible at baseline and were asked to drink 250ml of water instead of bladder infusion. After completion of the exercises (see Appendix D), the pad was then weighed and the net weight was calculated by subtracting from the original dry weight to achieve a measure of the total urine loss during the 20 min exercise. The pad weight was measured in grams. A positive pad weight result was defined as more than 1 g of leakage and the accuracy of the scale was 0. 1 g. Due to the population of this study being pregnant women during their second or third trimester, they were asked to sit-to-stand 10 times (as in the 1hour pad test) instead of jumping up and down 10 times. To measure the weight of the pad an NHB600 Electronics Balance Scale was used

3.4 PILOT STUDY

3.4.1 Introduction

Six participants were recruited for the pilot study which accounted for 10% of the number of participants in the main study. All participants were selected from women attending RMMCH antenatal clinic over two days. Those who met the inclusion criteria and agreed to participate were given a basic educational talk and asked to complete the KHQ followed by the 1 hour Pad test and then complete the KHQ again. (See Appendix N for a full report on objectives, procedure and results of the pilot study)

3.4.2 Implications for the Main Study

Participants were unable to walk continuously for 30 minutes. Due to being at 24- 28 weeks gestation, they were too tired and unable to walk for the entire duration. Out of the six participants, only two walked for 20 minutes before stopping, the remaining four had to stop before 15 minutes had passed.

None of the participants were able to run on the spot for one minute. They reported being too tired and unable to stand any longer. For this reason, the 1 hour pad test was substituted for a modified 20minute pad test instead. The 20 minute pad test was then modified to make it suitable for pregnant women by reducing the length of time of the test; walking for a shorter period and adding bearing down for 10 counts instead.

3.5 MAIN STUDY INTERVENTION

3.5.1 Introduction

In this section the procedure for the interventions carried out will be outlined.

3.5.2 Training of a Research Assistant (RA)

In order to ensure that the researcher was blinded to group allocation a research assistant (RA) was appointed. The RA was a physiotherapist who had been working in the public sector for three years. Training of the RA involved the RA sitting in on a treatment session in which the researcher taught pelvic floor muscle exercises to a patient at RMMCH. This was followed by a training session where the RA was given information on the female pelvic floor system, including the mechanisms of continence and means of pelvic floor rehabilitation. The RA was also given written material on the guidelines of pelvic floor muscle strengthening as well as information on how to teach participants how to isolate and activate the pelvic floor muscles as well the Transversus Abdominus muscles (Appendix K). The information included the method used to teach participants diaphragmatic breathing. The RA was then given the opportunity to put the information given, into practice by teaching the methods discussed, to women attending the clinic prior to the commencement of the study under the supervision of the researcher. The RA was also familiarised with the questionnaires, information sheets, consent forms and data collection sheets. The RA requested to withdraw from her duties during the course of the data collection period as she was on maternity leave. Prior to her leaving she had a training session with the new RA to explain what was required and she handed the information over

to the new RA who was trained by the researcher in the same way as the first RA. Training was completed before data collection continued further.

3.5.3 Current Operation for Antenatal Care at the Clinic

The usual operation of the ANC at RMMCH hospital entails baseline assessments of all the women who attend the clinic on each visit. These assessments include weight, height, blood pressure, heart rate and urine dipstick tests. Each attendee is given a number and is placed in a seated queue to wait for the gynaecologists to arrive. While waiting they are given a group education and brief exercise session (see table below) by one of the nurses allocated to this duty for that day. The interventions at the clinic were as follows:

Table 3.2: Intervention Taking Place at the ANC at RMMCH

Intervention	Procedure
Educational talk	▪ Risk factors and emergency procedure (outlining steps to follow in case of suspected early labour, bleeding etc.) ▪ Birthing techniques ▪ Breastfeeding ▪ First feeds and weaning ▪ Baby care (bathing, massage, oral care etc.) No mention of pelvic floor muscles and incontinence is made during the talk.
Group exercises	▪ Circulatory exercises ▪ Breast pumping and massage ▪ Stretches (arms and legs) ▪ Deep breathing ▪ Marching on the spot ▪ Pelvic tilts No exercises for pelvic floor muscle strengthening were taught

3.5.4 Procedure for Data Collection in the Main Study

3.5.4.1 Planning of data collection procedure

Rahima Moosa Mother and Child Hospital: An appointment was scheduled with the nurse in charge of running the ANC at RMMCH. Discussions were held to determine which days and times the antenatal classes are run and which days would yield a high number of women who fit the inclusion criteria. It was determined that although the ANC was being run from Monday to Friday each week, women attending the clinic on Wednesdays and Thursdays were most likely to fit the inclusion criteria as

they had no known co-morbidities such as hypertension, diabetes or risky pregnancies.

CROSBY CLINIC and WESTBURY CLINIC: Due to difficulty in obtaining participants, two additional centres were used for data collection with permission from Gauteng Health (see Appendix J). The procedure employed for data collection was exactly the same as for RMMCH.

3.5.4.2 **Data collection procedure**

The researcher and RA then attended the ANC each Wednesday, Thursday and Friday morning between 7:30 and 9:00 to screen women attending the clinic. All women present at the clinic on the day of assessment were checked against the inclusion and exclusion criteria. The RA taught pelvic floor exercises to the women attending the clinic who did not participate in the study while they waited to be seen by the clinic staff as this was not done by the clinic sisters as part of the antenatal education mentioned above and after this was done the RA joined the researcher in a private room. In order to maintain privacy, women who were between 20-30 weeks pregnant were interviewed privately and those participants who fitted the inclusion criteria were offered the opportunity to participate in the study. Those who chose to participate were given an information sheet (Appendix A) and asked to sign informed consent (Appendix B). They were also requested to provide some information about their history and lifestyle (Appendix E) and the following procedure was adopted for each session with participants:

1. <u>King's Health Questionnaire</u>

   The KHQ (Appendix C) was completed with the assistance of the researcher/ assistant (as explained in 2.3.1) Personal details and hospital and/or file numbers were all recorded separately (Appendix E: Participant particulars).

2. <u>Educational talk</u>

   The research assistant gave participants an educational talk on the structure and function of the pelvic floor, mechanisms of continence, bladder training and the method of performing Kegel exercises (Appendix L). Participants were advised to perform a home exercise programme comprising of eight to ten fast and slow pelvic floor contractions ten times a day

3. <u>Pad test</u>

Next, a baseline modified 20 minute pad test was performed by the researcher (see 3.3.3) and results were captured on a data collection form (Appendix F) which was separate for each participant. Subsequent assessment findings were all captured on the same form for each participant (see 3.3 below for details on subsequent assessments).

4. Group allocation

At this time the research assistant drew the envelope corresponding to the participant code and according to the group number inside the envelope (determined by computer-generated allocation) allocated the participant to the relevant group i.e. control or intervention.

5. Pelvic floor exercises

After the pad test, the researcher left the examination room and the assistant spent the rest of the time with the participants teaching them the method of performing the pelvic floor exercises so that all women attending the clinic received this information. The participants in the control group then left the room after this and the research assistant spent the rest of the session teaching the participants in the intervention group the additional exercises while the researcher was still not present.

6. Description of intervention exercises

Table 3.3: Description of Intervention Exercises

Intervention	Group	Frequency/Repetitions	Procedure
1. Educational talk	Control and intervention	At baseline	Description of the structure and function of the pelvic floor, mechanisms of continence, bladder training and the method of performing Kegel exercises (Appendix L).
2. Pelvic floor muscle exercises	Control and intervention	6 slow contractions and three fast contractions 10 times daily	Participants were advised to perform a home exercise programme comprising of fast and slow pelvic floor contractions ten times a day (Appendix A). Dosage of exercises was determined from the systematic review by Hay-Smith et al., (2008).
3. Abdominal activation and co-contraction	Intervention	Co-contraction with pelvic floor muscles as above	Participants in the intervention group were taught the correct breathing technique by palpation as well as co-contraction of the abdominal muscles (specifically transversus abdominus muscle) while doing pelvic floor exercises. Abdominal co-contraction was initiated by instructing the participant to place her fingers

Intervention	Group	Frequency/Repetitions	Procedure
			approximately 2cm inwards and downwards from the pelvic bones (hip bone) and to feel for a tensing of the muscle while trying to bring the lower abdomen close to the spine (Neumann and Gill, 2002). The contraction can also be felt by making an "sss" sound while feeling for the contraction in the same place. (Appendix A)
4. Diaphragmatic breathing	Intervention	With pelvic floor exercises as above	To teach diaphragmatic breathing participants were asked to breathe by allowing the belly to expand outwards. Participants practiced diaphragmatic breathing while holding an abdominal muscle contraction. Once this could be performed they were asked to contract the pelvic floor together with the abdominal muscles while breathing with the diaphragm (Appendix A).
5. Telephonic follow-up	Intervention	Fortnightly from the baseline assessment (which occurred between 20-28 weeks gestation) until the follow-up assessment at eight weeks postpartum	The research assistant conducted these calls to participants to remind them to do their exercises, mark the exercise diary as well as add in progressions to include sustained contractions with a six to eight second hold between contractions one month after initial assessment. (Appendix M)
6. Exercise diary	Intervention	From baseline assessment to follow-up assessment at eight weeks postpartum	Participants in the intervention group received an exercise diary (Appendix G, see attached) in which they were asked to record having done the exercises, the number of repetitions and the number of episodes of urine leakage. These participants also received a telephone call from the research assistant every fortnight from the baseline assessment to remind them to do the prescribed exercises (Appendix M).

All participants in both groups were contacted telephonically to make a follow-up appointment from eight weeks postpartum. At this follow-up assessment, all participants from both groups were assessed by the researcher using the KHQ and the pad test. Information was also collected about the mechanism of delivery (caesarean section or normal vaginal delivery); the birth weight of the baby; whether an episiotomy was done or not and the gestational age at birth. Data were collated and statistically analysed.

7. <u>Follow-up assessment</u>

Efforts were made to follow-up on participants by first contacting them telephonically. Some agreed to come and did arrive and some agreed to come but did not arrive on

the day of the assessment. For those who did not arrive at the appointed time and those who could not return for their follow-up assessments the following procedure was followed:

1. They were again contacted using the telephone numbers supplied at baseline, at different times of the day and from different telephone numbers every 2-3 days for a month.

2. They were offered transport money if they could not afford to come for the assessments.
3. Those who were contacted telephonically but who expressed not being able to attend a follow-up assessment (due to work or having relocated or other personal commitments) were interviewed telephonically where birth history was obtained and the KHQ was administered.

4. Using the address supplied at baseline, the researcher and research assistant embarked on home visits in an attempt to locate the participants, some were located and assessments completed, but most could not be located as they had either relocated with no forwarding address or the addresses supplied were incorrect.

3.6 ETHICAL CONSIDERATIONS AND CLEARANCE

3.6.1 Ethical clearance was obtained from the Human Research Ethics Committee (HREC) of the University of the Witwatersrand (registration number: M111109 (Appendix I)).

3.6.2 Permission was also sought from RMMCH and the Gauteng provincial health authority and facilities where the study took place (Appendix J)

3.7 DATA ANALYSIS

3.7.1 Introduction

Each participant was given a unique identifying code number to enable easy identification of each participant on their questionnaires and data collection forms. All raw data were recorded on these prepared assessment forms and questionnaires and logged using a prepared Excel software spreadsheet. The data logged into the Excel programme were analysed using SPSS. The statistical tests used to analyse these data are summarised in the table below:

Table 3.4: Statistical Tests

Dependent Variable	Instrument Used	Variable being Analyzed	Test
Quality of life	KHQ	Difference in the mean change in the quality of life scores between groups	Two-sample t-test
Amount of urine leaked	Pad test	Differences in the mean change in the amount of urine leaked in the pad test between groups	Wilcoxon's Rank Sum Test

To determine correlations between variables, the Kendall's Tau Correlation Coefficient and Spearman's Rank Correlation Coefficient were used. Demographic information was analysed using logistic regressions.

All data obtained were stored in files. The participant particulars and group allocation were captured on a separate form for each participant and this was stored in a file together with the consent forms which was kept by the research assistant (Appendix B).

The next chapter presents the findings of this study.

CHAPTER 4

4. RESULTS

4.1 INTRODUCTION

The results of the data collected during the study will be presented in this chapter. The aim of the study was to determine the effect of an antenatal exercise programme including diaphragmatic breathing with co-contraction of abdominal and pelvic floor muscles on urinary incontinence postpartum. Results will be reported on as they relate to the aim and objectives of this study as follows:

1. To determine the influence of urinary incontinence on the prepartum quality of life (QOL) of pregnant women.

2. To establish the effect of antenatal co-contraction of pelvic floor and abdominal muscle exercises with diaphragmatic breathing on the amount of urine lost under stress.

3. To establish the effect of antenatal pelvic floor muscle exercises without diaphragmatic breathing and abdominal muscle co-contraction on the amount of urine lost under stress.

4. To determine the influence of urinary incontinence on QOL of pregnant women after the intervention.

5. To compare the effects of the two exercise programmes on urinary incontinence and QOL of pregnant women postpartum.

Demographic information of study participants as well as reasons for withdrawal and loss to follow-up will be included in the results.

4.2 DESCRIPTION OF STUDY PARTICIPANTS

Below is a flow diagram of the study participants using the consolidated standards of reporting trials (CONSORT) as discussed by Schulz et al., (2010), showing the changes in the numbers of participants over time.

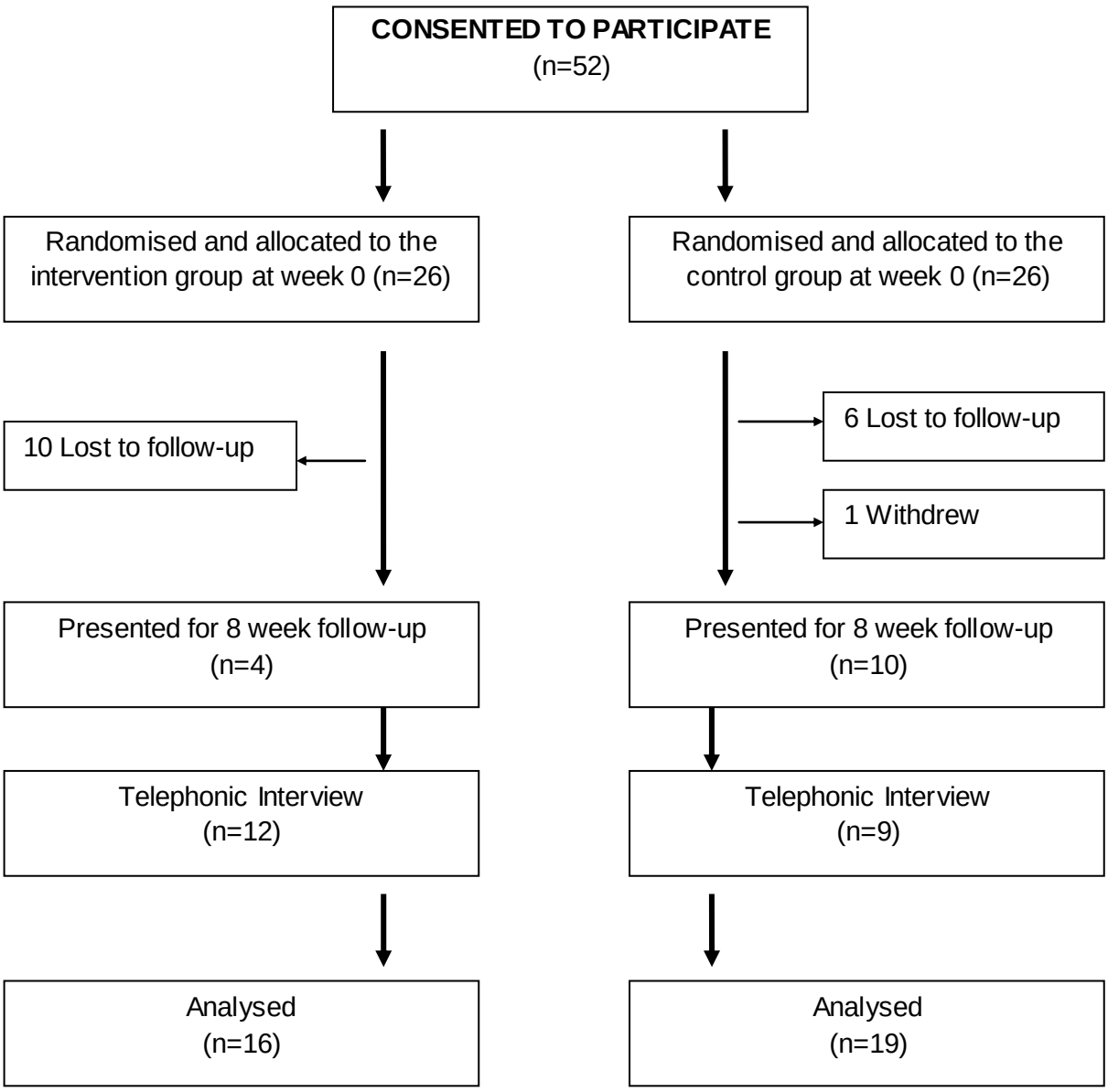

Figure 4.1: Flow of Participants in The Main Study Showing Loss to Follow-Up

At baseline, 52 participants agreed to participate and were randomised into the control group (n=26) and the intervention group (n=26). One participant who had been allocated to the control group withdrew from the study and six others in the control group were lost to follow-up (n=19). Ten participants from the intervention group were also lost to follow-up (n=16). Twenty one participants could not return for the follow-up pad tests and follow-up telephonic interviews were held with these participants from both the control group (n=9) and the intervention group (n=12), hence there was a dropout rate of 33%. Reasons for withdrawal and loss to follow-up are presented in Table 4.1 below:

Table 4.1: Reasons for Withdrawal and Loss to Follow-Up

Reason	n= 17	Specific reasons expressed
Withdrew	1	Did not want to participate any longer
Unable to contact via telephone after baseline assessments	10	Cellular phone numbers given are either: i. Incorrect ii. Not available iii. No answer
Relocated to another province/ country	4	Relocated to Zimbabwe n=2 Relocated to another province n=1 Relocated with no forwarding address and incorrect telephone numbers n=1
Appointment confirmed but did not arrive for follow-up appointments and could not be contacted thereafter by telephone/ home visit	2	Could not contact participant again via telephone nor by home visit after their missed appointment

4.3 DEMOGRAPHIC INFORMATION

Demographic data were collected from participants at baseline. This data is presented in Table 4.2 below for each of the 52 participants.

Table 4.2: Demographic Information

Characteristic	Control group (n=26); n (%)	Intervention group (n=26); n (%)
Age		
≤20 years	3 (12)	2 (8)
21-30 years	14 (54)	17 (65)
31-40 years	9 (35)	7 (27)
Body mass index (BMI)		
18-30	17 (65)	18 (69)
31-40	7 (27)	5 (19)
>40	0	1 (4)
Fitness Score		
Exercise daily	6 (23)	4 (15)
Exercise weekly	4 (15)	5 (19)
Never exercise	16 (62)	17 (65)
Smoker status		
Smoker	6 (23)	4 (15)
Non-smoker	19 (73)	22 (85)

Characteristic	Control group (n=26); n (%)	Intervention group (n=26); n (%)
Trimester		
2nd trimester	17 (65)	11 (42)
3rd trimester	9 (35)	15 (58)
Duration of symptoms (reported experience of urinary incontinence)		
<1 month	8 (31)	6 (12)
1-2 months	10 (38)	12 (46)
2-3 months	6 (23)	5 (19)
> 3 months	2 (8)	3 (12)
Parity (number of previous births)		
Primiparous	8 (31)	10 (38)
2-3 previous births	15 (58)	13 (50)
4 or more previous births	0	0
Multiple pregnancies? (i.e. twin pregnancy)		
Yes	3 (12)	1 (4)
No	23 (88)	25 (96)

Sixty percent (n= 31) of participants were between the ages of 21 and 30 years. Most participants (54%) were in their second trimester of pregnancy (n=28) and most (42%, n=22) were experiencing symptoms of UI for 1-2 months.

Results of the data analysed will now be presented as they relate to each of the study's objectives.

4.4 THE INFLUENCE OF UI ON QOL PRE- AND POSTPARTUM

Urinary incontinence was measured by the pad test and the stress incontinence score while QOL was measured using the King's Health Questionnaire (KHQ). Results will be compared for each of the three parts of the KHQ which are divided as follows:

- Part 1: General health perceptions and incontinence impact
- Part 2: Role limitations; physical limitations; social limitations; personal relationships; emotions; sleep/energy and severity measures.
- Part 3: Effect grading

A score closer to zero is interpreted as a better quality of life.

Differences in scores between the control group and the intervention group will be presented for the KHQ scores first followed by further analysis to test correlations between the KHQ scores and pad test scores and stress incontinence rating.

The KHQ scores were compared between groups at baseline using two-sample t-tests. These results are presented below for each part of the KHQ. The method of determining scores for the KHQ can be found in Appendix C.

Table 4.3: Difference in the Scores for Each Part of the KHQ at Baseline between the Control Group and the Intervention Group (n=52)

KHQ	Group	Mean	SD	p value
PART 1	Control n=26	84.62	37.39	0.31
	Intervention n=26	79.17	39.67	
PART 2	Control n=23	223.91	162.72	0.33
	Intervention n=21	244.58	136.03	
PART 3	Control n=25	12.48	4.48	0.46
	Intervention n=26	12.58	3.07	

From the data presented above, there was no significant difference between the control group and the intervention group for any part of the KHQ before the intervention. From the scores in both groups, it is evident that quality of life was negatively affected by incontinence due to the mean values being more than zero, especially for Part 2 in both groups.

To determine the effect of the two exercise programmes on QOL at the follow-up assessment, the results of the KHQ were tested for differences between the intervention and the control group using the two-sample t test and results are presented in Table 4.4.

Table 4.4: Differences in the KHQ Scores (Per Part) at Follow-Up between the Control and the Intervention Group (n= 33)

KHQ	Group (n=33)	Mean	SD	p value
PART 1	Control n=18	29.63	30.55	0.35
	Intervention n=15	33.89	31.88	
PART 2	Control n=14	34.13	54.00	0.09
	Intervention n=7	4.76	12.60	
PART 3	Control n=18	2.89	4.95	0.18
	Intervention n=15	1.47	3.64	

These values are an indication of scores obtained from the KHQ administered at a follow-up appointment or via telephonic interview in cases where subjects were unable to physically attend appointments. There were no significant differences when the scores were compared between the control group and the intervention group for each section. The mean scores were similar between groups for part one and part three but not for part two where the difference was considerable but did not reach a significant difference. The mean values are far less than the mean values at baseline, indicating an improvement in quality of life.

4.5 PAD TEST RESULTS

The effect of antenatal co-contraction of pelvic floor and abdominal muscle exercises with diaphragmatic breathing on the amount of urine lost under stress was measured by the pad test results at the follow-up assessment for participants in the intervention group.

Table 4.5: Pad Test Results at Baseline (measured in grams) for all Participants (n=52)

Urine loss in grams	Number of participants n=52 n (%)	Mean (urine loss in grams) per group	Overall mean (urine loss in grams)
0	1 (0.02)	0	2.6
0.1-0.5	35 (67.3)	0.3	
0.6-1.0	7 (13.46)	0.8	
1.1-1.5	1 (0.02)	1.5	
1.6-2	1 (0.02)	1.9	
2.1-2.5	4 (7.69)	2.2	
>2.5	3 (5.77)	11.5	

Most participants had lost 0.1-0.5 g of urine in the pad test (n=35) and the overall mean for participants at baseline was a loss of 2.6g of urine.

In Table 4.6 the actual amount of urine lost in the pad test is presented at baseline and at the follow-up assessment only for the participants who performed the follow-up assessment in order to compare the change in baseline and follow-up assessments.

Table 4.6: Change in Pad Test Results from Baseline to Follow-Up for all Participants who Conducted Follow-Up Pad Tests (n=14)

Baseline pad test results (n=14)	Mean at baseline	Follow-up pad test results (n=14)	Mean at follow-up	Group	Number of improved results n (%)	Number of unchanged results n (%)	Number of deteriorated results n (%)
0.3g	0.9g	0g	1.7g	Control group (n= 10)	7 (70)	2 (20)	1 (10)
0.1g		0.1g					
0.2g		0.1g					
17.3g		9.5g					
0.4g		0.2g					
0.3g		0.3g					
0.5g		0.2g					
0.4g		0g					
0.6g		0.3g					
2.4g		6.2g					
1g	1.0g	0.1g	0.4g	Intervention group (n= 4)	2 (50)	0 (0)	2 (50)
2.2g		0g					
0.8g		1.2g					
0.1g		0.4g					
	1.9g		**2.1g**		**9 (64.3)**	**2 (14.3)**	**3 (21.4)**

Table 4.6 shows that follow-up pad test results had improved in 70% (n=7) of participants in the control group who performed follow-up pad test assessments. In the intervention group, there were only four participants who arrived for the follow-up assessments and two participants improved in their pad test results while the other two had declined. Out of these 14 participants, there were two whose results had remained unchanged from baseline to follow-up. The mean amount of urine lost at baseline was 1.9g while at follow-up this had increased to 2.1g for those participants who had arrived for their follow-up assessments

Table 4.7: Difference in the Pad Test Results at Follow-Up for the Control Group Compared with the Intervention Group (n=14)

	Group	Mean	SD	p value
Pad Test Result	Control n=10	1.69	3.34	1.00
	Intervention n=4	0.42	0.54	

Results above do not show any significant differences in the pad test results at the follow-up assessment between the control and the intervention group.

Table 4.8 presents the results of correlations of stress incontinence (using the pad test results) and QOL using the KHQ. The values were obtained using the Kendall's Tau correlation coefficient.

Table 4.8: Correlation between Baseline Pad Test Results with Baseline KHQ Scores (Per Part) for both the Control and Intervention Groups (n=52)

	Control Group (n=26)		Intervention Group (n=26)	
	Correlation Co-efficient	**p value**	**Correlation Co-efficient**	**p value**
KHQ: Part 1 Score	-0.11 (n=26)	0.46	0.12 (n=26)	0.37
KHQ: Part 2 Score	-0.09 (n=23)	0.57	0.24 (n=21)	0.13
KHQ: Part 3 Score	-0.06 (n=25)	0.67	0.34 (n=26)	**0.01**

There was an inverse relationship with very weak correlations and no significant values between the pad test results and the mean score in part one, two and three of the KHQ in the control group. In the intervention group there was a weak but significant correlation between the baseline pad test results and the KHQ score in part three (p=0.01) (which measures how much participants are affected by incontinence).

In order to determine the difference in correlation post intervention of stress incontinence on QOL at follow-up, the data for follow-up pad test results as well as follow-up stress incontinence scores were assessed for correlation with follow-up KHQ scores using the Kendall's Tau Correlation Coefficient. The results are presented in Table 4.9.

Table 4.9: Correlation between Pad Test Results at Follow-Up and KHQ Scores (Per Part) at Follow-Up for the Control Group (n=8) and the Intervention group (n=4)

	Control Group (n=8)		Intervention Group (n=4)	
	Correlation Co-efficient	**p value**	**Correlation Co-efficient**	**p value**
KHQ: Part 1 Score	0.00 (n=8)	1.00	0.83 (n=4)	0.13
KHQ: Part 2 Score	0.17 (n=4)	1.00	-	-
KHQ: Part 3 Score	0.18 (n=8)	0.38	0.83 (n=4)	0.15

In the control group there was no correlation between the two variables for part one in the control group and very weak correlations for part two and three of the KHQ in the control group, while there was a non-significant strong positive correlation between part one and three of the KHQ and the pad test results in the intervention group. (Missing data: n=4 for Part 2)

4.6 STRESS INCONTINENCE SCORES

Table 4.10: Stress Incontinence at Baseline in both Intervention (n=25) and Control (n=26) groups

Stress Incontinence Scores	n=51 n (%)	Control Group n=26	Intervention Group n=25	P Value
”0”- Not Applicable	1 (2)	1 (3.9)	0 (0)	1
“1”- A little	49 (96.1)	3 (16.7)	24 (96)	
“2”- Moderately	1 (2)	0 (0)	1 (4)	
“3”- A lot	0 (0)	0 (0)	0 (0)	

Stress incontinence was checked for correlation with QOL at baseline using the stress incontinence scores presented above. The Spearman’s Rank Correlation Coefficient was used for testing correlation and results are presented below

Table 4.11: Correlation between Stress Incontinence and KHQ Scores Per Part for Both, the Control (n=26) and Intervention Group (n=26) at Baseline

	Control Group (n=26)		Intervention Group (n=26)	
	Correlation Co-efficient	**p value**	**Correlation Co-efficient**	**p value**
KHQ: Part 1 Score	-0.08 (n=26)	0.70	0.15 (n=25)	0.49
KHQ: Part 2 Score	-0.16 (n=23)	0.46	0.30 (n=21)	0.19
KHQ: Part 3 Score	0.31 (n=25)	0.13	0.29 (n=25)	0.17

Results for both groups indicated at baseline there were varying degrees of poor correlation when comparing stress incontinence with each part of the KHQ. In the control group there was a weak negative correlation between stress incontinence and part one and part two of the KHQ that were non-significant. There was a non-significant weak positive correlation between stress incontinence and all parts of the KHQ in the intervention group. Some participants had left some questions blank and therefore the number of responses for various parts was less than the total number of participants.

Table 4.12: Correlation between Follow-Up Stress Incontinence Scores and Follow-Up QOL (KHQ scores per part) in the Control Group (n=14) and the Intervention Group (n=12)

	Control Group (n=14)		Intervention Group (n=12)	
	Correlation Co-efficient	**p value**	**Correlation Co-efficient**	**p value**
KHQ: Part 1 Score	0.30 (n=14)	**0.03**	0.35 (n=12)	**0.03**
KHQ: Part 2 Score	0.16 (n=10)	0.27	0.50 (n=4)	0.25
KHQ: Part 3 Score	0.33 (n=14)	**0.02**	0.36 (n=12)	**0.01**

Results show positive correlations between stress incontinence and the KHQ scores for all parts, however the correlations are all weak - in part one and part three the correlations are significant for both groups. Part two of the KHQ in the intervention group had a moderate non-significant correlation.

4.7 THE INFLUENCE OF SUI ON QOL OF ALL PARTICIPANTS AT FOLLOW-UP

Table 4.13 outlines the results for stress incontinence for both groups at follow-up.

Table 4.13: Stress Incontinence at Follow-Up in both Intervention (n=15) and Control (n=18) groups

Stress Incontinence Scores	n=33 n (%)	Control Group n=18	Intervention Group n=15	P Value
”0”- Not Applicable	27 (81.8)	15 (83.3)	12 (80)	0.58
“1”- A little	6 (18.2)	3 (16.7)	3 (20)	
“2”- Moderately	0 (0)	0 (0)	0 (0)	
“3”- A lot	0 (0)	0 (0)	0 (0)	

At follow-up most participants (81.8% of all participants) said stress incontinence was no longer applicable to them while the rest of the participants (18.2%) said stress incontinence affected them “a little”. None of the participants scored “2” (moderate) or “3” (a lot) at follow-up. There was no significant difference between stress incontinence per group.

4.8 RELATIONSHIP BETWEEN SUI AND QOL SCORES BETWEEN THE TWO GROUPS AT FOLLOW-UP

Table 4.14 presents the number and percentage of participants experiencing stress incontinence for the control group and the intervention group at baseline and at follow-up. These numbers were used to determine correlations between stress incontinence at follow-up in the control group and stress incontinence at follow-up in the intervention group.

Table 4.14: Comparison of Participants with Stress Incontinence at Baseline and at Follow-Up Assessment (n=52)

Participants Experiencing Stress Incontinence	Baseline		Total at Baseline	Follow-up		Total at Follow-Up
	Control Group n= 26(%)	Intervention Group n=26 (%)	n= 52 (%) baseline	Control Group n= 19 (%)	Intervention Group n= 16 (%)	n= 35 (%) follow-up
Yes	25 (96)	26 (100)	51 (98)	4 (21)	3 (19)	7 (20)
No	1 (4)	0	1 (2)	15 (79)	13 (81)	28 (80)

From the table above 98% of participants reporting having experienced stress incontinence from both the intervention group and the control group combined, had reduced to only 20% of participants reporting having experienced stress incontinence at the time of the follow-up assessment for the combined group.

The Kendall's Tau Correlation Coefficient was used to measure the association between stress incontinence scores and QOL for the combined group at the follow-up assessment which is presented in Table 4.15 below:

Table 4.15: Correlation between Stress Incontinence and QOL (KHQ Scores) for all Participants during the Follow-Up Assessment

QOL SCORES	Correlation Co-efficient	P Value
KHQ: Part 1 Score	0.31 (n=26)	**0.00**
KHQ: Part 2 Score	0.15 (n=14)	0.19
KHQ: Part 3 Score	0.32 (n=26)	**0.00**

Results for the combined group at follow-up showed only a weak significant correlation for part one and three of the KHQ but a weak non-significant correlation for part two when compared with the stress incontinence score in the combined group.

The effects of the two exercise programmes on stress incontinence and QOL after intervention was assessed next using a Two-sample Wilcoxon rank-sum test. Here, the pad test results were used to measure the difference in stress incontinence scores between groups, while the KHQ was used as a measure of QOL. Results for the pad test after intervention was presented in Table 4.7 while the results for the difference in KHQ scores between groups at follow-up was presented in Table 4.4 above.

4.9 RELATIONSHIP BETWEEN DEMOGRAPHIC INFORMATION, STRESS INCONTINENCE AND QOL

Demographic information (age, stage of pregnancy, Body Mass Index (BMI), smoker/ non-smoker, duration of symptoms, multiple pregnancy and parity) and birth history (gestational age, birth weight, mode of delivery and episiotomy/no episiotomy) which was obtained from participants were tested for the relationship with stress

incontinence and QOL in order to determine if there were any significant correlations between the variables mentioned by means of a logistic regression analysis.

Table 4.16: Association between Demographic Variables and Pad Test Results at Follow-Up

Variable	Categories	Odds Ratio	(95% Confidence Interval)	Standard Error	P Value
Age (18- 30 years old)	31- 40 years old	0.82	(0.05 – 12.96)	1.16	0.89
Duration of symptoms (less than one month)	1-2 months	1.46	(0.08 – 26.55)	2.16	0.80
Parity (1 previous child)	2 previous children	0.52	(0.02 – 11.68)	0.82	0.68
	3 previous children	2.81	(0.07 – 108.40)	5.23	0.58
Stage of pregnancy (20- 24 weeks)	25 – 40 weeks	0.29	(0.19 – 4.24)	0.39	0.36

There was no significant likelihood of demographic variables being a predictor of a positive pad test result at follow-up. Data were not included for BMI; smoking status or multiple pregnancy as there were no participants in some of the categories for these variables and hence data could not be tested.

Table 4.17 shows the relationship between demographic variables age; stage of pregnancy; BMI; smoker/non-smoker; duration of symptoms; multiple pregnancy; parity and stress incontinence.

Table 4.17: Relationship between Demographic Variables and Stress Incontinence at Follow-Up

Variable	Category	Odds Ratio	(95% Confidence Interval)	Standard Error	P Value
Age (18-31)	31- 40 years old	2.35	(0.36 – 15.24)	2.24	0.37
BMI* (18-31)	31- 40	0.59	(0.05 – 6.80)	0.74	0.68
Duration of symptoms ** (less than one month)	1-2 months	1.29	(0.16 – 10.69)	1.39	0.82
	3-4 months	1.09	(0.08 – 14.88)	1.45	0.95
Parity (1 previous child)	2 children	0.18	(0.12 – 2.02)	0.20	0.16
	3 previous children	0.64	(0.04 – 9.36)	0.88	0.75
Stage of pregnancy (20-24 weeks)	25- 40 weeks	1.66	(0.19 – 14.42)	1.83	0.64

There was no association between any of the demographic variables and stress incontinence at follow-up. Some data could not be compared as there were some

participants who reported having no stress incontinence in some categories of the demographic variables (for example, there were no participants who reported being smokers or whom had multiple pregnancies together with stress incontinence and therefore these data could not be compared).

Similar regressions were done for each part of the KHQ and again no association was found. There was therefore no association between any of the demographic variables with stress incontinence, the pad test results or quality of life scores at follow-up.

Exercise Diaries

Finally, the exercise diaries given to participants in the intervention group were not returned as many participants could not attend the follow-up assessment, and for those who did attend, they reported having forgotten or misplaced the diaries given to them.

4.10 **CONCLUSION**

At baseline assessment, all women reported being affected by stress urinary incontinence to varying levels which was evident from the low KHQ scores and the rating of stress incontinence. After the intervention there was improvement in both groups' rating of stress incontinence (but there was no significant difference between improvement in the control group compared with the intervention group: p= 0.58) as well as QOL scores (from the KHQ: p= 0.09-0.35). There were also no significant differences between groups in the pad test scores after the intervention (p=1.00).

The next chapter will discuss the findings from this study in relation to similar studies.

CHAPTER 5

5. DISCUSSION

5.1 INTRODUCTION

This chapter will discuss the results obtained in the analysis of all the data collected using the aim and objectives of the study. The aim of the study is to determine the effect of an antenatal exercise programme including diaphragmatic breathing with co-contraction of abdominal and pelvic floor muscles on urinary incontinence postpartum. Discussion of results will be related to the objectives of this study which are as follows:

- To determine the influence of urinary incontinence on the prepartum quality of life (QOL) of pregnant women.
- To establish the effect of antenatal co-contraction of pelvic floor and abdominal muscle exercises with diaphragmatic breathing on the amount of urine lost under stress.
- To establish the effect of antenatal pelvic floor muscle exercises without diaphragmatic breathing and abdominal muscle co-contraction on the amount of urine lost under stress.
- To determine the influence of urinary incontinence on QOL of pregnant women after the intervention.
- To compare the effects of the two exercise programmes on urinary incontinence and QOL of pregnant women postpartum.

Measures used in the study to determine the effect of urinary incontinence were the modified pad test, the stress incontinence score to measure the amount of urine lost and the King's Health Questionnaire (KHQ) to measure quality of life (QOL)

5.2 DISCUSSION

The effect of urinary incontinence on QOL prepartum and postpartum will be discussed first.

The Influence of Urinary Incontinence on the Prepartum QOL of Pregnant Women

In this study QOL was affected negatively by UI at baseline as demonstrated by results of the King's Health Questionnaire (KHQ) in both groups. Using two-sample t

tests the KHQ scores were compared between groups at baseline and the mean values for each part of the questionnaire were similar for both group showing no statistically significant difference between the control and the intervention groups. All women who participated in this study presented with difficulties related to QOL at baseline. Similar findings were reported by Handa et al., (2007); Tincello et al., (2009); Erbil et al., (2011) and Segedi et al., (2011). The study by Bailey et al., (2010) conducted in Bloemfontein, South Africa reported a negative effect on quality of life of women with urinary incontinence although these women were not pregnant or in the early postpartum period.

In contrast, a study assessing the self-reported quality of life of Korean American women by Kang et al., (2010) found that women with urinary incontinence had a higher rating of quality of life compared with scores obtained in the general population in previous studies (Patrick et al., 1999; Hagglund et al., 2001; Hannestad et al., 2002). One of the reasons for this was the possibility that Korean-American women who had severe symptoms may have been hesitant to participate due to their cultural norm of privacy (Kang et al., 2010), hence a true picture may not have been obtained.

The Influence of Urinary Incontinence on QOL of Pregnant Women after Intervention

When comparing results at follow-up, there was no significant difference between groups. Rett et al., (2007) had also used the KHQ as a measure of QOL, as in this study, and found marked improvements after intervention in all domains of the KHQ except for personal relationships. However, their study involved 26 women treated with surface electromyography-assisted biofeedback and pelvic floor muscle exercises and also did not include pregnant or postpartum women.

Stress incontinence scores and QOL scores for part one and three of the KHQ in this study showed significant weak to moderate correlations indicating that although not a strong link, there was a link between severity scores of stress incontinence and the effect on QOL for part one (related to general health perception) and part three (related to how much participants are affected by incontinence). There was a moderate non-significant correlation and a poor non-significant correlation between stress incontinence and part two in the intervention group and the control group respectively. The study by Handa et al., (2007) using the “Hunskaar score” to

measure the severity of urinary incontinence without any intervention showed no correlation between the UI severity score and the QOL measures. The difference in the inclusion criteria of primiparous women only as opposed to this study's inclusion of multiparous women may account for the difference in outcomes. In addition the assessment tools (SF-12) used compared to the KHQ in this study may also account for the differences together with the sample size of 759 (Handa et al., 2007) compared with the relatively small sample size of 52 in this study where the dropout rate was 33% (see CONSORT diagram in Chapter 4). Borello-France et al., (2006) found improvements in QOL after the intervention. Borello-France's et al., (2006) study of women who experienced stress incontinence at least once a week but who were not pregnant indicated statistically significant improvements in quality of life after intervention using a different QOL measure in women with stress urinary incontinence.

Due to the difficulty experienced in this study in conducting follow-up assessments, the KHQ was conducted by means of telephonic interviews for some participants. The use of a self-report assessment at follow-up by means of conducting the KHQ over the telephone could also have affected the accuracy of results without an objective measure (such as the pad test), and this was also a concern raised by Hung et al., (2010) as discussed in the literature review.

Next, the effect of the involvement in the intervention was tested using pad test results. Only 14 participants were present.

The Effect of Antenatal Pelvic Floor Exercises with and without Abdominal Muscle co-Contraction and Diaphragmatic Breathing on the Amount of Urine Lost Under Stress

When assessing the differences in the pad test results between the two groups after the intervention, there was no statistically significant difference found.

Similar interventions to this study were used by Dumoulin et al., (2004) and Hung et al., (2010) and both these studies showed improvements in the pad test results in their intervention groups. Dumoulin et al., (2004) used abdominal muscle training with pelvic floor rehabilitation for one of their interventions as well as using a modified 20 minute pad test as their primary outcome measure. They found that those in the intervention groups (receiving pelvic floor rehabilitation alone or pelvic floor

rehabilitation with abdominal muscle training) had significant improvements in the pad test results for both intervention groups but not in the control group. Hung et al., (2010) used diaphragmatic breathing, deep abdominal and pelvic floor muscle co-contraction in women with urinary incontinence and their findings were similar to this study as well as that of Dumoulin et al., (2004). Hung et al., (2010) also used the 20 minute pad test as in this study and their results showed that participants in the training group reported significant cure rates and improvement in symptoms. The symptoms referred to by Hung et al., (2010) included symptoms not assessed in our study (such as lower back pain; postmenopausal symptoms; urgency etc.). Despite a higher sample size of 70 participants and a lower dropout rate of 8.6% Hung et al., (2010) also found that there was no significant difference between groups after the intervention in the amount of urine lost or the number of urine leaks, and this was difficult to compare with our study due to the small numbers of follow-up pad tests performed.

When looking at the stress incontinence scores of participants after the intervention, results showed that there was no significant difference between groups although actual stress incontinence ratings had changed for both groups. In this study both groups received pelvic floor exercises and hence an improvement in results for both groups would be expected since pelvic floor exercises have been shown to improve urinary incontinence in previous studies (Reilly et al., 2002; Chiarelli et al., 2003; Sapsford et al., 2004; Joanna Briggs Institute, 2006; Dumoulin et al., 2014).

The dropout rate in this study was 33%. An interesting finding that arose in the course of the study was the movement of many participants across cities, provinces and countries to have their babies in a hospital as opposed to a smaller clinic with limited facilities in rural areas. This was noted at the time of follow-up, when participants could not be contacted as they had returned to their homes in the outskirts of the city or other provinces or rural towns, although only four women reported having relocated, it may also be true of some of the other women who could not be contacted at all if they had relocated to another country and their contact numbers had changed. This factor brings to light other population dynamics relevant to the South African context and possibly indicates the need for follow-up at rural clinics and possibly community-based education programmes that include physiotherapy involvement in antenatal education. Studies that advocate for more treatment sessions such as that of Rett et al., (2007) are not always applicable to the South African public health setting as participants in this study have demonstrated

that they often migrate to the city while pregnant, have their babies in a hospital setting and return home soon thereafter.

The high dropout rate in this study could affect its validity as according to Fewtrell et al., (2008) a loss of ≥ 20% poses serious threats to validity of a study's results. They also acknowledge that the length of time between baseline and follow-up may affect the rate of loss of participants and hence longer follow-up time may result in a higher number of participants lost to follow-up compared with shorter follow-up periods which is described as being about 18 months after baseline (Fewtrell et al., 2008; Akl et al., 2012). They further mention that other dynamics may also affect the rate at which participants are lost such as the age of participants, perceived benefit of participation, amount of inconvenience involved in participating as well as difficulty contacting and tracing participants (Fewtrell et al., 2008) which accounted for the majority of the number of participants lost to follow-up in this study.

Akl et al., (2012) conducted a systematic review of randomized controlled trials and the potential impact of estimated treatment effects of information lost to follow-up. They found that assumptions were being made about the potential outcomes of the participants who had dropped out of the studies assessed. A number of factors including reasons for dropout and follow-up rate were considered in the assessment. The question that a study is examining may also determine what the most likely effect the intervention had on participants who dropped out of that study (Akl et al., 2012). The explanation that in cases where participants are required to comply with a trial protocol as well as attend follow-up it would be reasonable to conclude that those participants who were lost to follow-up had experienced an adverse event was also given by Akl et al., (2012). It is also possible that the participants in our study whom were lost to follow-up had also experienced a similar adverse event.

On the other hand, participants who dropped out of the studies as a result of having relocated to another region were likely to have better outcomes compared with those who had dropped out due to "failure to improve" as mentioned by Akl et al., (2012). In this study follow-up data were available for 35 participants, of whom 19 were in the control group and 16 were in the intervention group, although the difference in the number of participants is small between groups, the challenge arose in the type of follow-up data acquired. Some participants were only able to provide telephonic follow-up data by means of an interview at which the QOL questionnaire was rendered for reasons already mentioned above, while other participants were able to

arrive for a follow-up pad test as well as complete the QOL questionnaire by themselves. The number of follow-up pad tests conducted was only 14 with 10 participants from the control group and only four participants from the intervention group and this may pose a problem in terms of validity as Akl et al., (2012) have noted from their systematic review that the number of participants lost between a control and intervention group may also affect the validity of the study outcomes if there is a large difference between them.

Bailey et al., (2010) conducted a study in Bloemfontein, South Africa assessing the prevalence and effects of urinary incontinence in women working in the Universitas Academic Hospital. They used a questionnaire to assess 154 women and of these, 109 questionnaires were returned, with a 70.8% response rate (Bailey et al., 2010). Although Bailey et al., (2010) had also lost a similar number of responses as in our study (33%) their sample size was far larger than our study and hence our results could have been affected negatively by the dropout rate of 33%.

The Effects of the Two Exercise Programmes (Pelvic Floor Muscle Exercises alone or Pelvic Floor Muscle Exercises with Abdominal Co-Contraction and Diaphragmatic Breathing) on Urinary Incontinence and QOL of Pregnant Women Postpartum

Two measures of urinary incontinence (being stress incontinence scores as well as the pad test) were used in this study. Urinary incontinence in the control group compared with the intervention group will be discussed first followed by the effect on QOL in both groups.

Dumoulin et al., (2004) used abdominal training with pelvic floor muscle exercises for one of their intervention groups also found improvements in the pad test results that were significant for their two intervention groups and no significant improvements in the control group. In our study, results showed that the mean amount of urine lost in the pad test for participants in the intervention group had reduced at follow-up compared with baseline, while the mean amount of urine lost in the pad test for participants in the control group had increased by 0.01g, but this is not an accurate interpretation due to the small number of follow-up pad tests performed compared with those at baseline. Since urine loss of 1gram was defined as a positive pad test result (Ghoniem et al., 2008), follow-up assessments showed that for the ten participants who had completed their follow-up assessments in the control group

none of them had improved in their pad test results (having urine loss of less than 1g). Of the four participants in the intervention group who performed follow-up pad tests, two had improved results in the pad test compared with baseline.

The pad test results of the combined group at baseline (n=52) showed that there was an average loss of urine of 2.6 grams per participant. The total mean for all participants at follow-up (n=14) was 2.1 grams (0.4g for the intervention group and 1.7g for the control group). When comparing the pad test results at follow-up for both groups findings indicated that although the mean for each group had reduced from baseline, there were no differences between groups (p = 1.00) at follow-up.

When comparing the effect on QOL, the baseline scores for each part of the KHQ were similar between both groups. At follow-up the actual scores for the KHQ were improved from baseline in both groups; however, there was no statistical difference between the two groups in terms of quality of life. Dumoulin et al., (2004) in their study found improved scores for QOL measures for both their intervention groups that were statistically significant but no significant improvements in the control group. Similar to the findings in our study, Dumoulin et al., (2004) found no significant change in QOL scores when comparing the two treatment groups (one treatment group received pelvic floor muscle training alone while the other received pelvic floor muscle training with abdominal muscle training).

Pelaez et al., (2014) used the International Consultation on Incontinence Questionnaire –Urinary Incontinence Short Form (ICIQ-UI SF) as their primary outcome measure which includes a question on the effect of leaking on daily life, however, their findings indicated significant differences in the scores between their intervention group and control group. The difference between the study by Pelaez et al., (2014) and our study is that the control group only received routine care (which included education by a midwife about pelvic floor exercises, but not instruction to perform the pelvic floor exercises at home) as opposed to this study where participants in the control group also received pelvic floor muscle training and hence an improvement could be expected in both groups since pelvic floor exercises have been shown to be effective in treating urinary incontinence (Reilly et al., 2002; Chiarelli et al., 2003; Sapsford et al., 2004, Joanna Briggs Institute, 2006; Dumoulin et al., 2014). Hung et al., (2010) who included regular pelvic floor exercises for their control group and pelvic floor muscle exercises with other interventions including diaphragmatic breathing and abdominal muscle activation similar to this study, found

statistically significant differences between groups in only two items ("Number of activities affected by incontinence" and "Avoiding activity due to worrying about leaking") of the Symptom Impact Index (SII) used to measure QOL, hence findings in this study are in keeping with similar studies conducted previously.

When assessing the objective and subjective continence outcomes, Dumoulin et al., (2004) found that continence outcomes had improved for both groups in their study. Dumoulin's et al., (2004) study was similar to our study in terms of their small sample sizes (n=21 n=23 and n=20 compared with this study's n=26 for both groups at baseline) as well as the use of a modified 20 minute pad test. It is interesting to note the improvements in outcomes in both studies even though our study included only women who experienced urinary incontinence for the first time despite some women having been multiparous, whereas Dumoulin's et al., (2004) study only included women with persistent urinary incontinence. The similarity with our study is that there were improved stress incontinence scores, pad test results and QOL but there were no real differences between the two groups. Another similarity in Dumoulin's et al., (2004) findings and this study is that while pelvic floor muscle exercises together with diaphragmatic breathing and abdominal co-contraction are useful in reducing stress incontinence, pelvic floor muscle exercises alone are also useful in achieving this reduction. One can conclude that, the addition of the co-activation exercises and breathing did not further improve urinary incontinence outcomes in pregnant women postpartum.

The Relationship between Demographic Characteristics and Study Outcomes (Pad test, Stress Incontinence and KHQ Scores)

Although not part of the objectives of this study, due to the high dropout rate we decided to determine if there was a relationship between the demographic information and the outcome measures of this study to enrich data. Results of this study showed that none of the demographic characteristics of age, BMI, stage of pregnancy, duration of symptoms, parity, multiple pregnancy, smoker/ non-smoker at baseline could act as an indicator or risk for any of the outcome measures in this study. A number of previous studies have association and correlations between some of the same demographic variables and incontinence such as Hannestad et al., (2003); Hannestad et al., (2004); Rortveit and Hunskaar (2006) and Solans-Domenech et al., (2010). Although our study measured similar characteristics and shared some demographic variables with participants in these studies, the results

from our study were the same as their findings and this could have been due to the high dropout rate in our study.

5.3 LIMITATIONS

Although the number of individual sessions was only one at baseline and one at follow-up, with reminder telephone calls for those in the intervention group, there was still a high dropout rate. The circumstances of this study's location and population seemed to pose the greatest obstacle to a return visit (including travel; work or family commitments). Perhaps if the follow-up assessment was scheduled for six weeks postpartum instead of eight weeks and on the same day as the six week vaccination appointment it would have allowed for more follow-up assessments to be conducted.

The exercise diaries given to participants in the intervention group were also not returned as many participants could not attend the follow-up assessment, and for those who did attend, they reported having forgotten or misplaced the diaries given to them. They were also not easily contactable, hence could not be reminded to record their daily exercises in the diaries. The use of exercise diaries for this population was not advisable as the study participants were pregnant mothers in the second trimester and keeping an exercise diary would be difficult especially after birth with the responsibilities of caring for a newborn baby. Perhaps messages to their cellphones would have been useful or reminders on a cellphone calendar would have been more beneficial for this population.

5.4 CONCLUSION

In comparing the effect on quality of life, the baseline scores for each part of the KHQ were similar between both groups. At follow-up the actual scores for the KHQ were improved from baseline in both groups; however, there was no statistical difference between the two groups in terms of quality of life. Results for both groups indicated at baseline there were varying degrees of poor correlation when comparing stress incontinence with each part of the KHQ. In the control group there was a weak negative correlation between stress incontinence and part one and part two of the KHQ that were non-significant. There was a non-significant weak positive correlation between stress incontinence and all parts of the KHQ in the intervention group. Although this study did show that the quality of life of participants was negatively affected at baseline, results showed no real correlations between stress incontinence and quality of life at baseline.

After the intervention, stress incontinence scores and QOL scores for part one and three of the KHQ in this study showed significant weak to moderate correlations indicating that although not a strong link, there was a link between severity scores of stress incontinence and the effect on QOL for part one (related to general health perception) and part three (related to how much participants are affected by incontinence). Results showed that there was no significant difference between groups although actual stress incontinence ratings had changed for both groups.

In our study, the pad test results for participants in the intervention group had reduced at follow-up compared with baseline. When establishing the effect of the intervention on the pad test results, there was no real difference between the control group and the intervention group at follow-up ($p = 1.00$).

This study's findings showed no differences between the control group and the intervention group when comparing the effects of antenatal co-contraction of pelvic floor and abdominal muscle exercises with diaphragmatic breathing and antenatal pelvic floor muscle exercises without diaphragmatic breathing and abdominal muscle co-contraction on urinary incontinence and quality of life of pregnant women postpartum.

Analysis of demographic data of participants in this study showed that none of the demographic characteristics could act as a risk factor for stress incontinence or poor quality of life.

Of all the analyses conducted at follow-up, there were no differences between the control group and the intervention group. The high dropout rate of 33% was most likely to have affected our results.

The last chapter will summarise the findings of this study.

CHAPTER 6

6. CONCLUSION AND RECOMMENDATIONS

6.1. CONCLUSION

This chapter summarises the findings of this study and provides recommendations. The overall aim of the study was to determine the effect of an antenatal exercise programme including diaphragmatic breathing with co-contraction of abdominal and pelvic floor muscles of urinary incontinence postpartum.

The following were the findings of this study:

Results showed that there was no correlation between stress incontinence and quality of life at baseline. At follow-up, the amount of urine lost under stress (pad test results) showed no significant difference when compared between the control group and the intervention group.

There was no correlation between the pad test results and any part of the King's Health Questionnaire (KHQ) in the control group at follow-up, but there was a strong positive non-significant correlation between the pad test results and part one (related to general health perception) and part three (which measures how much participants are affected by incontinence) of the KHQ in the intervention group.

There was a moderate non-significant correlation between stress incontinence and part two of the KHQ in the intervention group and a poor non-significant correlation between stress incontinence and part two (relating to role, physical and social limitations; personal relationships; emotions; sleep/energy and severity measures) of the KHQ in the control group. There were weak and significant correlations between stress incontinence and part one and part three of the KHQ after the intervention for both groups.

In comparing the effects of the interventions between groups, there were no significant differences in quality of life and urinary incontinence postpartum.

An antenatal exercise programme including diaphragmatic breathing with co-contraction of the abdominal and pelvic floor muscles did not affect urinary incontinence more than an antenatal exercise programme without diaphragmatic

breathing and abdominal co-contraction. While there were varying degrees of weak; moderate and strong correlations between stress incontinence, the pad test results and parts of the King's Health Questionnaire scores at follow-up, none of them were real changes between groups after the intervention.

It is also clear that the situational change both geographically and in terms of the change in pregnancy status may have influenced the pragmatic organization of this study. This is important for future studies where researchers could align their data collection with other public health practices such as aligning to the six week follow-up. The researcher went to extra ordinary lengths to follow-up the participants therefore resulting in a lengthening of the study, but faced difficulties in participants change in both location and telephone numbers a phenomenon that has been experienced in South Africa due to the economic benefits of changing telephone contracts due to competitive pricing with various cellular network providers.

6.2 RECOMMENDATIONS

6.2.1 Recommendations for Clinical Practice

It would be beneficial to include supervised pelvic floor muscle exercises as a prevention for urinary incontinence as part of antenatal education in the community health setting since some participants in this study had relocated from the city before completing their follow-up assessments. The change in geographical location impacted negatively on the outcomes of the study because of the high dropout rate.

6.2.2 Recommendations for Future Research

Follow-up assessments could in future be scheduled for the same day as other appointments such as the six week vaccinations for babies even if this is done at a primary health care level to avoid the difficulty with travelling for follow-up appointments.

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APPENDIX A

- **INFORMATION SHEET**

INFORMATION SHEET

"The effect of an antenatal exercise programme including diaphragmatic breathing with co-contraction of abdominal and pelvic floor muscles on stress urinary incontinence postpartum"

Hello my name is Tasneem Ebrahim and I am a physiotherapy master's student. I am doing research to find out if certain exercises can affect the leakage of urine that pregnant women often experience. This leakage of urine is called urinary incontinence and it means that you sometimes wet yourself before you can reach the toilet. Some women experience this problem as urine running down their legs and wetting their pants, while other women have only small amounts of urine that leaks and use a pad/ sanitary towel to protect their clothing. Incontinence can be caused by many different problems. One of the causes is weak muscles. The muscles that you use to stop you from leaking urine are called the pelvic floor muscles.

During pregnancy the pelvic floor muscles become stretched and weak because of the weight of the baby. Weak muscles cannot work well to stop you from leaking urine especially when you do something that takes a lot of effort like coughing, laughing or sneezing. This is called stress incontinence and is a common problem among pregnant women.

I would like to invite you to take part in this research. If you agree, you will be asked to sign consent and will become part of the study. Next, I will explain how pelvic floor muscles work and show you how to do the exercises to strengthen them. You will need to answer some questions that will help me to understand how incontinence affects you. You will then be asked to do a pad test. This will take about an hour to complete. The pad test is used to measure how much urine leaks after stress (e.g. coughing). You will be asked to empty your bladder first and then put on a sanitary pad. You will then drink two glasses of water and rest. For the next half an hour you will be asked to sit, stand, walk around, climb stairs and cough. You will then remove the pad and it will be weighed to measure how much, if any, urine has leaked during the activities. During the pad test you may become tired from the exercises but you will be free to stop at any time if you want to rest.

You will be put into one of two groups. One group will be taught the pelvic floor exercises (see attached) with breathing exercises and trunk muscle exercises. They will also receive a phone call every two weeks to remind them about the exercises and will also get a diary to fill in whenever the exercises are done at home. The other group will only be taught how to do the pelvic floor exercises and will not get a diary or telephone calls. Eight weeks after the birth of your baby, we will need to do the pad test again, and four weeks after that we will repeat the pad test for the last time. At this time, you will also be asked to answer the same questions that you did on the first day and I will go through the exercises with you again.

I will give you R40 to pay for your transport costs to come to the hospital/ clinic for your assessments. You do not have to take part in this study if you do not want to. If you would like to take part but later on decide that you do not want to take part any longer then you may still leave the study without any problems. The information from this study is confidential, I will keep all results anonymous and I will not share this information with anyone without your permission.

If you have any further questions or need to contact me, you can reach me on 011 489 0336 or 083 697 5575. If you have any complaints that you want to report, you can contact Prof. Cleaton-Jones (Chairman of the Human Research Ethics Committee) on 011 717 1234.

Thank you
Tasneem Ebrahim

PELVIC FLOOR MUSCLE EXERCISES

Firstly you need to find your pelvic floor muscles. Do this when you are sitting on the toilet seat, passing urine. While emptying your bladder try to stop the flow of urine midstream. Take note of the muscles you are using to do this. Relax and allow your bladder to empty completely. At first you will find that you can only slow down the flow but cannot stop it. This will improve as you begin to strengthen your muscles.

Now try doing this while lying on your back with your knees slightly bent. Imagine that you are on the toilet seat passing urine. Now imagine that you want to stop the flow of urine midstream, and really try to stop it. Try squeezing and lifting the muscles inwards. Make sure that your buttocks do not move as those are not the muscles you are trying to work. Try to squeeze the deep muscles without moving or squeezing the buttocks.

Now that you can feel and identify your pelvic floor muscles we can begin strengthening.

Slow Contractions

1. Lie on your back with your knees slightly bent. Concentrate on breathing calmly allowing your stomach to rise as you breathe in and fall as you breathe out. Now, continue breathing and slowly start squeezing and lifting your pelvic floor muscles inwards as you did on the toilet seat. Squeeze slowly as strong as you can and then relax completely. Remember not to hold your breath! At first it will be difficult to control the squeeze but as you practice it gets easier.

   REPEAT 6 times then do 3 fast contractions

Fast Contractions

2. Now try to do a strong quick squeeze. Begin with breathing, then quickly squeeze the muscles as strong as you can and let go. Do not hold. Remember it should feel like lifting upwards and inwards

REPEAT 3 TIMES

Now do the same exercises (6 slow contractions and 3 fast contractions**) 10 times a day**

DIAPHRAGMATIC BREATHING AND ABDOMINAL CO-CONTRACTION

1. While lying on your back, start with the breathing that you were taught. As you breathe in your belly should rise up. As you breathe out let your tummy drop in again, this helps you use your diaphragm to breathe.

2. For the next part try to practise the abdominal muscle contractions by squeezing the abdominal muscle as you were taught. To feel this, place your fingers about 2 centimetres inwards and 2 centimetres downwards from your hip bone and say "ssss" when you feel the muscle tighten under your fingers then you are in the right place. Now practice squeezing this muscle without making the "ssss" sound. When you can do this try to do your breathing as explained above and also squeeze your abdominal muscles at the same time. It might be tricky at first but it will get easier as you practise.

3. Now that you have practised the abdominal muscle contraction and you can breathe well while doing it you can start doing the pelvic floor muscle contractions as well. Find your abdominal muscles and squeeze. While squeezing the abdominal muscles, squeeze the pelvic floor muscles as well and still continue to breathe in the way you practised. Try to practise doing these three steps 10 times a day. Once you find it easy to do while lying on your back, you may try and do it in sitting as well.

APPENDIX B

- **CONSENT FORM**

CONSENT FORM **CODE:** _____

Informed Consent

I_____ declare that

- I have read the information sheet and I understand what is required of me
- I am aware that I might become tired or feel some discomfort while doing the exercises or during the testing and I will inform the researcher if I need to rest or do not want to continue
- I have been given the opportunity to ask questions
- Participation is voluntary and I may choose to leave the study at any time without suffering any consequences
- By signing this consent form I agree to participate in the study

_____ _____

Signature Date

APPENDIX C

- **KING'S HEALTH QUESTIONNAIRE**

THE KING'S HEALTH QUESTIONNAIRE

1. How would you describe your health at the present? Please tick one answer

Very good	⬭
Good	⬭
Fair	⬭
Poor	⬭
Very poor	⬭

2. How much do you think your bladder problem affects your life? Please tick one answer

Not at all	⬭
A little	⬭
Moderately	⬭
A lot	⬭

Please turn the page

Below are some daily activities that can be affected by bladder problems.
How much does your bladder problem affect you?

We would like you to answer every question. Simply tick the box that applies to you

3. ROLE LIMITATIONS	**1** **Not at all**	**2** **Slightly**	**3** **Moderately**	**4** **A lot**
A. Does your bladder problem affect your household tasks? (cleaning, shopping etc)	⬭	⬭	⬭	⬭
B. Does your bladder problem affect your job, or your normal daily activities outside the home?	⬭	⬭	⬭	⬭

4. PHYSICAL/SOCIAL LIMITATION	**1** **Not at all**	**2** **Slightly**	**3** **Moderately**	**4** **A lot**
A *Does your bladder problem affect your physical activities (e.g. going for a walk, running, sport, gym etc)?*	⬭	⬭	⬭	⬭
B. Does your bladder problem affect your ability to travel?	⬭	⬭	⬭	⬭
C. Does your bladder problem limit your social life?	⬭	⬭	⬭	⬭
D. Does your bladder problem limit your ability to see and visit friends?	⬭	⬭	⬭	⬭

5. PERSONAL RELATIONSHIPS	0 Not Applicable	1 Not at all	2 Slightly	3 Moderately	4 A lot
A. *Does your bladder problem affect your relationship with* your partner?	⬭	⬭	⬭	⬭	⬭
B. Does your bladder problem affect your sex life?	⬭	⬭	⬭	⬭	⬭
C. Does your bladder problem affect your family life?	⬭	⬭	⬭	⬭	⬭

6. EMOTIONS	1 Not at all	2 Slightly	3 Moderately	4 Very much
A. Does your bladder problem make you feel depressed?	⬭	⬭	⬭	⬭
B. Does your bladder problem make you feel anxious or nervous?	⬭	⬭	⬭	⬭
C. *Does your bladder problem make* you feel bad about yourself?	⬭	⬭	⬭	⬭

7.SLEEP/ENERGY	1 Never	2 Sometimes	3 Often	4 All the time
A. Does your bladder problem affect your sleep?	⬭	⬭	⬭	⬭
B. Does your bladder problem make you feel worn out and tired ?	⬭	⬭	⬭	⬭

8.Do you do any of the following?	*If so how much?*			
	1	*2*	*3*	*4*
	Never	**Sometimes**	**Often**	**All the time**
A. *Wear pads to keep dry?*	⬭	⬭	⬭	⬭
B. *Be careful how much fluid you drink ?*	⬭	⬭	⬭	⬭
C. Change your underclothes because they get wet?	⬭	⬭	⬭	⬭
D. Worry in case you smell?	⬭	⬭	⬭	⬭

We would like to know what your bladder problems are and how much they affect you?
From the list below choose only those problems that you <u>have at present</u>.
Leave out those that don't apply to you.

How much do they affect you?

*FREQUENCY**: going to the toilet very often***

1. A little ⬭ *2.Moderately* ⬭ *3. A lot* ⬭

***NOCTURIA**: getting up at night to pass urine*

1. A little ⬭ *2.Moderately* ⬭ *3. A lot* ⬭

*URGENCY: **a strong and difficult to control desire to pass urine***

1. A little ⬭ *2.Moderately* ⬭ *3. A lot* ⬭

URGE INCONTINENCE: urinary leakage associated with a strong desire to pass urine

1. A little ⬭ *2.Moderately* ⬭ *3. A lot* ⬭

STRESS INCONTINENCE: ***urinary leakage with physical activity eg. coughing, running***

1. A little *2.Moderately* *3. A lot*

⬭ ⬭ ⬭

NOCTURNAL ENURESIS: wetting the bed at night

1. A little *2.Moderately* *3. A lot*

⬭ ⬭ ⬭

INTERCOURSE INCONTINENCE: ***urinary leakage with sexual intercourse***

1. A little *2.Moderately* *3. A lot*

⬭ ⬭ ⬭

WATERWORKS INFECTIONS

1. A little *2.Moderately* *3. A lot*

⬭ ⬭ ⬭

BLADDER PAIN

1. A little *2.Moderately* *3. A lot*

⬭ ⬭ ⬭

Thank You For Your Time

TO CALCULATE SCORES

PART 1

1) General Health Perceptions

Very good 1

Good 2

Fair 3

Poor 4

Very poor 5

Score = ((Score to Q1 – 1)/4) x 100

2) Incontinence Impact

Not at all 1

A little 2

Moderately 3

A lot 4

Score =((Score to Q2 – 1)/3) x 100

PART 2

Individual scores as recorded at the top of each column of possible responses

3) Role limitations

Score =(((Scores to Q 3A + 3B) – 2)/6) x 100

4) Physical limitations

Score =(((Scores to Q 4A + 4B) – 2)/6) x 100

5) Social limitations

[If 5C >/= 1] Score =(((Score to Q 4C + 4D + 5C) – 3)/9) X 100

[If 5C = 0] Score =(((Score to Q 4C + 4D) – 2)/6) x 100

6) Personal relationships

[If 5A+5B >=2]Score =(((Scores to Q 5A + 5B) – 2)/6) x 100

[If 5A+5B =1] Score =(((Scores to Q 5A + 5B) – 1)/3) x 100

[If 5A+5B =0] Treat as missing value

7) Emotions

Score =(((Score to Q 6A + 6B + 6C) – 3)/9) X 100

8) *Sleep / energy*

Score =(((Scores to Q 7A + 7B) – 2)/6) x 100

9) *Severity measures*

Score =(((Scores to Q 8A + 8B + 8C + 8D) – 4)/12) x 100

PART 3

Scale	*score*
Omitted	0
A little	1
Moderately	2
A lot	3

APPENDIX D

- **MODIFIED 20 MINUTE PAD TEST**

MODIFIED 20 MINUTE PAD TEST

The collecting device (sanitary pad) must be weighed before being given to participants. Thereafter, participants should void before the test, then put on the collecting device and drink 250ml of water. The following activities are then commenced:

1. Cough 10 times

2. Bear down 10 times

3. Do 10 deep knee bends

4. Sit to stand 10 times

5. Wash hands for 1 minute

6. Up and down 5 stairs 10 times

7. Walk in hall for 10 minutes

Once the exercises are completed, the sanitary pad is to be weighed again and the difference in weight measured as the outcome.

APPENDIX E

- **DEMOGRAPHIC DATA COLLECTION FORM**

DEMOGRAPHIC DATA COLLECTION FORM

PARTICIPANT INFO	
AGE	
CODE	
STAGE OF PREGNANCY	
BMI	
Height	
Weight	
SMOKER/NON-SMOKER	
DURATION OF SYMPTOMS	
FITNESS SCORE	**i- Exercise daily**
	ii- Exercise weekly
	iii- Never exercise
MULTIPLE PREGNANCIES?	
BIRTH INFO:	
GESTATIONAL AGE	
BIRTH WEIGHT	
MODE OF DELIVERY	
EPISIOTOMY Y/N	

PARTICIPANT PARTICULARS

CONTACT DETAILS	
NAME	
HOSPITAL NO.	
DOB	
CODE	
PARTICIPANT CONTACT NO.	
ADDRESS	
NEXT OF KIN CONTACT NO.	

APPENDIX F

- **DATA COLLECTION FORM**

DATA COLLECTION FORM

DATE	BASELINE			8 WEEKS POSTPARTUM			16 WEEKS POSTPARTUM		
PAD TEST (g)	PRE-EX Weight	POST-EX Weight	GAIN	PRE-EX Weight	POST-EX Weight	GAIN	PRE-EX Weight	POST-EX Weight	GAIN
KHQ SCORE Part 1:									
Part 2:									
Part 3:									

APPENDIX G

- **EXERCISE DIARY**

EXERCISE DIARY:

Please tick (√) under the date if you have done your exercises and tick how often you do them

We will fill in the months together. The number 7 in the second column is the 7th month of your pregnancy, 8 is the eighth month, 9 is the 9th month of pregnancy and 10 is the 10th month of pregnancy. The next column is marked 1, this is the first month after the birth of your baby, 2 is the 2nd month after birth, 3 is the 3rd month after birth and 4 is the 4th month after the birth of your baby.

Month	7				8				9				10				1				2				3				4			
WEEK	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Exercises done every day ( )																																
5-6 times a week																																
3-4 times a week																																
2 times a week or less																																
How many times did you leak this week?																																

APPENDIX H

- **COMPUTER GENERATED RANDOMISATION**

Subject number	Group Assigned
1	B
2	A
3	A
4	A
5	A
6	A
7	A
8	A
9	B
10	B
11	B
12	A
13	B
14	B
15	A
16	B
17	A
18	A
19	A
20	B
21	B
22	A
23	B
24	B
25	B
26	B
27	B
28	A
29	A
30	B
31	A
32	B
33	A
34	B
35	A
36	A
37	A
38	A
39	B
40	B
41	B
42	A
43	B
44	B
45	B
46	A
47	A
48	B
49	A
50	B
51	A
52	B

APPENDIX I

- **ETHICAL CLEARANCE FORM**

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG
Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R14/49 Miss Tasneem A Ebrahim

CLEARANCE CERTIFICATE	M111109
PROJECT	The Effect of an antenatal Exercise Program Including Diaphragmatic Breathing with Co-Concentration of Abdominal and Pelvic Floor Muscles on Stress Urinary Incontinence Postpartum
INVESTIGATORS	Miss Tasneem A Ebrahim.
DEPARTMENT	Department of Physiotherapy
DATE CONSIDERED	25/11/2011
M1111090DECISION OF THE COMMITTEE*	Approved uncondtionally

Unless otherwise specified this ethical clearance is valid for 5 years and may be renewed upon application.

DATE 16/01/2012 **CHAIRPERSON** .....
(Professor PE Cleaton-Jones)

*Guidelines for written 'informed consent' attached where applicable
cc: Supervisor : Dr Douglas Maleka

DECLARATION OF INVESTIGATOR(S)
To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University.
I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to a completion of a yearly progress report.**
PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES...

APPENDIX J

- **Permission letters**

Joburg
a world class African city

9

ENQUIRIES: C. Fraser
Tel: +27(0) 11 407 7437
Tel: +27(0) 11 407 6840

4th Floor B Block
Metropolitan Centre
158 Loveday Street
Braamfontein

PO Box 31244
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SouthAfrica
2017

Tel +27(0) 11 407 7513
Fax +27(0) 11 339 2866

18 September 2012

Dear Ms. Ebrahim

APPROVAL TO CONDUCT RESEARCH WITHIN HEALTH IN THE CITY OF JOHANNESBURG

Permission has been granted to you to conduct research in the Health Department within the City of Johannesburg.

Topic: **The Effect of an Antenatal Exercise Program on Stress Urinary Incontinence Postpartum**

Please contact the following person(s) before you commence with your project and to gain access to the clinics:

Region	Regional Health Manager	Contact No.	Cell phone
B	Ms Paulinah Maepa	011 718 9656	082 551 5804

Should you have any queries please do not hesitate to contact our department.

We look forward to your Final Research Report.

Thank you

18/9/12

DR. R. BISMILLA
Executive Director
City of Johannesburg
Health Department

health and
social development
Department: Health and Social Development
GAUTENG PROVINCE

RAHIMA MOOSA
MOTHER AND CHILD HOSPITAL

PRIVATE BAG X20
NEWCLARE
2112

Enquiries: Mrs. S. Jordaan
Tel: (011) 470 – 9030/4
Fax: (011) 477 4117

Helen Joseph Hospital
Physiotherapy Department
JOHANNESBURG
2000

Re: The effect of an antenatal exercise program including diaphragmatric breathing with co-contraction of abdominal and pelvic floor muscles on stress urinary incontinence postpartum

Dear Tasneem Ebrahim

Permission is granted for you to conduct the above survey as indicated in your request:

1. The Rahima Moosa hospital will not in anyway incur or inherit costs as a result of the said study.
2. Your study shall not disrupt services at the study site.
3. Strict confidentiality shall be observed at all times.
4. Informed consent shall be solicited from patients participating in your study.
5. NO file should leave the records department and/or the hospital premises.

Arrangement will be made with recordkeeping clerks so that you could occupy space in their department.

Kindly forward this office with the results of your research on completion of it.

I, Tasneem A. Ebrahim accept the terms and conditions set-in this document

sign _____ date 03/02/12

Yours sincerely,

Jordaan

CHIEF EXECUTIVE OFFICER
SJ/cj. 2012-01-27

APPENDIX K

- **RESEARCH ASSISTANT TEACHING MATERIAL**

RESEARCH ASSISTANT TEACHING MATERIAL

- See Appendix L
- Ashton-Miller JA, DeLancey JO, 2007 Functional Anatomy of the pelvic floor. *Annals of the New York Academy of Sciences* 1101: 266-296
- Neumann P, Gill V, 2002 Pelvic floor and abdominal muscle interaction: EMG activity and intra-abdominal pressure. *International Urogynecology Journal* 13: 125-132

APPENDIX L

- **KEGEL EXERCISES**

PELVIC FLOOR EXERCISES

What is the pelvic floor*?*

The pelvic floor muscles are a layer of muscles that stretch from your pubic bone in front, to your tailbone at the back.

Function:

1. Stabilise the pelvis
2. Prevent prolapse (by supporting your organs & keeping them in place)
3. Anal support and closure
4. Urethral closing pressure
5. Inhibits the bladder
6. Sexual function

There are two types of muscle fibres, fast twitch fibres used for strength and slow twitch fibres used for endurance. Fast twitch fibres are used mainly when you need strong muscles to support your bladder under sudden pressure (coughing, laughing, sneezing) and slow twitch fibres are used when you need to hold the urine for longer (waiting to get to a toilet)

How does the pelvic floor work?

At rest the pelvic floor muscles are slightly tightened to stop urine leaking from the bladder and faeces from the bowel. When you go to the toilet, your pelvic floor muscles relax to allow you to pass urine or faeces and they tighten again afterwards.

How do the pelvic floor muscles become weak?

These muscles often become weakened after childbirth when the pelvis, organs and muscles are stretched to make way for the baby. Aging, straining and repetitive impact sports activities can also cause weakness of these muscles.

How do you know if your muscles are weak?

If pelvic floor muscles are weak, the will not be able to support your organs well, leading to prolapse. Organ prolapse is when your uterus, bowel or bladder protrude out or drop lower than their normal position. Weak pelvic floor muscles also means that they will be unable to hold the bladder closed which can result in leakage of urine especially when the pressure in

your abdomen is increased, for e.g. when laughing, coughing, sneezing, exercising or lifting heavy objects.

By strengthening these muscles you can improve or stop urine leakage and improve bladder support.

Sometimes pelvic floor muscles can be too tight or the tension/relaxation mechanism may be irregular causing urine retention (inability to pass urine when bladder is full) and even constipation.

How do you strengthen your pelvic floor muscles?

There are a few steps to follow when doing your exercises:

1. Firstly you need to find your pelvic floor muscles.

   Do this when you are sitting on the toilet seat, passing urine. While emptying your bladder try to stop the flow of urine midstream. Take note of the muscles you are using to do this. Relax and allow your bladder to empty completely. At first you will find that you can only slow down the flow but cannot stop it. This will improve as you begin to strengthen your muscles.

   Now sit on a chair with your knees slightly apart. Imagine that you are on the toilet seat passing urine. Now imagine that you want to stop the flow of urine midstream, and really try to stop it. Try squeezing and lifting the muscles inwards. Make sure that your buttocks do not move as those are not the muscles you are trying to work. Try to squeeze the deep muscles without moving or squeezing the buttocks. Do the same exercise again but now imagine you are trying to stop yourself from passing wind from the back passage. Squeeze and lift the deep muscles again, try to feel the skin around your back passage lift off the chair.

Now that you can feel and identify your pelvic floor muscles we can begin strengthening.

2. Lie on your back with your knees slightly apart. Concentrate on breathing calmly allowing your stomach to rise as you breathe in and fall as you breathe out. Now, continue breathing and slowly start squeezing and lifting your pelvic floor muscles inwards as you did on the toilet seat. Squeeze slowly as strong as you can and then relax completely. Remember not to hold your breath! At first it will be difficult to control the squeeze but as you practice it gets easier.

3. Now do the same exercise but this time try to hold the squeeze for 5 seconds before you let go. Again, remember to breathe calmly. This exercise will strengthen your slow twitch muscles and help you to control your bladder when you feel the urge to go to the toilet.

4. Now try to do a strong quick squeeze to strengthen your fast-twitch muscles. Begin with breathing, then quickly squeeze the muscles as strong as you can and let go. Do not hold.

These exercises must be done as often as possible in order to be effective. You can do them while watching TV, while in the car or taxi, while standing or walking and no one will know you are doing them! Pelvic floor muscles are just like all the other muscles in your body, it takes time to strengthen muscles. You may only see a difference after a few weeks of regular exercise.

Important points to remember

- If you practice your exercises on the toilet, remember to allow your bladder to empty completely afterwards. Never hold urine in for long periods.

- Remember to use the quick squeeze before you cough, laugh, sneeze, jump or lift something heavy.

- Stay away from too much coffee, alcohol and acidic foods as these can irritate the bladder.

- Your body needs water to function normally, make sure you drink 6-8 glasses a day and go to the toilet when you need to. If you try not to drink water your bladder environment will become acidic and can cause infection worsening urine leakage.

- Never go to the toilet “just in case”, this makes your bladder capacity smaller causing more frequent trips to the toilet. Only go when you need to.

- Remember to breathe while squeezing, if you hold your breath, your body cheats by using different muscles to the ones you should be using.

APPENDIX M

- **PROTOCOL FOR TELEPHONIC FOLLOW-UP**

TELEPHONE CALL PROTOCOL

1. Greeting

2. Confirmation of participant details (name/ date of birth)

3. How are you feeling today? Or how have you been since my last call?

4. Have you been doing the exercises we practiced?

5. If not, why?

6. Are you having any difficulty in doing the exercises? If yes, why?

7. Are you having any difficulty in filling in the diary? If yes, why?

8. Please remember to do the exercises daily as we practiced them

9. If applicable- now I would like you to add in a sustained contraction to your regular exercises you have been doing. This means you must try and hold the contraction for a few seconds before you relax. Let's do it together now, when I say "squeeze" you must squeeze your pelvic floor muscles and try to keep it squeezed until I say "relax". Repeat three times and now try to do this after the slow contractions you did before.

10. What is your expected date of delivery?

11. Thank you for your time, I will call you again in two weeks time

12. Greeting

APPENDIX N

- **PILOT STUDY**

PILOT STUDY

Objectives

- To familiarise the researcher and research assistant with instrumentation and technique employed in using the instruments to facilitate the desired assessment and data collection.
- To estimate the amount of time taken to complete the assessment and recruitment of one participant
- To determine the intra-rater reliability of the questionnaire
- To identify any challenges that might arise during the procedure.

3.4.2 Procedure

Participants were offered to participate in the study if they met the following criteria:

1. Stress incontinence first experienced during pregnancy
2. Between 18 to 40 years of age
3. Stage of pregnancy between 24-28 weeks pregnant
4. Healthy women with no medical or obstetric complications (determined by interview with each participant as well as inclusion of participants on days allocated for uncomplicated pregnancies).

Exclusion criteria were the same as mentioned above (3.3.4). The following sequence of testing procedure was adopted:

- King's Health Questionnaire

  All participants then completed the King's Health Questionnaire either independently or with assistance from the researcher/research assistant if requested. Those who requested assistance with the questionnaires asked for clarity on certain questions which the researcher/ assistant then provided.

- Educational talk

  A standard educational talk (Appendix L) was given to each participant regarding pelvic floor function and the method of strengthening the pelvic floor (Kegel Exercises).

- Pad test

  Participants were asked to void completely before commencing with the pad test. Participants were then given an individually wrapped sanitary pad and asked to remove the protective sticker-covers before weighing the pad. The participant was asked to place the pad in a Ziploc bag (that was labelled with the participant's name) and then place the bag on the scale. The weight was measured to one decimal point and recorded. The participant then removed the pad from the bag and placed it inside her underwear in the bathroom and returned to the examination room with the same Ziploc bag which was kept aside. Next, participants were given 500ml of water to drink measured as two full polystyrene cups. They then rested for half an hour before starting the exercises.

  Exercises were done according to the guidelines by the International Continence Society's method (Ryhammer et al., 2009) of the 1 hour pad test as follows: Test schedule as recommended by International Continence Society

  a) Test is started without the patient voiding.
  b) Pre-weighed collecting device (*) is put on and first 1-hour test period begins.
  c) Subject drinks 500 ml sodium-free liquid within a short period (max. 15 min), then sits or rests.
  d) Half hour period: subject walks, including stair climbing equivalent to one flight up and down.
  e) During the remaining period the subject performs the following activities:
     a) Standing up from sitting, 10 times
     b) Coughing vigorously, 10 times
     c) Running on the spot for 1 minute
     d) Bending to pick up small object from floor, 5 times
     e) Wash hands in running water for 1 minute
     f) (f) At the end of the 1-hour test the collecting device (*) is removed and weighed.

  * "Collecting device" refers to the sanitary pad.

  After the exercises were done, the participants were asked to remove the pad and place it inside the same Ziploc bag to be weighed again. The Ziploc bag was again weighed with the pad in it and the measurement again recorded in grams. The difference between pre-test and post-test pad weight was also recorded. Lastly the participants were asked to complete the King's Health Questionnaire again.

APPENDIX O

- **"TURNITIN" REPORT**

THE EFFECT OF AN ANTENATAL EXERCISE PROGRAM INCLUDING DIAPHRAGMATIC BREATHING WITH CO-CONTRACTION OF ABDOMINAL AND PELVIC FLOOR MUSCLES ON STRESS URINARY INCONTINENCE POSTPARTUM

ORIGINALITY REPORT

16%	6%	14%	4%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS