DURBAN UNIVERSITY OF TECHNOLOGY

KNOWLEDGE AND PRACTICES OF PREGNANT WOMEN REGARDING EXERCISE DURING PREGNANCY: A COMPARISON BETWEEN PRIVATE AND PUBLIC SECTOR.

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Dissertation submitted in partial fulfilment of the requirements of the Degree in Masters of Technology in Chiropractic in the Faculty of Health Sciences at the Durban University of Technology

Supervisor: Dr F. Haffejee
Date: June 2017

Declaration

This is to certify that the work is entirely my own and not of any other person, unless explicitly acknowledged (including citation of published and unpublished sources). The work has not previously been submitted in any form to the Durban University of Technology or to any other institution for assessment or for any other purpose.

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Student Date

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Supervisor Date

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PhD

Dedication

“Lucky is the woman; whose first child is a daughter.”
(Prophet Muhammad – SAW).

"The Woman who has two daughters and she looks after them well, they will lead her to Paradise."
(Bukhari: Al-Adab al-Mufrad).

I therefore Dedicate this dissertation to my two beautiful daughters Tasmiya and Aisha. Your being, motivates me to do better.

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ABSTRACT

Introduction:

Evidence suggests that pregnant women who lead sedentary lifestyles and have a poor knowledge of exercise during pregnancy are at risk of developing diseases like gestational diabetes, pre-eclampsia and low back pain along with many other chronic conditions. An exercise program during pregnancy has benefits for both the mother and the child. No studies have ascertained the knowledge and practices of exercise in pregnant women in South Africa, furthermore, there was a need to conduct research regarding exercise amongst South African pregnant women, particularly to determine whether any barriers to physical activity exist.

Aim:

To compare the knowledge and practices of pregnant women regarding exercise during pregnancy between a selected private practice and public clinic.

Methodology:

A quantitative, descriptive, cross sectional survey was used in this research study. The population consisted of pregnant women (*n* = 400) attending both public and private sector antenatal care in the Ethekwini municipal area of KwaZulu-Natal, South Africa. Public sector participants were drawn from the Addington Hospital public antenatal clinic and private sector participants were drawn from the gynaecological practice of Dr D Sankar. Purposive, stratified sampling was used. Following the signing of an informed consent form, data was collected by means of a self-administered questionnaire. A minimum sample size of 324 patients was calculated by the statistician.

Descriptive statistics, such as frequencies and percentages were used to describe the demographic profile of respondents and their physical activities. Inferential statistics, including Chi-Square tests of association and student *t*-tests were used to determine differences in proportions and means respectively between the two categories of participants. Odds ratios (OR) were calculated to ascertain the measure of association between a risk factor and an outcome.

Results:
There were 198 (57.6%) participants from the private gynaecological practice and 146 (42.4%) from the public clinic at Addington Hospital. The mean age of the study population was 27.65 ± 5.3 years. Almost half of the study population were Indians (46.2%). Blacks made up the second largest proportion of the study population (39.2%). More than half of the study participants were involved in exercise during their pregnancy (57.1%). However, only 37% of the study population met the international criteria of physical activity, which is 30 minutes of moderate -intensity aerobic exercise, per day, for 5 days a week, during pregnancy as set out by the American College of Obstetrics and Gynecologists (2002).

However, there was evidence of unstructured physical activity which increased the level of acceptable physical activity in the majority of participants 82.1%. Walking was the most common activity that the women engaged in from both the private sector (88.8%) and public clinic (89.3%). The average time spent on walking was more than 30 minutes a day. Household chores and climbing stairs also increased the levels of physical activity within the participants.

Only a minority of participants (35.4%) stated that they were diagnosed with an adverse health condition, which prevented them from exercising. Some participants who did not exercise reported that fatigue was the reason for not being physically active (51.6%).

Conclusion:
Interventions need to be implemented to increase the knowledge of physical activity amongst pregnant women and the benefits that are associated with it. An attempt needs to be made by health practitioners to try and increase the level of physical activity among pregnant women, so that they may benefit from its effects.

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List of Abbreviations

ACOG: American College of Obstetricians and Gynecologists

ADA: American diabetes association

BMI: Body mass index

CHD: Coronary heart disease

DUT: Durban University of Technology

GDM: Gestational diabetes mellitus

Kg: Kilograms

KJ: kilojoules

Kcal: kilocalories

Km: Kilometer

KZN: KwaZulu-Natal

MDD: Maternal depressive disorder

MmHg: millimetres of mercury

OR: Odds Ratio

US: United states of America

List of Definitions

Artherosclerosis is the hardening of blood vessels by plaque (Kumar *et al.,* 2007).

Endorphins are hormones that are secreted by the pituitary gland for improvement of mood and prevention of depression (Poudevigne, M. S. and O'Connor, 2006).

Exercise is a category of physical activity that is intentional, structured and repetitive in order to maintain or improve physical fitness (Caspersen *et al*., 1985).

Human chorionic gonadotropin is produced by the placenta and is responsible for maintaining progesterone production by the corpus luteum (Clapp, 2000).

Hyperglycaemia is a condition in which an excessive amount of glucose circulates in the blood plasma. This is generally a blood sugar level higher than 11.1 mmol/l (Kumar *et al.,* 2007).

Hypertension is an an increased blood pressure, with the systolic pressure greater than 140 mmHg and the diastolic pressure greater than 90 mmHg (Eckel *et al*., 2014).

Gestational diabetes (GDM) occurs when blood glucose levels are raised during pregnancy, but resolved after pregnancy (American Diabetes Association, 2004).

Miscarriage is an unintentional termination of pregnancy (Nascimento *et al*., 2012).
Obesity is an increase in fat stores, particularly in the abdominal cavity causing an increase of the body mass index (BMI) to greater than 30 (Kumar *et al.,* 2007).
Oestrogen is produced by the placenta and is responsible for foetal well-being (Clapp, 2000).

Physical activity is defined as bodily movements that are produced by the skeletal muscles, which result in energy expenditure (Caspersen *et al*., 1985).

Preeclampsia is a pregnancy-related disorder that increases maternal hypertension to levels greater than 140/90 mm Hg (Haffejee, *et al*., 2013).

Pregnancy is the initiation of fertilization from the day of the last menstrual period up until birth (Nascimento *et al*., 2012).

Preterm birth occurs when the foetus is delivered before the three trimesters are complete (Nascimento *et al*., 2012).

Progesterone is a hormone that is produced in the ovaries, and is responsible in maintaining pregnancy (Clapp, 2000).

Prolactin is a hormone responsible for the change in the mammary gland structure from ductal to lobular – alveolar (Clapp, 2000).

Trimesters are stages in pregnancy each comprising of three months (Nascimento *et al*., 2012).

CHAPTER ONE
INTRODUCTION

1.1. Background

Regular exercise contributes positively to the physical and psychological health of both men and women. Exercise has been shown to reduce the risk of obesity, cardiovascular disease, diabetes and other diseases (Genest *et al*., 2012). An exercise program during pregnancy has benefits for both the mother and the child. It has been shown to reduce the risk of preeclampsia, gestational diabetes and preterm birth (Da Costa *et al*., 2003). Furthermore, exercise also improves pain tolerance, reduces the incidence of caesarean sections, reduces weight gain, improves self-image and reduces depression and low back pain (Hegaard *et al*., 2007). Exercising during pregnancy may protect against certain risk factors like gestational diabetes and increased weight gain (Watson *et al*., 2015).

In 1985, due to the limited knowledge, research and evidence based studies, the American College of Obstetricians and Gynecologists (ACOG) provided recommendations for exercise that were traditional, conservative and less strenuous on the mother and foetus (American College of Obstetricians and Gynecologists, 1985). Furthermore, women in the 1980s were restricted from performing intense activity continuously for more than 15 minutes per session, and were required to limit their heart rate to 140 beats per min (Abraham *et al*., 2001). However, more recent studies have shown that physical activity during pregnancy is beneficial for both the pregnant mother and foetus, as well as for the mother during the postpartum period (Clapp, 2002).

There are various types of physical activity pregnant women can engage in such as water aerobics, strength training and yoga. Many pregnant women are motivated to exercise as they believe it makes them energetic; while others exercise due to social pressure especially from spouses who want them to stay fit (Down *et al*., 2003). A study on American Caucasian women indicated that women are well educated on exercise and are involved in physical activity, but that the amount of exercise is reduced during pregnancy, due to the fear of strenuous activity harming the baby

(Hausenblas *et al*., 2008). To date, no studies have ascertained the knowledge and practices of exercise in pregnant women in South Africa; therefore, this study will fill in the gap in the literature.

There was a need to conduct research regarding exercise amongst South African pregnant women, particularly to determine whether any barriers to physical activity exist. There was also a need to determine reasons for exercise in those individuals who are physically active and whether there has been any self-perceived improvement in health benefits from the exercise (Watson *et al*., 2015).

A study on the knowledge and beliefs of medical practitioners in South Africa on exercise during pregnancy showed that 98% of medical practitioners were aware of the benefits of exercise during pregnancy, 19% provided their pregnant patients with information pamphlets and 83% were unaware of the recommended guidelines of exercise during pregnancy (Watson et al., 2015). This study also revealed that more than half of the study population requested information on exercise during pregnancy, from their health care providers. Research has shown that health care providers can have a positive effect on their patient's attitudes towards exercise (Clapp, 2000). This study will provide practitioners with information about pregnant women's knowledge and practices of exercise during pregnancy.

Two clinics have been chosen for this study. One of them is in Addington Hospital, which is a government regional hospital. The other is a private gynaecological practice run by Dr D Sankar. These clinics were chosen by purposive sampling as they have a high patient number in both the public and private sectors.

Since chiropractors treat back and joint pain, the results of this study will be useful for chiropractors and enable them to use this information in their management of their pregnant patients. Furthermore, educating women on the importance of exercise during pregnancy may lessen the burden of disease in this population.

1.2. Aims and Objectives

1.2.1. Aim

To compare the knowledge and practices of pregnant women regarding exercise during pregnancy between a selected private practice and public clinic.

1.2.2. Objectives

- To determine the knowledge and practices of pregnant women regarding exercise during pregnancy from patients attending a private practice clinic.
- To determine the knowledge and practices of pregnant patients regarding exercise during pregnancy from patients attending a public clinic.
- To compare the types of physical activity performed by pregnant women attending private and public-sector health care.
- To compare the types of physical activities performed during routine daily tasks.
- To compare the health status of pregnant women attending private and public-sector health care.

1.3. Flow of Thesis

Chapter two provides details on the literature on various physical activities that are beneficial during pregnancy, chronic diseases that are common during pregnancy and the effect that physical activity has on these diseases.
Chapter three reports the methodology that was undertaken to conduct the research study. Ethical considerations from all the respective authorities are highlighted here. The statistical tests that were used are also outlined in this chapter.
Chapter four explains the results of the study. This is presented in the form of graphs, figures, tables and written information.
Chapter five is a discussion on the results that were obtained in the study.

Chapter six provides a summary of the study and outlines recommendations for future studies.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents a detailed review of the types of physical activity that are beneficial for pregnant women during pregnancy. It also includes an insight into the risk factors and pathophysiology of chronic diseases that are associated with a sedentary lifestyle during and out of pregnancy. Various exercise routines have been discussed and the benefits that they have on the mother and the foetus are included.

The literature review was conducted using the following search engines: PubMed, Summons, Medscape and Google scholar. The keywords used in the search engines were as follows: “exercise in pregnancy”, “risk factors of exercise”, “risk factors of exercise during pregnancy”, “benefits of exercise”, “benefits of exercise during pregnancy”, ”perceptions of exercise by pregnant women”, “studies of exercise during pregnancy in South Africa”, “exercise and preeclampsia”, “exercise and diabetes”, “walking during pregnancy”, “cycling during pregnancy”, “weightlifting during pregnancy”, “household chores equivalent to exercise” and “household chores during pregnancy”.

2.2 Overview

Regular exercise contributes positively to the physical and psychological health of both men and women. Exercise has been shown to reduce the risk of obesity, cardiovascular disease, diabetes and other diseases (Genest *et al*., 2012). An exercise programme during pregnancy has benefits for both the mother and the child as it has been shown to reduce the risk of preeclampsia, gestational diabetes and preterm birth (Da Costa *et al*., 2003). It also improves pain tolerance, reduces the incidence of caesarean sections, reduces weight gain, improves self-image and reduces depression and low back pain (Dewey and McCrory, 1994; Rabkin *et al*.,

1990; Hall and Kaufmann, 1987; Hegaard *et al*., 2007; DeRosis and Pellegrino, 1982).

There are various types of physical activities that pregnant women can engage in such as water aerobics, strength training and yoga (Downs and Hausenblas, 2003). Many pregnant women are motivated to exercise as they believe it makes them energetic; while others exercise due to social pressure especially from spouses who want them to stay fit (Downs and Hausenblas, 2003). A study on American Caucasian women indicated that women are well educated on exercise and are involved in physical activity, but that the amount of exercise is reduced during pregnancy, due to the fear of strenuous activity harming the baby (Hausenblas *et al*., 2008). No other studies have been done to compare the knowledge and practices of exercise in pregnant women, particularly in South Africa; therefore, this study will fill in this gap in the literature.

Similar levels of structured physical activity were present in women from both the private and public-sector clinics. This is in contrast to that reported for American women. In that population, women who attended a private gynaecological practice, resided in a higher income area and were more highly educated, were more physically active than their counterparts from lower socio-economic areas, who attended the public health facilities (Petersen *et al*., 2005). Similarly, in another study by Evenson *et al*. (2004) researchers found that, physical activity was significantly greater among women with a higher education, younger age, those who attended a private gynaecological practice and women with good health. A possible reason for this difference is that most of the current study participants, both from the private practice and the public clinic, reported attending ante-natal classes. These classes offer a variety of advice on the well-being of the mother and the baby, and these include the benefits of exercise as well as lessons on how to exercise without causing any harm to both the mother and the foetus.

This study was carried out to determine the knowledge of physical activity amongst pregnant women and the levels of physical activity that they were involved in. While studies suggest that physical activity during pregnancy may have a positive impact on maternal and infant health, incorporating lifestyle interventions that increase physical activity during pregnancy is often difficult to deliver at primary care settings due to lack of time, lack of adequate knowledge on physical activity or negative attitudes among the patients to increase their physical activity.

The aim of this study is to determine the type and level of exercise that pregnant South African women participate in and to compare the amount of exercise performed between women attending public and private sector health care.

2.3 Pregnancy

2.3.1 Definitions

The initiation of pregnancy (fertilization) is the first day of the last menstrual period and the foetal age is called gestational age. Apart from the physical changes, the pregnant woman also undergoes mental and emotional changes. Normal pregnancy lasts up to 40 weeks and is grouped into three stages called trimesters, each comprising of three months (Nascimento *et al*., 2012).

2.3.2 Maternal Physiological changes

These are changes that a woman undergoes during pregnancy to accommodate her growing foetus. These include cardiovascular, hormonal, hematological, metabolic, renal and respiratory changes.

2.3.2.1 Hormonal changes

During pregnancy, there are fluctuations in hormone levels as well as secretion of new hormones. Oestrogen is produced by the placenta and is responsible for foetal

well-being (Clapp, 2000). During pregnancy, the progesterone levels increase 15 times more than the normal levels prolactin levels increase due to the increase in serum oestradiol concentrations during pregnancy.Human chorionic gonadotropin is also produced by the placenta and is responsible for maintaining progesterone production by the corpus luteum (Prager and Braunstein, 1995).

2.3.2.2. Cardiovascular changes

During pregnancy, the blood volume increases by 40-50 % thus resulting in an increase in heart rate of approximately 15 beats/min more than the pre-pregnancy heart rate (Ibanez *et al*., 2010). During the first trimester, the cardiac output increases by 50%. At 12-26 weeks, the diastolic blood pressure decreases by 15-20 mm Hg and increases again to pre-pregnancy levels at 36 weeks (Ibanez *et al*., 2010). This is due to the over exertion that is placed on the mother by the growing foetus, therefore slowing the mother down. Blood pressure levels above 140/90 mm Hg are indicative of preeclampsia (Ibanez *et al*., 2010) which is discussed in detail below.

2.3.2.3. Heamatological changes

During pregnancy, the blood volume increases by 40-50%, with an increase of 20-30% in red blood cell volume. Additionally, there is an increase in white blood cell count, which may peak over 20 mg/ml due to increased stress on the mother. Conversely there is also a decrease in platelet count to 100-150 mg/ml (Ibanez *et al*., 2010). Pregnant women are at risk of developing embolisms due to the changes in the hormone levels and blood composition, which could lead to blood clots (Soma-Pillay *et al*., 2016). Oedema or swelling of the lower limbs is also common during pregnancy, this is due to the enlarged uterus that compresses against the large veins in the pelvic area, preventing adequate drainage of the smaller veins in the lower limbs (Soma-Pillay *et al*., 2016).

2.3.2.4. Metabolic changes

During pregnancy, metabolic requirements of the mother changes. There is an increased requirement of nutrients needed to nourish the foetus and the mother. Pregnant women require an increased intake of protein during pregnancy, amino acids are actively transported to the placenta to nourish the growing foetus (Soma-Pillay *et al*., 2016).

2.3.2.5. Musculoskeletal changes

Due to the numerous anatomical, physiological and hormonal changes, there is a change in the posture and gait of a pregnant woman (Dunning *et al*., 2003). These changes increase the risk of falls and musculoskeletal disorders like low back pain, leg cramps and hip pain (Dunning *et al*., 2003). The pelvis tilts and the back arches to maintain balance (Whitcome *et al*., 2007). Poor posture may arise as the abdominal muscles stretch with the growing foetus (Whitcome *et al*., 2007). Increase in the hormones, oestrogen and relaxin cause the soft tissues, cartilage and ligaments to remodel. Relaxin also causes the pubic symphysis to become lax (Dunning *et al*., 2003).

2.4 Physical Activity

2.4.1 Definitions

Physical activity is defined as any bodily movement that is brought about by skeletal muscles that results in energy loss (US Department of Health and Human Services, 2008). The total energy required to complete an activity can be measured in kilojoules (kJ) or kilocalories (kcal); 4.184 kJ is essentially equivalent to 1 kcal (US Department of Health and Human Services, 2008). The term kJ is preferred because it is a measure of energy loss. However, the kcal, a measure of heat, is used more frequently. Everyone performs physical activity to sustain life, however, the amount of physical activity is largely due to personal choice and may vary considerably from person to person, as well as over time.

Physical activity can include everyday activities such as walking, office work, housework and gardening, Active recreational activities like dancing and sporting activities include: exercise, fitness training, swimming and tennis (US Department of Health and Human Services, 2008).

2.4.2 Physical activity during pregnancy

It is important to do some regular physical activity during pregnancy as part of a healthy lifestyle (Bauman, 2004). In most cases, moderate physical activity during pregnancy is safe and can have benefits for both the mother and baby and should not harm either of them. However, certain precautions need to be taken about the type of physical activity that is performed, such as, intensity, duration and position of the mother whilst exercising (Bauman, 2004). It is best to avoid supine and bending positions, as this can cause strain to the spinal column of the mother and prone position can affect the foetus (Avery *et al*., 1999). Care needs to be taken when doing any activity during pregnancy as excessive activity may harm the mother and foetus. Furthermore, hormonal changes can affect the muscles and ligaments, causing the joints to become more lax and mobile during pregnancy (Pollock *et al*., 2000).

2.4.3 Aerobic activity

Aerobic activity, also known as “cardio”, is any activity that increases the heart and breathing rate. Examples of aerobic activity are: structured exercises like brisk walking, jogging, running, swimming and water aerobics as well as unstructured exercises like heavy housework, climbing stairs, gardening and dancing (American College of Sports Medicine, 2009). These activities make a person mildly out of breath and sweaty (American College of Sports Medicine, 2009). Aerobic activity improves physical fitness and emotional health, it also prevents or reduces the risk of diabetes mellitus, depression, cardiovascular disease and osteoporosis. To maintain a healthy lifestyle, a minimum of 30 minutes of moderate-intensity aerobic activity for

five days a week is recommended (American College of Obstetrics and Gynecologists, 2002).

2.4.4 Muscle-strengthening activity

Muscle strengthening activities can include climbing stairs, lifting or carrying shopping items such as groceries, weight training, pelvic floor exercises, yoga or resistance exercises that use the major muscle groups (Pollock *et al*., 2000). These muscle groups consist of biceps, triceps, deltoids, erector spinae, quadriceps and hamstring muscles (Pollock *et al*., 2000). Strength training has shown to lower the risk of osteoporosis, osteopenia and bone fracture (Roubenoff and Hughes, 2000). Resistance training that is performed at least two times a week improves muscular strength and endurance by 25% to 100% (Pollock *et al*., 2000). It is recommended by the American College of Obstetricians and Gynecologists, that different types of exercises be performed to target all the major muscle groups (American College of Obstetricians and Gynecologists, 2002).

2.5 Types of Physical activity

2.5.1 Structured Physical activity

Exercise is a subcategory of physical activity. It is a type of physical activity that is structured and repetitive. It aims to improve or maintain physical fitness (Caspersen *et al*., 1985).

2.5.1.1 Jogging

During jogging, there is rhythmic forward movement of the lower limbs and this activates the lower limb muscles (Moore and Dalley, 2014). In addition, the thorax and abdominal muscles are also used to keep the torso in an upright position (Milburn, 1981). With good health and an uncomplicated pregnancy, jogging or running is not contra-indicated during pregnancy. Women who run regularly before pregnancy can usually continue with the running during pregnancy without any difficulty. It is recommended however, that the run must be of low intensity, low

speed, on a flat terrain and of a shorter duration, during pregnancy (American College of Sports Medicine, 2006). The American College of Sports Medicine recommends that pregnant women should begin with a warm up for 5-10 minutes by first stretching and walking, then jog at a slow and easy pace for about 5 minutes and cool down by walking for another 5-10 minutes (American College of Sports Medicine, 2006).

2.5.1.2 Swimming

Many forms of exercise are considered too aggressive and therefore are not recommended during pregnancy. Deep water aerobics, however, is a type of activity that is safe for people of all ages, health status and varying levels of fitness (Tanaka, 2009). Water acts as a cushion for the body's weight-bearing joints, reducing stress on muscles, tendons and ligaments. Swimming is a low impact sport, as the water supports the weight of the mother as well as the growing belly, thus, decreasing the weight that is put on the spine (American College of Obstetricians and Gynecologists, 2002). Pregnant women have been reported to benefit from the reduced impact of this activity (American College of Obstetricians and Gynecologists, 2002).Swimming during pregnancy increases maternal aerobic capacity and also provides pregnant women with a sense of well-being. It may also help in relieving morning sickness (American College of Obstetricians and Gynecologists, 2002).

The precautions to be taken while swimming are similar to performing other exercises. It is important for the swimmer to be well-hydrated and to maintain a heart rate between 120 and 140 beats per minute (to avoid overexertion) (US Department of Health and Human Services, 2008). No swimming stroke is considered dangerous, but diving should be avoided during pregnancy.

2.5.1.3 Yoga

Yoga is a multifaceted approach to exercise that involves stretching, mental balancing and focused breathing (Artal, 2003). Research suggests that prenatal yoga is safe and has many benefits for pregnant women such as reduction in low back pain, reduction in the risk of caesarean section and improvement in sleep and breathing patterns (Artal, 2003).

2.5.1.4 Walking

Walking is a simple way to keep physically fit and aids in the labour process by strengthening the pelvic muscles, increasing flexibility in the pelvic floor and keeping the mother energetic and active throughout the pregnancy (Saftlas *et al*., 2004). When walking, the pregnant woman should start off slowly to warm the body and muscles, then increase speed to a brisk pace for a better workout and the speed should not exceed that which she cannot tolerate (Saftlas *et al*., 2004). It is recommended that pregnant women, do brisk walking for 30 minutes for 5 days per week (American College of Obstetricians and Gynecologists, 2006). This helps the body to adjust to all the pregnancy and hormonal changes, improves blood circulation and oxygen transport to all the body organs as well as the foetus and increases the elasticity of the muscles to prepare for the birth (Saftlas *et al*., 2004). Brisk walking, which is an average walking pace of +/- 1.5 km/hour, is associated with a 30–33% reduced risk of GDM as compared to no walking at all (Dempsey *et al*., 2004; Zhang *et al*., 2006).

2.5.1.5 Weight lifting

Weight training strengthens muscles in both pregnant and non-pregnant women. It causes a temporary increase in blood pressure; the amount of increase depends on the amount of the weight being carried by the individual (Ibanez *et al*., 2010). There are long term benefits that are associated with weight training like, improvement of cardiovascular health (Marzolini *et al*., 2012). In non-pregnancy, the incorporation of strength training exercises of all the major muscle groups, into a fitness routine at

least two times a week, is recommended (US Department of Health and Human Services, 2008).

It was previously assumed that weight lifting and other resistance exercises may be too stressful and can cause injury during pregnancy (Pivarnik,1994). However, it is now widely recognised in both the fitness and medical communities that strength training, with appropriate modifications, such as weightlifting in a seated position instead of supine position, is beneficial to a woman's overall prenatal and postpartum physical and mental well-being (Artal, 2003). It is, however, advisable for pregnant women to avoid lifting very heavy weights (Marzolini *et al*., 2012).

The alterations in body weight, size and hormones during pregnancy can cause various problems for the mother. Many of these problems are associated with weakened musculature. Weak muscles result in increased inactivity, this together with added stress, brings about pregnancy related weight gain (Haskell *et al*., 2007). Weight training strengthens muscles and joints and decreases low back pain. Weight training exercises strengthen muscle groups that undergo stress and strain during pregnancy (Haskell *et al*., 2007). Weight training exercises that are recommended during pregnancy include the dumbbell bench press, dumbbell shrugs, bent over shoulder laterals as well as hip abductors and adductors. These exercises target the major muscle groups that include, pectorals, trapezius, deltoids, rhomboids and pelvic muscles (Haskell *et al*., 2007).

However, no matter which exercise, heavy weights more than 10Kg should always be avoided due to the strain they can put onto the abdomen, thus lighter weights are always recommended (Wolfe and Davies, 2003). Three full body sessions of 30 minutes per session a week with light weights is sufficient to gain physical fitness. Aerobic training, coupled with weight training, gives pregnant women a better overall health result (Wolfe and Davies, 2003).

There are certain precautions that pregnant women should take while weight training such as, using proper form and technique when lifting weights to reduce strain on the

lower back, abdomen and shoulder joints (US Department of Health and Human Services, 2008). They should also avoid pausing during inhalation and exhalation, as this increases the blood pressure. Breathing should be continuous and usage of lighter weights is recommended to prevent strain to the lower back and abdomen (Ibanez *et al*., 2010, US Department of Health and Human Services, 2008).

2.5.1.6 Cycling

Cycling is a moderate intensity physical activity, which targets all the main muscle groups in the lower limbs. It has been shown, that 30 minutes of cycling 3 times a week on a stationary or outdoor bicycle can reduce the risk of cardiovascular diseases, diabetes mellitus and obesity in both pregnant and non-pregnant women (American College of Obstetricians and Gynecologists, 2006). There are also numerous pregnancy related benefits, associated with cycling, like increased flexibility and strengthening of the pelvic floor muscles. Hence cycling during pregnancy allows for an easy birth. It is usually recommended that pregnant women use stationary bicycles only, as outdoor bicycles can be risky during pregnancy due to the uneven terrain and could increase the risk of falls (American College of Obstetricians and Gynecologists, 2006). However, if the woman was previously cycling, she can continue doing so during pregnancy, if her health is good and she has an uncomplicated pregnancy (American College of Obstetricians and Gynecologists, 2006).

In general, all structured activity burns calories and is thus useful for maintaining weight (American College of Obstetricians and Gynecologists, 2002). Table 2.1. shows the number of calories burnt when the listed exercises are conducted for a period of 30 minutes.

Table 2.1. Structured exercise and the number of calories burned.

Physical Activity	Calories/30 min
Jogging	236
Cycling	236
Aerobics	207
Walking – Brisk	185
Swimming	175
Dancing	171
Yoga	135
Walking – Slow	112
Weight training (moderate)	103

(American College of Obstetricians and Gynecologists, 2002).

2.5.1.7 Dancing

Dancing is a social activity that varies amongst different races, but is practiced by many individuals of both genders and all ages. It has been recently shown that dancing provides numerous health benefits such as weight loss, maintenance of general fitness, strengthening of abdominal muscles, relieving of back pain and stress as well as improvement of self-confidence (American College of Obstetricians and Gynecologists, 2002). Dancing also prevents diseases like depression, cardiovascular disease and musculoskeletal disorders (American College of Obstetricians and Gynecologists, 2002). However pregnant women need to ensure that one leg is always on the ground; furthermore, they need to avoid taking sudden sharp turns and jumping (American College of Obstetricians and Gynecologists, 2002).

2.5.1.8. Pilates

In recent years, Pilates has shown to play a vital role in rehabilitation and fitness (Segal, Hein and Basford, 2004). The aim of Pilates is to train an individual to strengthen the core and trunk musculature in co-ordination with respiration in order to achieve dynamic body flexibility (Segal, Hein and Basford, 2004). The core muscle are made up of the transverse abdominus muscle and trunk muscles which are the back extensor muscles that consist of iliocostalis, longissimus and spinalis, collectively known as the erector spinae muscles (Moore and Dalley, 2013). Pilates exercises are a sequence of muscle contraction exercises that allow for the maintenance of a neutral spinal posture and limits unnecessary dynamic muscle involvement during daily activities, which can eventually lead to muscular fatigue and spinal instability (Segal, Hein and Basford, 2004).

There are three goals to be achieved when performing Pilates: 1.) To coordinate normal breathing during movement. 2.) To stabilize the scapula, rib cage and hips during abdominal movements and 3.) To maintain normal head and cervical spine posture during all movements (Segal, Hein and Basford, 2004). Pilates is not part of aerobic activity and the intensity cannot be changed. However, Pilates has been proven to have numerous benefits like, decreased musculoskeletal and joint pain due to the compressive and decompressive forces that facilitate nutrition to joints and cartilage. It also increases strength, balance, coordination and posture in athletes and increases flexibility in rheumatoid arthritis patients (Segal, Hein and Basford, 2004).

2.5.1.9. Zumba

Dancing has been a form of unstructured physical activity for many years and recently been proven to have health benefits (Vahabi *et al.,* 2015). Furthermore, it can be used as a structured routine for improving cardiac function and losing weight (Vahabi *et al.,* 2015). The most applied form of dancing for these benefits is Zumba (Micallef, 2014). Zumba is a Latin-based fitness dance that allows for the loss of weight (Micallef, 2014). It consists of one-hour sessions that commence and end

with five to ten minutes of stretching (Micallef, 2014). Zumba consists mainly of moderate intensity movements with bouts of vigorous activity that add up to the recommended 75 minutes of vigorous activity per week (Micallef, 2014). Dancing provides immediate results such as a better physical well-being, improvement in mental health, sense of enjoyment, enhanced functional ability in arthritic patients and increases social well-being (Vahabi *et al.,* 2015). Cultural specific dancing has been shown to reduce the risk for heart diseases, obesity, depression and arthritis (Vahabi *et al.,* 2015).

2.5.2 Unstructured Physical activity

Unstructured physical activity is defined as an activity of daily living that is done without the purpose of improving or maintaining physical fitness (Caspersen *et al*., 1985). However, if any of these activities are performed at a moderate to vigorous pace, for a minimum of two and a half hours every week, they could also have health benefits (American College of Obstetricians and Gynecologists, 2001). These activities include climbing stairs, housework, gardening and walking to get to a desired destination (American College of Obstetricians and Gynecologists, 2001; Caspersen *et al*., 1985).

2.5.2.1. Housework

Household chores of moderate intensity can cause energy expenditure with resultant health benefits (Withers, et al., 2006). Sweeping, window cleaning and vacuuming are vigorous activities, particularly if they involve the moving of furniture (Gunn et al., 2004). These activities can be associated with health benefits and can be used as an alternative to walking or cycling (Withers, et al., 2006). Other activities such as dusting, tidying up and washing dishes are however not intensive and do not contribute to physical activity. However, some women have the misconception that doing daily household chores is equivalent to going to the gym and doing a structured workout (Taylor *et al*., 1978). Nonetheless, these women are overestimating the intensity or duration of the activity as well as the number of calories burnt while doing these chores (Taylor *et al*., 1978). House work may not be

sufficient to provide all the benefits of a structured workout. Some common household chores that can burn calories are indicated in Table 2.2.

Table 2.2. Household chores and the number of calories burned

Physical Activity	**Calories/30 min**
Climbing stairs	306
Carrying heavy loads	236
Scrubbing floors	163
Vacuuming	150
Mopping	132
Playing with kids	88
Sweeping	86
Ironing	77
Washing dishes	77

(Taylor *et al*., 1978)

In order for household chores to reap the benefits of physical activity, a broad range of chores needs to be carried out, preferably incorporated into an exercise routine, as often house work alone is an insufficient physical activity, particularly to lose weight (Taylor *et al*., 1978). A structured workout provides better results for the same amount of time spent. For instance, 30 minutes of vacuuming or sweeping floors burns about 130 calories, while 30 minutes of vigorous cycling on a stationary bike burns 400 calories, (American College of Sports Medicine, 2006). However, some housework is beneficial. For instance, 30 minutes of mowing the lawn with a hand

mower burns 215 calories, which is similar to the calories burnt during 30 minutes of combined jogging and walking. (American College of Sports Medicine, 2006).

2.5.2.2. Looking after children

Looking after and playing with children can increase fitness (Fredricks and Eccles, 2005). Actively playing with children can result in moderate to vigorous activity and if done daily can meet the requirement of acceptable physical activity (Fredricks and Eccles, 2005). Being involved in active games increases the heart rate and could burn up to 200 calories (Fredricks and Eccles, 2005). There are health benefits associated with looking after and playing with children, which include, cardiorespiratory fitness and loss of weight (Bassuk and Manson, 2010). Furthermore, active time spent with children increases their academic, psychological and social well-being.

2.5.2.3 Climbing stairs

Climbing stairs is an activity that improves blood circulation and strengthens major muscle groups in the hip and legs. Walking up and down stairs for 30 minutes burns 306 calories, which is equivalent to 20 minutes on a stepper at the gym (American College of Obstetricians and Gynecologists, 2001). As with any exercise there are risks and benefits that are associated with it. Performing the exercise incorrectly and with poor focus, can cause muscle strain, activate trigger points and compromise the pregnancy (Clapp, 1996). The biggest risk and fear in most pregnant women, regarding climbing stairs, is falling. In early pregnancy, the incidence of falls is less due to the centre of gravity being the same as before pregnancy (Clapp, 1996). During late pregnancy, the incidence is higher due to the enlarged abdomen and the change in the centre of gravity. This can make balancing difficult (Clapp, 1996).

2.5.3 Benefits of Physical activity

Physical activity and exercise have numerous benefits which include increased longevity, reduced risk from coronary heart disease, stroke, diabetes, hypertension, obesity, improved mental health and cognitive function (Bassey, 2000; Vogel *et al*., 2009). Regular physical activity has also been shown to increase and maintain weight loss, improve musculoskeletal conditions like osteoporosis and arthritis (Dunn and Jewel, 2010).

Coronary heart disease (CHD) also called Ischeamic Heart Disease (IHD) occurs when there is inadequate oxygen and blood supply to and from the heart (Kumar *et al.,* 2007). The myocardium, which is the main muscle of the heart needs adequate blood supply to ensure proper contraction which is ensured by the coronary arteries that transport oxygen and blood to the myocardium (Vardhan, 2006). When there is a blockage in the coronary artery due to artherosclerosis, the area of the myocardium that it supplies becomes ischaemic, which then leads to necrosis and eventually results in congestive heart failure (Vardhan, 2006). Moderate physical activity will increase the heart rate which then increases the blood supply to the heart muscles and to the rest of the body (Kumar *et al.,* 2007).

Diabetes mellitus is an extensive term used to describe disorders that cause increased blood glucose levels (hyperglycaemia), namely, type I, II and gestational diabetes (Kumar *et al.,* 2007). Normal blood glucose levels range between 70-120 mg/dL (Padoa, 2014). An individual is diagnosed as diabetic when random blood glucose levels increase to over 200mg/dL and when the fasting glucose concentration rises above126mg/dL (Kumar *et al.,* 2007). Regular physical activity decreases the risk of developing diabetes and decreases blood sugar levels. When performing exercises, the body burns energy. Excess glucose that is found in the bloodstream is taken up by the body tissues and converted to energy, therefore reducing blood sugar levels (Kumar *et al.,* 2007).

Obesity is defined as an increase in fat stores, particularly in the abdominal cavity, where the ratio of weight to height squared / body mass index (BMI) is greater than 30 (Kumar *et al.,* 2007). Individuals with normal BMI generally have high levels of physical activity, but these levels decrease with an increase in BMI (Salehi *et al.,* 2010). Obesity is a disease that is linked to CHD, diabetes and hypertension. When the body weight increases, the blood supply increases to accommodate the excess body tissue, which could indirectly lead to hypertension (Salehi *et al.,* 2010). Fat deposits can also affect arteries and can cause blockages, leading to artherosclerosis and then CHD. Women with obesity are more prone to developing diabetes, due to the body cells being less sensitive to insulin and the uptake of blood glucose by the cells. Regular exercise increases energy expenditure and thus decreases fat stores in the body, which prevents and decreases the risk of developing these diseases (Kumar *et al.,* 2007).

Low back pain refers to pain in the posterior aspect of the body, between the twelfth ribs and the gluteal folds and can be associated with or without pain referral to the lower limbs (Hoy *et al.,* 2014). Low back pain was ranked sixth in the Global Burden of Disease (Hoy *et al.,* 2012). Physical activity strengthens the musculoskeletal system and joints, thus making them stronger, healthier and less susceptible to injury. If an injury does occur, a stronger muscle will heal faster compared to a weakened muscle (Hoy *et al.,* 2014). During pregnancy when there is an increase in the body weight due to the large abdomen and foetus, there is increased strain placed on the lumbar spine. Physical activity will then strengthen the spine and be able to accommodate the growing foetus and extra weight gain (American College of Obstetrics and Gynecologists, 2002).

2.5.4 Benefits of physical activity during pregnancy

The exercises that are recommended in pregnancy differ from first to third trimester, and amongst different women who may present with certain illnesses or have certain preferences. The best type of exercise during pregnancy is one that increases the heart rate, maintains suppleness, manages weight gain by burning calories and

prepares the required muscles for labour and birth. These types of exercises include; brisk walking, swimming, aqua aerobics and riding a stationary bicycle (American College of Sports Medicine, 2006). During the entire pregnancy, it is best not to overheat; therefore, pregnant women are advised to avoid exercising in humid conditions for longer than 45 minutes (American College of Obstetricians and Gynecologists, 2001). The US exercise guidelines recommend that all healthy pregnant women should perform 150 min of moderate-intensity exercise per week. In the first trimester, it is safe for woman to perform the above exercises daily for 30 minutes. In the second trimester, exercise can be increased by 15 minutes or maintained and in the third trimester, it is advisable to reduce the exercise to three to four times a week to prevent over activity which can lead to early labour (American College of Obstetricians and Gynecologists, 2001).

Being physically active during pregnancy reduces the chances of developing varicose veins, reduces the incidence of swollen feet, ankles or hands, reduces the risk and severity of anxiety or depression, helps prevent upper and lower back pain, both during and after pregnancy and reduces the risk of developing gestational diabetes (American College of Obstetricians and Gynecologists, 2002).

Exercise during pregnancy is most often carried through to post pregnancy, making it easier for mothers to follow a routine. At this stage, the exercise intensity increases as the goal changes from being physically fit to maintaining a normal healthy pregnancy while preventing an excessive weight gain and improving self-image (American College of Obstetricians and Gynecologists, 2002). Postpartum exercise also reduces the risk of developing heart disease, osteoporosis, high blood pressure, colon and breast cancer and reduces weight (American College of Sports Medicine, 2006).

2.6 The effect of physical activity on metabolic diseases of pregnancy

The risk of developing high blood pressure (hypertension) increases with age (Durstine *et al*., 2009). Factors like smoking, stress, excessive weight and a family history of hypertension further increase the risk. Hypertension occurs when the weakened heart muscles pump blood against resistance to the entire body. When the pressure of the blood within the arteries is higher than it should be, this results in high blood pressure (Eckel *et al*., 2014). Physical activity strengthens the heart muscles, thus allowing the heart to pump more blood with less effort. Consequently, the pressure on the arteries is reduced, thus lowering the blood pressure (Eckel *et al*., 2014). This effect of reducing pressure on the arteries and thus lowering the blood pressure also occurs during pregnancy (Durstine *et al*., 2009).

Aerobic activity is particularly good at controlling high blood pressure. (Pal *et al*., 2013; Eckel *et al*., 2014). The American Department of Health and Human Services recommend at least 150 minutes of moderate aerobic activity or 75 minutes of vigorous aerobic activity a week, for health benefits such as keeping the blood pressure under control. However, pregnant women are required to reduce the intensity from moderate to mild-moderate and eliminate any vigorous activity (US Department of Health and Human Services, 2008).

Some chronic diseases that can be avoided by exercising during pregnancy are: pregnancy induced hypertension, gestational diabetes, musculoskeletal disorders, obesity and depression (Pivarnik *et al*., 2006).

2.6.1 Pregnancy Induced Hypertension (Preeclampsia)

Preeclampsia is a pregnancy-related disorder that increases maternal hypertension to levels greater than 140/90 mm Hg. The hypertension is accompanied by proteinuria of at least 300 mg of protein in a 24-hour urine sample or greater than 1+ on a urine dipstick. In addition, there is also marked peripheral oedema (Haffejee, *et al*., 2013). In severe cases, it leads to eclampsia which brings about seizures and/or

cerebral hemorrhage and is the second leading cause of maternal death in the United States (Genest *et al*., 2012). In South Africa, preeclampsia may affect 11.5% of pregnancies and is more common in women from low socio-economic backgrounds (Immink *et al*., 2008) Research suggests that regular prenatal exercise may prevent the progression of the disease (Weissgerber *et al*., 2004).

A retrospective study conducted in Canada indicated that women who participated in regular physical activity during the first 20 weeks of pregnancy, benefited with a 35-43% reduction in risk of preeclampsia compared to sedentary women (Sorensen *et al*., 2003). The researchers also noted that the relative risk of preeclampsia decreased as average time on physical activities increase (Marcoux *et al*., 1989). The risk of preeclampsia decreased in proportion to exercise intensity and total energy lost during the activities. Walking and climbing stairs are activities that are performed routinely and unconsciously daily. Performing these simple activities, reduces the risk of preeclampsia (Marcoux *et al*., 1989).

Aerobic exercise performed by non-pregnant women significantly reduced the systolic and diastolic blood pressures (Sorensen *et al*., 2003). Similarly, exercise has also been shown to reduce diastolic blood pressures in pregnant women, even in those with a history of mild hypertension, preeclampsia or family history of hypertensive disorders (Yeo *et al*., 2000).

2.6.2 Pregnancy induced Diabetes (Gestational diabetes)

Physical inactivity is a major risk factor for obesity and type 2 diabetes (Ben-Haroush *et al*., 2004). Obesity and gestational diabetes mellitus (GDM) are closely interrelated (Ben-Haroush *et al*., 2004). GDM is the most common medical complication associated with childbirth, affecting up to 10% of all pregnancies (Padayachee and Coombes, 2015). Women with GDM are prone to developing diabetes postpartum. GDM occurs when blood glucose levels are raised during pregnancy, but resolved after pregnancy (American Diabetes Association, 2004).

Physically active women who exercise throughout pregnancy show significantly lower rates of GDM than women who do not exercise regularly (Dempsey *et al*., 2004). Compared to inactive women, those who exercise during pregnancy reduce their odds of acquiring GDM by 59%. Those whose exercise levels are above average, reduce their odds even further, which indicates that performing more exercise increases the benefit of reducing disease.

Women with GDM are predisposed to having larger babies. Furthermore, there is an increased health risk for babies born to women with GDM. These babies are predisposed to type 1 or 2 diabetes mellitus later in life (Canadian Diabetes Association Clinical Practice Guidelines Expert Committee, 2003). Large babies are at greater risk of obesity, which, in turn, is a risk factor for diabetes mellitus (Catalano *et al*., 2003). The increased birth weight usually consists of excessive body fat, which causes the baby to be lethargic at birth, often leading to a caesarean section delivery. Babies born to women with GDM may also have very low blood glucose due to the high foetal insulin concentration produced in response to excess maternal glucose diffusing into foetal blood. Once the umbilical cord is cut, the high maternal blood glucose supply is cut off, while the foetal pancreas continues to deliver high concentrations of insulin into the foetal circulation. This results in hypoglycemia at birth, requiring intravenous glucose supply (Canadian Diabetes Association Clinical Practice Guidelines Expert Committee, 2003).

The American Diabetes Association (ADA) recommends that women with a normal pregnancy should start or continue a programme of moderate exercise as part of treatment for GDM. Research has shown that more physically active women have a lower prevalence of GDM (Dyke *et al*., 2002) and thus pregnant women are advised to embark on a physical activity programme (American Diabetes Association, 2004) However, frequency, intensity, time and type of physical activity that produce beneficial results for women with GDM differ (Dyke *et al*., 2002). The Canadian Diabetes Association suggests that, physical activity should be encouraged and modified to suit each individual patient (Canadian Diabetes Association Clinical Practice Guidelines Expert Committee, 2003).

2.6.3 Maternal physical activity and mental health

Alterations in mood and behaviour are common during pregnancy due to the hormonal and physical changes (Miller, 2002). During the first trimester, negative mood symptoms like anxiety and depression are often reported. Symptoms improve during the second trimester and worsen during the third (Miller, 2002). During the first few weeks after pregnancy, most women display negative mood symptoms or high emotional reactions, which subside without treatment (Miller, 2002). In addition to mood changes, women also have greater predisposition to clinically defined mood disorders, namely depression and anxiety (Wisner *et al*., 2002).

Most studies performed during the perinatal period suggest that Maternal Depressive Disorder (MDD) prevalence is similar during and after pregnancy, with an estimated prevalence of 10–20% (Miller, 2002). Anxiety disorders are also common in the perinatal period and often occur concomitantly with depression. Several factors increase the risk for mood disturbances during the perinatal period. Psychosocial factors that contribute to stress and depression are weight gain and body image, maternal stress and worry, sleep difficulties, change in routine, perceived lack of control, and changing role functions (Wisner *et al*., 2002). Recognized risk factors for perinatal depression include family history of depression, previous depressive episodes, social isolation, chronic health conditions, and stress (Wisner *et al*., 2002). Depression can contribute to substance use, lack of compliance with medical care, fewer healthy practices, reduced role functioning, and loss of income (Wisner *et al*., 2002).

Undiagnosed or untreated depressive disorders may lead to disruptions in family relationships after pregnancy, including infant attachment, and vulnerability to subsequent depression (Miller, 2002). Thus, recognition and treatment of postpartum mood disorders are important to the physical and psychosocial well-being of both mother and child. Antidepressant medications can be administered during pregnancy as well as postpartum. However, this has negative effects on the developing foetus. Furthermore, low medication concentrations have also been found in breast milk

which may also be detrimental to the baby (Miller, 2002). Thus, use of medications during the postpartum period requires careful consideration, with many women being reluctant to take them (Wisner *et al*., 2002).

There is evidence for improved mood with both short and long term physical activity. These include increased vigour, reduced fatigue, stress and anxiety, decreased symptoms of negative mood and depression, and improved self-concept (Dishman, 1998). Evidence suggests that exercise can also be effective in preventing and treating mild to moderate depression and anxiety (Dunn *et al*., 2001). In a study by Blumenthal *et al*., the effectiveness of exercise compared to antidepressant medication was examined in older adults diagnosed with mild to moderate MDD. After 16 weeks of treatment, all groups showed improvement in their depression, indicating that exercise is as beneficial as antidepressant medication in the treatment of depression and anxiety (Blumenthal *et al*., 1999).

Furthermore, there is consistent evidence of a beneficial effect of physical activity on body image, self-esteem, and general well-being during pregnancy. In a study by, Wallace *et al*, 1986, pregnant women participating in an aerobic exercise programme found that they had higher self-esteem and lower fatigue compared to sedentary controls (Wallace *et al*., 1986). Similarly, Hall and Kaufmann showed that pregnant women with high attendance at exercise classes had better self-image and less tension compared to women who had low attendance (Hall and Kaufmann, 1987).

2.6.4. Maternal physical activity and post-partum depression

Studies have shown an inverse relationship between maternal physical activity and both the incidence and severity of post-partum depression (Da Costa *et al*., 2003). Nordhagen and Sundgot-Borgen (2002), found that women who engaged in a moderate amount of pre-natal exercise had lower scores on a depression test that measures depressive symptoms during pregnancy and into the postpartum period in comparison with those women who were not active. Similarly, in a study by Koniak-

Griffin (1994), researchers found that six weeks of exercise had profound effects on reducing anxiety in an ethnically diverse population study of pregnant teenagers (Koniak-Griffin, 1994). The findings of these studies are similar to research studies in the general population, which show that exercise is as effective as medication in treating mild to moderate forms of depression (Martinsen, 2008). Furthermore, factors contributing to this anti-depressive effect are thought to include an increased biosynthesis of neurotransmitters, improved body composition, and better functional capacity. Moreover, the exercise does not have to be for a long period of time to provide positive results. Even a single bout of exercise has been shown to improve test scores of mood and depression in perinatal and postnatal women (Martinsen, 2008).

2.7. Conclusion

Some pregnant women are motivated to exercise because it makes them energetic, others exercise due to social pressure especially from spouses who want them to stay fit. In contrast, other women do not want to exercise because they believe that it will cause fatigue and may make them vomit (Downs and Hausenblas, 2003). Pregnant women have reported that even though they have access to a wide variety of information sources, including medical practitioners, family and the internet, exercise during pregnancy is a confusing topic (Clarke and Gross, 2004).

Exercise has been shown to be beneficial during pregnancy. Over the years, exercise has evolved from basic running, walking and swimming to aerobics, weight training and Pilates. Furthermore, these exercises have shown to have numerous benefits for both the mother and the foetus as well as post-partum benefits too. However, no matter what exercise is practiced, caution must be taken and careful consideration must be made with regards to position, duration and intensity. With regular physical activity, pregnant women can also prevent the risk of developing chronic illnesses, which are common during pregnancy as well as other general chronic illnesses that are linked with physical inactivity. However, recommendation and advice from the medical practitioner is important

CHAPTER 3
METHODOLOGY

3.1 Introduction

This chapter presents the methodology that was used in this research study. The methods will be described using the subheadings: research design, ethical considerations, population, study instrument, data collection and data analysis.

3.2 Research design

A quantitative, descriptive, cross sectional survey was used in this research study. A quantitative research study uses numerical data to explain a phenomenon (Babbie, 2010). The data is then analysed using statistics and then generalized across groups of people within the population to explain that phenomenon (Babbie, 2010). Cross sectional surveys are observational in nature. In this study, the knowledge of exercise and the level of physical activity practiced during pregnancy was analysed. The prevalence of exercise among pregnant women and type of physical activity that they were involved in were compared between women attending the government hospital clinic and a private gynaecological practice.

3.3 Ethical considerations

Ethical approval to conduct this study was obtained from the Durban University of Technology (DUT) Ethics Committee (IREC 104/16; Appendix A). Permission to conduct this study at Addington Hospital, a government hospital, was sought and obtained from the Department of Health, KwaZulu-Natal (KZN) (Appendix B). The head of public relations of Addington hospital also provided consent for the study (Appendix C). Permission was also sought and obtained from Dr D Sankar at Parklands Hospital (Appendix D). All participants were required to provide written informed consent (Appendix E). Participation in the study was voluntary and participants were informed that they could withdraw at any time with no adverse consequences. Privacy, anonymity and confidentiality were ensured as no names or personal identifying information were on the questionnaire. These were collected

separately from the signed consent forms. No reference was made to specific individuals throughout the study.

3.4 Population

The population consisted of pregnant women attending both public and private sector antenatal care in the Ethekwini municipal area of KwaZulu-Natal, South Africa. Public sector participants were drawn from the Addington Hospital public antenatal clinic (hereunder referred to as the public clinic) and private sector participants were drawn from the gynaecological practice of Dr D Sankar. A total of 400 pregnant women who fulfilled the inclusion criteria were invited to participate in the study. The following inclusion and exclusion criteria were set:

3.4.1 Inclusion criteria

- Pregnant women attending either the Addington Hospital public antenatal clinic or the private gynaecological practice of Dr. D Sankar in Durban.
- Pregnant women over the age of 18 years.
- Pregnant women from all races, cultures and socio-economic backgrounds.
- Primiparous and multiparous women.
- Fluency in either English or isiZulu

3.4.2 Exclusion criteria

- Those who did not consent to the study.
- Any pregnant women related to the researcher.
- Anyone who participated in the focus group and pilot study.

3.4.3 Sampling

The sample size was calculated by the statistician. Using the combined monthly patient population size of 2 000, at the private practice and public clinic, a confidence level of 95% and a confidence interval of 5%, a minimum sample size of 324 patients was calculated. As we expected a response rate of approximately 80%, 200 women from both the private practice and the public hospital clinic were targeted. A total of 379 questionnaires were answered.

Purposive, stratified sampling was used. This type of sampling is described as samples within samples. It is a type of non-probability sampling that allows the researcher to select units for a population, that the researcher is interested in studying (Patton, 2001). The two clinic sites were purposefully chosen for convenience. They were stratified by type of clinic, ie. public or private practice. The sample within each clinic was chosen randomly by inviting all patients at each on alternate days of the week.

The nurses at the public hospital clinic and the receptionist at the private gynaecological practice assisted the researcher to recruit participants. All prospective participants were approached at the time of recruitment and the study was explained both verbally and in writing. Those willing to participate were provided with a consent form to sign and subsequently a questionnaire to fill in.

3.5 Study instrument

A self-administered questionnaire (Appendix F) that was designed by the researcher was used as the study instrument. Relevant information from a previously validated questionnaire was used (Kader, 2016). Permission to use the questionnaire was sought and obtained from Dr Kader (Appendix G, H). After compilation of the original questionnaire (Appendix F), it was translated into isiZulu by a Health Science specialist, fluent in both English and isiZulu (Appendix I). To verify the translation, the isiZulu version was back-translated into English by a second translator fluent in both languages. The questions were based on exercise in general and exercise patterns related to pregnancy. These questions were closed ended and confined to either yes/no or Likert scale type questions.

There were a total of 26 questions in the questionnaire and they covered the following categories:

- Section A: Demographics
- Section B: Physical activities at home and at work
- Section C: Health status
- Section D: Knowledge of physical activity
- Section E: Physical Activity

3.5.1 Validity of the instrument

A focus group is a group of people who analyse the questionnaire in relation to the topic and provide the researcher with suggestions on improving or changing the questionnaire to alleviate any misinterpretations (Morgan, 1997). The focus group analyses the questionnaire to generate data that will improve the rationality and determine content and face validity (Morgan, 1997).

A focus/expert group discussion comprising of five people was conducted. The supervisor, an academic chiropractor, a newly graduated chiropractor, a bilingual senior chiropractic student and a pregnant woman (who is also a chartered accountant) made up the focus group.

The focus group members examined the original questionnaire (Appendix F) to determine whether it was ambiguous, understandable and relevant to the study. The recommendations that were made by the focus group team (Appendix J) were taken into consideration and the original questionnaire (Appendix F) was adjusted accordingly. This resulted in the generation of an updated post focus group questionnaire (Appendix K).

3.5.2 Reliability of the instrument

The post-focus group questionnaire (Appendix K) was then piloted for reliability using eight individuals from the population group, three of whom were isiZulu speaking participants. All eight individuals met the inclusion criteria for the study and answered

the questionnaire in English. The purpose of the pilot study was to detect flaws and establish the usefulness of questions and if necessary amend the questions to best fit the sample population so as to meet the objectives of the study.

The questions were brief and understandable. There were no changes or further recommendations made by any of the pilot study group participants. This questionnaire was thus used as the final survey document.

3.6 Data collection

Participants in the waiting area of both the private practice of Dr. D Sankar and the public-sector clinic at the Addington hospital were approached. The study was initially explained to them verbally. Those who met the inclusion criteria and who were willing to participate were provided with an information sheet and an informed consent form (Appendix E). Following the signing of the consent form, data was collected by means of a self-administered questionnaire in the participants' preferred language, either English (Appendix K) or isiZulu (Appendix I). Participants took approximately 5-10 minutes to complete the questionnaire. The researcher was available throughout the data collection stage to assist any participant who required assistance in filling out the questionnaire. All participants from both the clinics filled out the questionnaire in English, as they were all fluent in English. Objectivity, lack of coercion and freedom from bias were maintained throughout the study procedure by the researcher. The completed questionnaires were collected and deposited in a sealed box, separate from the signed informed consent forms, to ensure complete anonymity. The data from the questionnaires were captured on an Excel spreadsheet prior to exporting onto the statistical programme, SPSS (version 24) for data analysis.

3.7 Data analysis

3.7.1 Statistical analysis

The data collected were analysed using SPSS to compute the findings for this research. The following two types of statistics were calculated:

- Descriptive statistics, such as frequencies, percentages and graphs were used to describe the demographic profile of respondents and their physical activities. The reason descriptive statistics were used in this study was to describe and compare variables numerically, as well as to provide a broad overview of trends within the data (Saunders *et al*., 2009).
- Inferential statistics, including Chi-Square tests of association and student *t*-tests were used to determine differences in proportions and means respectively between the two categories of participants. Chi-Square tests were used to determine the association between variables (Saunders *et al*., 2009).
- Odds ratios (OR) were calculated to ascertain the measure of association between a risk factor and an outcome. The OR represents the odds of an outcome given a particular risk factor, compared to the odds of the outcome occurring in the absence of that risk factor (Szumilas, 2010).
- Calculation of the amount of exercise carried out by each woman were as follows: Time spent on household chores + Time spent walking to transport + Time spent on exercise + Number of flights of stairs climbed daily.

CHAPTER FOUR
RESULTS

4.1 Introduction

This chapter explains the results of this research study. Tables and graphs have been used where applicable.

4.2 The Sample

A total of 400 questionnaires were distributed and 346 completed questionnaires were received. This gave a response rate of 86.5%. There were 198 (57.6%) participants from the private gynaecological practice and 146 (42.4%) from the public clinic at Addington Hospital.

4.3 Demographics

This section depicts the biographical characteristics of the respondents.

4.3.1. Age

The mean age of the study population was 27.65 ± 5.3 years (5.3 years = Standard deviation). The majority of women were from the age category of 25-29 years (35.7%, *n* = 123), followed by ages 20-24 years (27.2%, *n* = 94) and 30-34 years (22.6%, *n* = 78). The majority of the women from the public clinic were in the age group 20-24 years compared to those from the private clinic who were 25-29 years ($p < 0.001$). The age categories are shown in Figure 4.1.

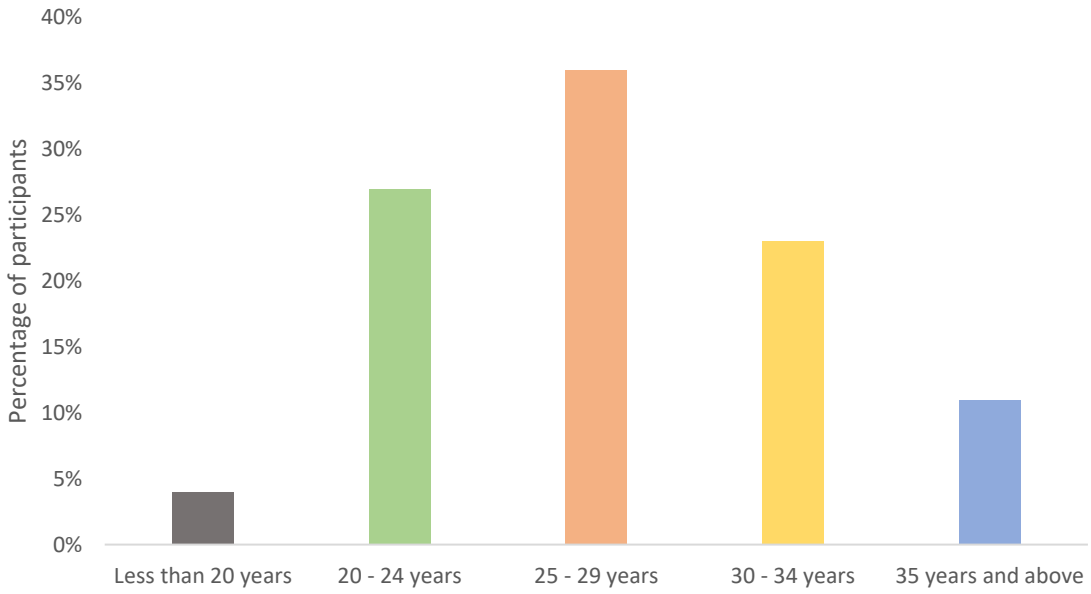

Figure 4.1. Distribution of participants in the different age categories.

4.3.2. Race

Almost half of the study population were Indians (46.2%, *n* = 159). Blacks made up the second largest part of the study population (39.2%, *n* = 135) and there was a small proportion of White (7.6%, *n* =26) and Coloured (7.0%, *n* = 24) participants. The racial profile is depicted in Figure 4.2. Significantly more Indians (69.2% *n* =137) attended the private gynaecological practice compared to Blacks who attended the clinic at the public hospital (78.1%, *n* = 114; $p < 0.001$). The White and Coloured population were a minority at both the clinics.

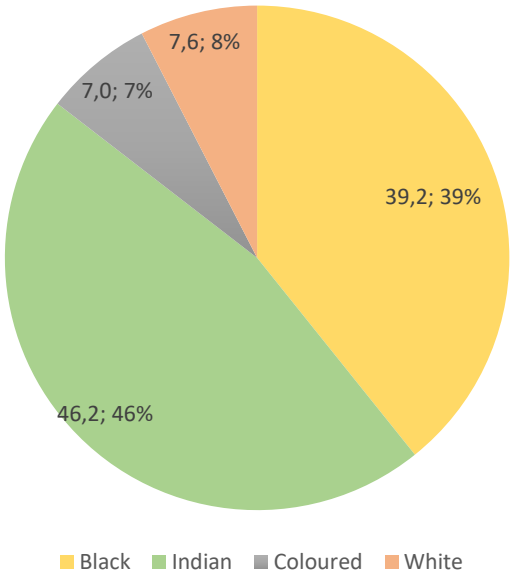

Figure 4.2. Distribution of participants from the different race groups.

4.3.3. Stage of pregnancy

Women from all stages of pregnancy formed part of the study population. Table 4.1 shows the proportion of women, who were at various stages in pregnancy. The majority of the study participants were in their eighth month of pregnancy (22.9%, *n* = 78). There was no difference in the stage of pregnancy of participants from the private gynaecological practice and the public hospital clinic (*p* = 0.605).

Table 4.1 Distribution of women in the various stages of pregnancy

Months Pregnant	**Total participants % (*n*)**
2 months	4,4 (15)
3 months	7,9 (27)
4 months	9,4 (32)
5 months	9,7 (33)
6 months	16,5 (56)
7 months	18,2 (62)
8 months	22,9 (78)
9 months	9,7 (33)
Did not know	1,2 (4)

4.3.4. Pregnancy history

Almost half of the study population (48.2%, *n* = 164) reported that the current pregnancy was the first pregnancy. This was similar for the participants from the private gynaecological practice and the public clinic (*p* = 0.316). A minority of participants (22.9%, *n* = 78) reported to have suffered a miscarriage in their previous pregnancies. There was no difference between the number of miscarriages in the private practice (21.6%, *n* = 42) when compared to the number of miscarriages in the public clinic (24.7%, *n* = 36; *p* = 405). Figure 4.3 depicts the number of participants who suffered a miscarriage in the two study sites. Almost a quarter (21.5%, *n* = 73)

of the participants reported that that had a pregnancy related health problem in this pregnancy. This was similar in both the private practice (20.1%, *n* = 39) and the public clinic (23.3%, *n* = 34, *p* = 0.54). There was no relationship between previous miscarriage and the likelihood of women exercising in pregnancy (p = 0.242; Fishers exact test).

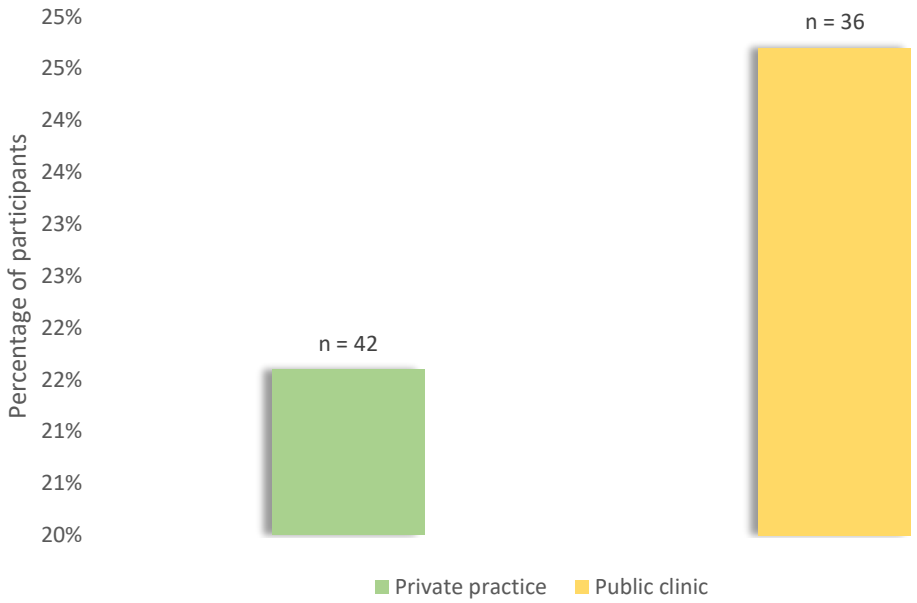

Figure 4.3 Number of participants who suffered a miscarriage.

4.3.5. Employment history

A third of the study population were employed (33.5%, *n* = 113). A similar proportion of women from the private practice (34.6%, *n* = 67) and the public clinic (31.9%, *n* = 46; *p* = 0.594) were employed.

4.4. Physical activity

4.4.1 Structured physical activity

More than half of the study participants were involved in exercise during their pregnancy (57.1%, *n* = 194). Although a greater proportion of women from the

private sector (60.3%, *n* = 117) compared to the public sector (52.7%, *n* = 77) reported exercising during pregnancy, this difference was not statistically significant (*p* = 0.163). Furthermore, many participants stated that they were physically active prior to their pregnancy (59.1%, *n* = 201). There was no significant difference between the number of women from the private sector (61.1%, *n* = 118) being involved in physical activity compared to those from the public sector (57.2%, *n* = 83; *p* = 0.470). Although 57.1% of the participants indicated some form of structured physical activity during pregnancy, only 37% of the study population met the criteria of physical activity, which is 30 minutes of moderate -intensity aerobic exercise, per day, for 5 days a week, during pregnancy as set out by the American College of Obstetrics and Gynecologists (2002).

Walking was the most common activity that the women engaged in from both the private sector (88.8%, *n* = 111) and public clinic (89.3%, *n* = 75; *p* = 0.912). The average time spent on walking was more than 30 minutes. Table 4.2 indicates the different types of activities that the participants from the private and public sector engaged in.

Table 4.2 Type of physical activity performed by the participants

Type of exercise	**Total participants % (*n*)**	**Private practice % (*n*)**	**Public clinic % (*n*)**	***p* - value**
Walking	89.0 (186)	88.8 (111)	89.3 (75)	0.912
Swimming	34.6 (72)	41.9 (52)	23.8 (20)	0.007
Jogging	30.0 (62)	23.4 (29)	39.8 (33)	0.012
Yoga	16.3 (34)	24.2 (30)	4.8 (4)	< 0.001
Zumba	9.1 (19)	13.6 (17)	2.4 (2)	0.006
Weight lifting	8.2 (17)	12.1 (15)	2.4 (2)	0.012
Cycling: Stationary	6.7 (14)	9.7 (12)	2.4 (2)	0.039
Cycling: Moving	5.3 (11)	4.8 (6)	6.0 (5)	0.725
Pilates	5.8 (12)	7.3 (9)	3.6 (3)	0.263
Water Aerobics	4.8 (10)	5.6 (7)	3.6 (3)	0.493

The women who attended the private gynaecological practice were involved in more diverse forms of exercises. Swimming (41.9%, *n* = 52) being the most popular activity, followed by yoga (24.2%, *n* = 30) and jogging (23.4%, *n* = 29). The average amount of time that was spent on each activity was between 15 – 20 minutes per session.

From Table 4.2, it is evident that there was a difference in preference for various activities between the participants who attended the two clinics. For instance, weight lifting (12.1%, *n* = 15 *vs* 2.4%, *n* = 2; *p* = 0.012), swimming (41.9%, *n* = 52 *vs* 3.8%, *n* = 20; *p* = 0.007), yoga (24.2%, *n* = 30 *vs* 4.8%, *n* = 4; *p* < 0.001; Fisher's exact test), Zumba (13.6%, *n* = 17 *vs* 2.4%, *n* = 2; *p* = 0.006) and cycling a stationary bike (9.7%, *n* = 12 *vs* 2.4%, *n* = 2; *p* = 0.039) were preferred by women who attended the private gynaecological practice compared to those who attended the public clinic. Conversely jogging was preferred by women who attended the public clinic (39.8%, *n* = 33) compared to those who attended the private practice (23.4%, *n* = 29; *p* = 0.012).

The amount of time that was spent on activities by the women who attended the private gynaecological practice was greater compared to the women who attended the government hospital clinic. For instance, water aerobics (20 minutes *vs* 13 minutes; *p* = 0.010). Figure 4.4 gives a full breakdown of all the exercises and the time spent on these by women attending the two study sites.

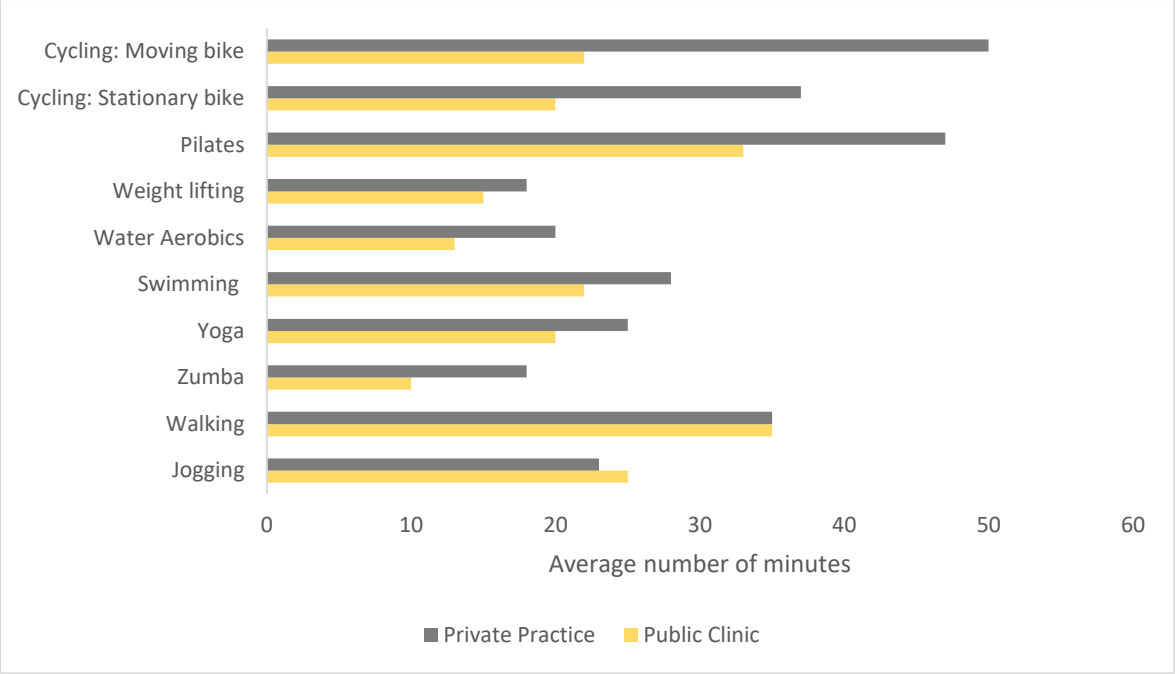

Figure 4.4 Illustration of time spent on exercises by women from the private and public sector.

More than half of the study population (59.5%, *n* = 201) reported that they were involved in exercise prior to their pregnancy and during pregnancy the number of physically active women decreased to (57.1%, *n* = 194). It is evident that some women stopped exercising due to pregnancy. These participants included reasons for not being physically active. The most common reason that was reported by the participants for not being physically active was fatigue. Table 4.3 indicates the various reasons cited by the participants. It must be noted that more women who were employed (33.5%, *n* = 113) exercised during pregnancy compared to those who were unemployed (66.5% *n* = 224, *p* = 0.594). The odds of exercising were higher in those participants who were employed during their pregnancy (*p* = 0.054; OR 1.5, 95% CI: 0.9 – 2.5).

Table 4.3 Reasons for lack of physical inactivity (*n*= 152)

Reason	**Total participants % (*n*)**	**Private practice % (*n*)**	**Public clinic % (*n*)**	***p* - value**
I feel tired when I exercise	51.6 (89)	47.5 (47)	57.5 (42)	0.192
I feel tired all the time	32.6 (56)	35.4 (35)	28.8 (21)	0.362
My doctor has advised me to rest	32.2 (55)	37.4 (37)	25.0 (18)	0.087
I feel tired after I exercise	30.2 (52)	31.3 (31)	28.8 (21)	0.719
I am not in good health	18.6 (32)	19.2 (19)	17.8 (13)	0.818
Exercise will harm the baby	14 (24)	17.2 (17)	9.6 (7)	0.156
Exercise will harm me	1.2 (2)	1.0 (1)	1.4 (1)	0.828
I don't feel exercise is necessary	0.6 (1)	1.0 (1)	0.0 (0)	0.389

4.4.2. Unstructured physical activity

4.4.2.1. Household chores

The majority of the study participants from both the private (80.9%, *n* = 157) and public sector (89.0%, *n* = 130) were engaged in household chores with more women from the public-sector clinic involved in these chores (*p* = 0.041). The average time spent on each chore was 15 – 25 minutes. Figure 4.5 illustrates the chores performed and the average time spent on each by women from the private and public sector.

The chore most frequently performed by women from both sectors was washing dishes. However significantly more women from the public sector performed this chore (85.0%, n = 244; p = 0.005). Significantly more women from the public-sector clinic compared to those from the private gynaecological practice also swept (86.2% *vs* 63.7%, $p < 0.001$), ironed (80.8% *vs* 63.7%, $p < 0.001$) and hand-washed clothes (77.7% *vs* 54.1%, $p < 0.001$). Table 4.4 compares the chores undertaken by participants from the two clinics.

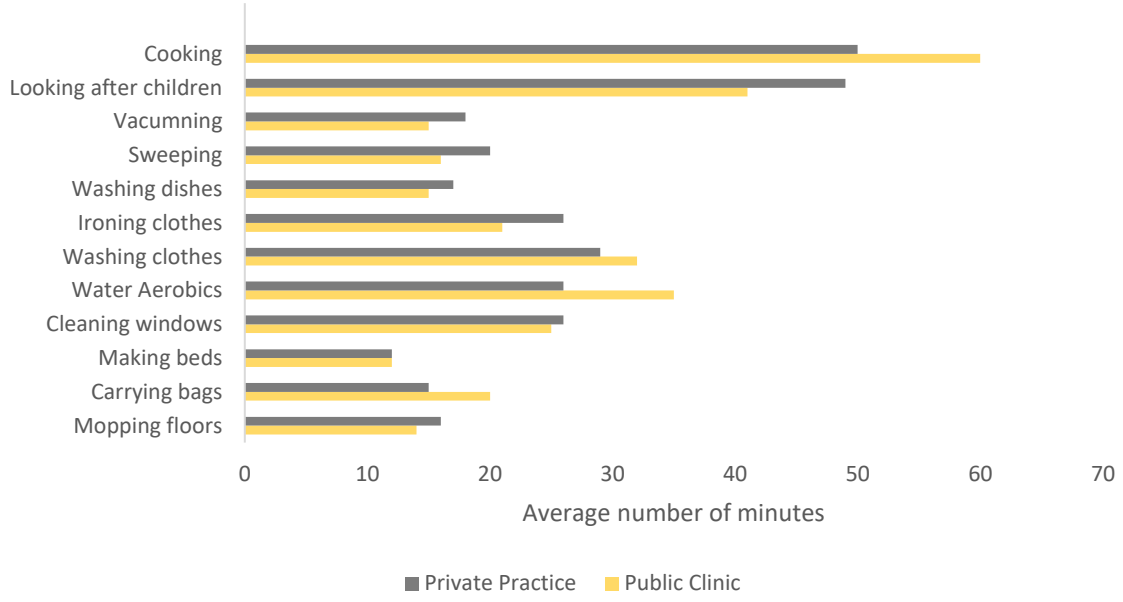

Figure 4.5 Illustration of time spent on various household chores.

Table 4.4 Household chores performed by the participants

Household chore	**Total participants % (*n*)**	**Private practice % (*n*)**	**Public clinic % (*n*)**	***P* - value**
Washing dishes	85.0 (244)	79.6 (125)	91.5 (119)	0.005
Making beds	82.2 (236)	76.4 (120)	89.2 (116)	0.005
Carry bags	75.6 (217)	75.8 (119)	75.4 (98)	0.936
Sweeping	73.9 (212)	63.7 (100)	86.2 (112)	< 0.001
Ironing clothes	71.4 (205)	63.7 (100)	80.8 (105)	< 0.001
Mopping floors	66.9 (192)	60.5 (95)	74.6 (97)	0.011
Hand washing clothes	64.8 (186)	54.1 (85)	77.7 (101)	< 0.001
Carry heavy objects	45.7(154)	47.2 (91)	43.8 (63)	0.535
Looking after children	51.9 (149)	58.0 (91)	44.6 (58)	0.024
Cleaning windows	37.6 (108)	38.2 (60)	36.9 (48)	0.822
Vacuuming	28.6 (82)	37.6 (59)	17.7 (23)	< 0.001
Scrubbing floors	23.0 (66)	21.7 (34)	24.6 (32)	0.553
Cooking	16.1 (50)	24.0 (43)	5.3 (7)	0.001

Time spent looking after children was significantly greater in women who attended the private gynaecological practice (49.5 minutes) compared to women who attended the public clinic (40.5 minutes; $p = 0.012$).

The odds of exercising were higher in those women who did not carry heavy objects in their pregnancy ($p = 0.013$; OR 1.34, 95% CI: 1.06 – 1.69). The odds of exercising were not significant for any of the other chores.

The mean activity per week was 428.6 +/- 299min. The number of people that had performed activities per week is 324 (93%). However, the total number of people who had more than 150 minutes of exercise per week was 269 (85.6%). There was no difference between the activity levels of the women who attended the private clinic (439.11 +/- 295 min per week) compared to those who attended the public clinic (477.92 +/- 301 min per week, p = 0.067).

4.4.2.2. Climbing stairs

More than half of the respondents (61.2%, *n* = 208) climbed stairs, either at home or at work, as part of their daily routine. Although, more women from the private gynaecological practice (63.9%, *n* = 124) compared to women from the government hospital clinic (57.5%, *n* = 84) climbed stairs, this difference was not significant (*p* = 0.232). The number of flights climbed daily varied with more women from the public clinic climbing more than three flights of stairs daily (*p* = 0.044). The odds of climbing stairs were higher in those women who exercised during pregnancy (OR 1.9, 95% CI: 1.36 – 3.06; *p* = 0.003). Similarly, those who exercised prior to their pregnancy were more likely to climb stairs (OR 1.8, 95% CI: 1.2 – 2.8, *p* = 0.009).

Furthermore, the odds of climbing stairs were higher in women who thought that exercise was beneficial to their health (OR: 4.41; 95% CI: 1.15 – 16.93, *p* = 0.02). Similarly, the odds of climbing stairs during the pregnancy were higher in women who believed that exercise during pregnancy was beneficial (OR: 4.02, 95% CI: 2.19 – 7.35, *p* < 0.001).

4.4.2.3. Transport

There was a significant difference in the types of transport used by the study participants (*p* < 0.001). Most participants used a car (53.6%, *n* = 187) as their main mode of transport, some used public transport (taxi, bus or train) (24.9%, *n* = 87) whilst others walked (4.0%, *n* = 14). Some participants used a combination of both

car and walking (4.0%, *n* = 14) as their means of transport while others used a combination of public transport and walking (10.6%, *n* = 37). Significantly more women from the private practice used a private car (78.3%, *n* = 155) compared to women from the public clinic who used public transport (51.5%, *n* = 75; *p* < 0.001). Figure 4.6 gives a breakdown of the transport used among the study participants.

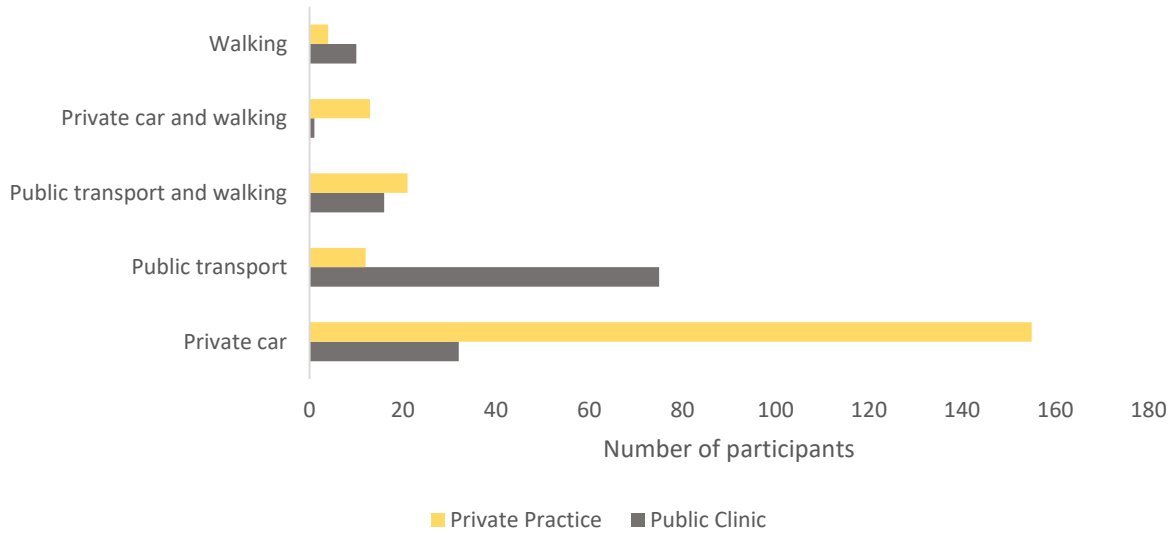

Figure 4.6 Modes of transport used by the participants

More than half of the total study population (51.2%, *n* = 173) reported walking for more than ten minutes to and from their main mode transport. The majority of these participants were from the public clinic (72.6%, *n* = 106) compared to those from the private gynaecological practice (34.9%, *n* = 67; *p* < 0.001).

Most of the respondents who used a personal vehicle reported that they parked wherever they found parking (54.2%, *n* = 103), others parked closer to the entrance (38.4%, *n* = 73) and a minority parked further away from the entrance (4.2%, *n* = 8; *p* = 0.073).

Although through structured exercise, only 37% of the study population met the international criteria of physical activity (30 minutes of moderate -intensity aerobic exercise per day for 5 days a week) during pregnancy, when taking unstructured physical activity into consideration, the overall acceptable prevalence of physical activity in the study population increased to 82.1%.

4.5. Health Status

Only a minority of participants (35.4%, *n* = 118) stated that they were diagnosed with an adverse health condition. There was no difference in the number of women, who were diagnosed with any medical condition, between the private gynaecological practice (32.8%, *n* = 62) and the public clinic (38.9%, *n* = 56; *p* = 0.250). Hypertension (18.1%, *n* = 37), diabetes mellitus (17.15, *n* = 34) and anaemia (16.6%, *n* = 33) were the most common diagnosed conditions, reported by participants from both settings. Full details of these and other diagnoses are provided in Table 4.5.

Table 4.5 Health conditions of study participants

Health condition	**Total participants % (*n*)**	**Private practice % (*n*)**	**Public clinic % (*n*)**	***p* - value**
Hypertension	18.1 (37)	14.3 (15)	22.2 (22)	0.141
Diabetes	17.1 (34)	11.5 (12)	23.2 (22)	0.030
Anaemia	16.6 (33)	22.1 (23)	10.5 (10)	0.028
Hypotension	9.0 (18)	12.5 (13)	5.3 (5)	0.075
Thyroid disease	5.5 (11)	9.6 (10)	1.1 (1)	0.008
Arthritis	4.0 (8)	3.8 (4)	4.2 (4)	0.896
Depression	2.0 (4)	1.9 (2)	2.1 (2)	0.927

More women from the public clinic (23.2%, *n* = 22) were diagnosed with diabetes compared to women who attended the private gynaecological practice (11.5%, *n* = 12; *p* = 0.030). In contrast, more women from the private practice were diagnosed with anaemia (22.1%, *n* = 23) compared to women who attended the public clinic (10.5%, *n* = 10; *p* = 0.028). Thyroid disease was also more common in women who attended the private practice (9.6%, *n* = 10) compared to those who attended the public clinic (1.1%, *n* = 1; *p* = 0.008). The odds of those women who were diagnosed with a health-related problem during pregnancy were more likely to be advised by their doctor to rest during the pregnancy (OR: 1.58, 95% CI: 0.8 – 3.1). This was however not significant (*p* = 0.17), as many women who were advised to rest did not have any health-related pregnancy problem (*n* = 46).

In those women who reported having a medical condition, the majority of them stated that the condition was diagnosed during the pregnancy, with the most common conditions being diabetes (94.1 %, *n* = 32) followed by anaemia (81.8%, *n* = 27) and hypertension (64.9%, *n* = 24). Table 4.6 gives a breakdown of the various ailments and the period in which they were diagnosed. Figures 4.7, 4.8 and 4.9 illustrate the main conditions among the study participants and the period of diagnosis.

Table 4.6 Period of diagnosis of the various health conditions by the participants.

Health condition	**Private practice % (*n*)**		**Public clinic % (*n*)**		***p* - value**
	Before pregnancy	**During pregnancy**	**Before pregnancy**	**During pregnancy**	
Diabetes	8.3 (1)	91.7 (11)	4.5 (1)	95.5 (21)	0.654
Anaemia	17.4 (4)	82.6 (19)	20.0 (2)	80.0 (8)	0.858
Hypertension	40.0 (6)	60.0 (9)	31.8 (7)	68.2 (15)	0.609
Hypotension	23.1 (3)	76.9 (10)	0.0 (0)	100.0 (5)	0.239
Thyroid disease	70.0 (7)	30.0 (3)	100.0 (1)	0.0 (0)	0.521
Depression	100.0 (2)	0.0 (0)	50.0 (1)	50.0 (1)	0.248

Diabetes that is diagnosed during pregnancy is known as gestational diabetes. Many of the participants had gestational diabetes as this diagnosis was made during pregnancy (Dempsey *et al*., 2004). Although more women with gestational diabetes were from the public clinic (95.5%, *n* = 21) compared to the private practice (91.7%, *n* = 11), this difference was not statistically significant (*p* = 0.654). Figure 4.7 illustrates the number of participants with diabetes and gestational diabetes from the two study settings.

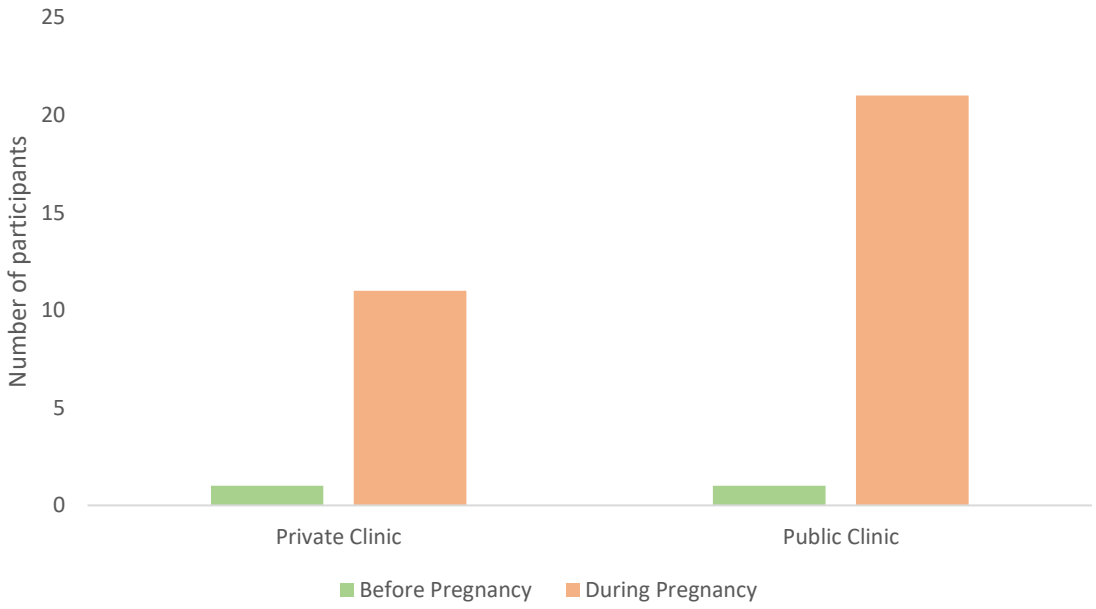

Figure 4.7. Illustration of the number of participants diagnosed with diabetes before and during pregnancy.

Many women reported anaemia during their pregnancy. There was no difference between the number of pregnant anaemic women from the private practice (82.6%, *n* = 19) and from the public clinic (80.0%, *n* = 8; *p* = 0.858). Figure 4.8 illustrates the number of anaemic women from the two study settings.

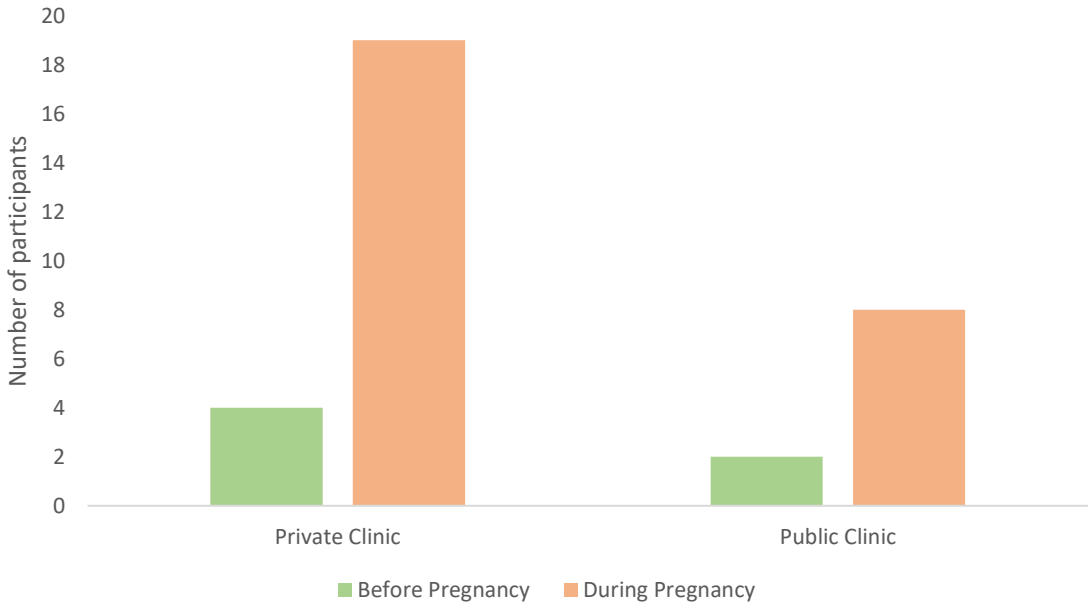

Figure 4.8. Illustration of the number of participants and the period in which they were diagnosed with anaemia

Although more women who attended the public clinic were diagnosed with hypertension compared to those from the private practice, this difference was not statistically significant (68.2%, *n* = 15 vs 60.0%, *n* = 9; *p* = 0.609). Figure 4.9 illustrates the number of women with hypertension from the two study settings.

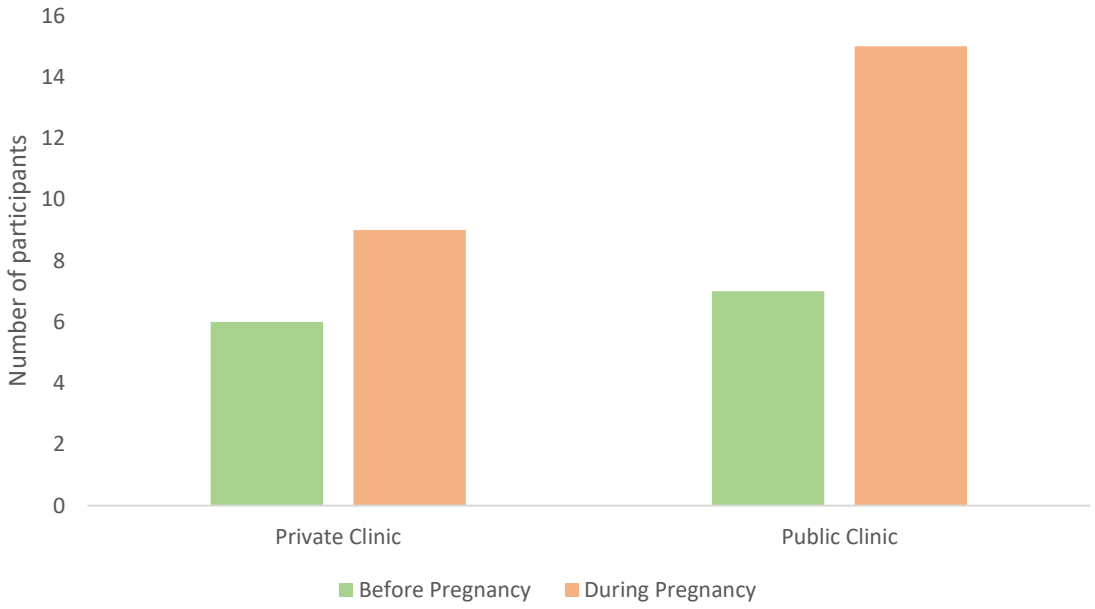

Figure 4.9. Illustration of the number of participants and the period in which they were diagnosed with hypertension

More than half of the study population (61.2%, *n* = 208) reported that they took some form of medication or supplement during their pregnancy. Significantly more women from the private gynaecological practice (68.6%, *n* = 133) compared to those from the public clinic (51.4%, *n* = 75, *p* < 0.001), took medication during the pregnancy.

Most commonly, the participants reported that they took multi-vitamin, iron and calcium supplements. Figure 4.10 illustrates the type of medication taken by the participants. Not all participants who were diagnosed with a condition were on medication for that condition.

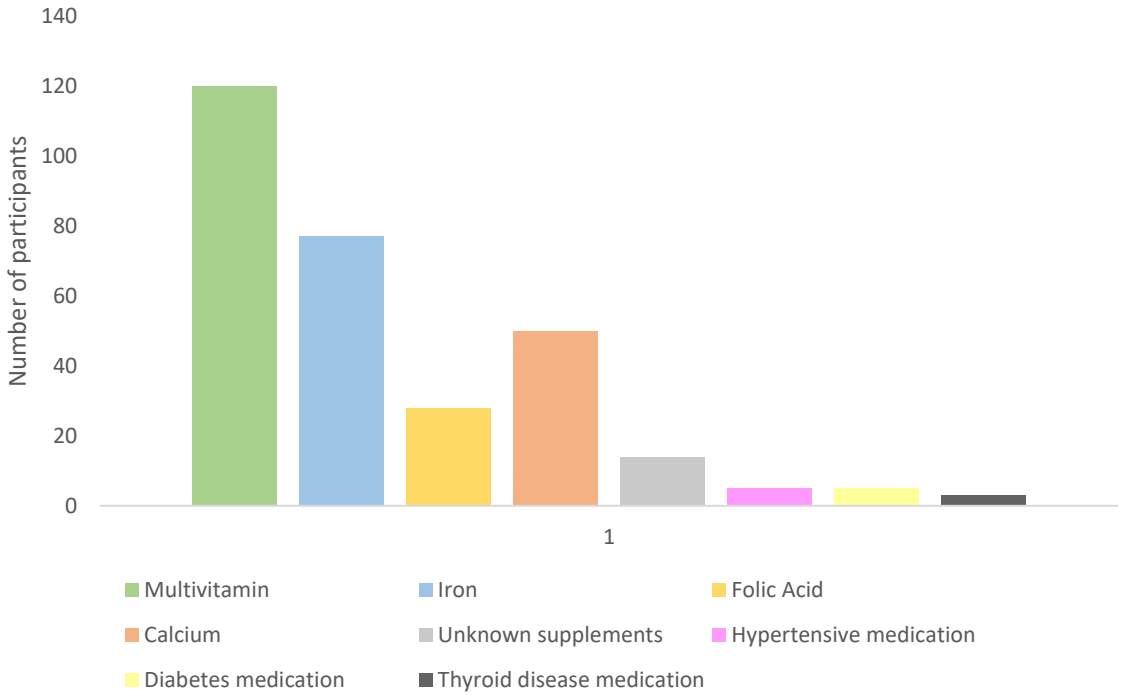

Figure 4.10 Medication and supplements taken by the study participants.

4.6. Knowledge on Physical activity

Most of the study population agreed that exercise was beneficial for good health (96.8%, *n* = 329). Significantly more women from the private practice believed that exercise was beneficial for good health in general (99.0%, *n* = 192) compared to women who attended the public clinic (93.8%; *n* = 137, *p* = 0.008). Similarly, more women from the private gynaecological practice (89.7%, *n* = 174) believed that

exercise was beneficial during pregnancy compared to women who attended the public clinic (74.7%, *n* = 109, *p* < 0.001). The most common benefits of exercise provided by the participants were that it will make the labour easy (33.8 %, *n* = 117) and make the baby healthy (31.7%, *n* = 110). The reported benefits of physical activity during pregnancy are listed in Table 4.9 below.

Table 4.9 Benefits of physical activity during pregnancy

Benefits	**Total participants % (*n*)**	**Private practice % (*n*)**	**Public clinic % (*n*)**
Makes the labour easy	33.8 (117)	18.2 (63)	15.6 (54)
The baby will be healthy	31.7 (110)	16.1 (56)	15.6 (54)
Will make the person energetic	20.2 (70)	9 (31)	11.2 (39)
Good personal health	18 (62)	8.6 (30)	9. 4(32)
No complications in pregnancy	14.4 (50)	8.3 (29)	6.1 (21)
Weight loss	12 (41)	8.9 (30)	3.1 (11)
Improves blood circulation	7.8 (27)	4.7 (16)	3.1 (11)
Relaxes the pelvic muscles	4.0 (14)	2.8 (10)	1.2 (4)
Improves mental health	2.3 (8)	0.5 (2)	1.8 (6)
Flexibility of joints	2.3 (8)	0.5 (2)	1.8 (6)
Reduces low back pain	1.7(6)	1.2 (4)	0.5 (2)
Increases the chances of a normal delivery	1.4 (5)	0.9 (3)	0.5 (2)

Participants, who thought that exercise was beneficial during pregnancy, were more likely to have exercised during their pregnancy (OR 2.4, 95% CI: 1.37 - 4.42; *p* = 0.002)

CHAPTER FIVE
DISCUSSION

5.1. Introduction

This chapter provides a detailed explanation and discussion of the results found in the research study.

5.2. Demographics

There were more women of Black African race that attended the public clinic. In contrast, more Indian women attended the private gynaecological practice. There were however a few White and Coloured women who attended both these clinics. Younger women attended the public clinic compared to the private clinic where there were more women from older age categories.

5.3. Prevalence of Physical activity

More than half of the study population was involved in physical activity during their pregnancy (57.1%) and more reported that they were active before their pregnancy (59.5%). This shows that during pregnancy some women stop or reduce physical activity. This can be due to lack of knowledge of the benefits of exercise during pregnancy and fear that exercise will harm the baby. Only 37 % met the criteria of physical activity, which is 30 minutes of moderate -intensity aerobic exercise per day for 5 days a week during pregnancy set out by the (American College of Obstetrics and Gynecologists, 2002). These values exclude unstructured physical activity. Taking unstructured physical activity such as household chores and walking to a desired mode of transport into consideration, the prevalence of physical activity increased to 82.1%.

A research study by Evenson *et al*. (2009), showed that, among American pregnant women of all races, only 15% were involved in physical activity. Therefore, the South African women in the present study are more physically active than their American counterparts. There were many barriers that prevented women from being physically

active during their pregnancy, the most common ones reported by these women were, health conditions and social and cultural pressures. Similarly, in the current study, many women who were not physically active, reported that they were unable to exercise due to the lack of time, not being in good health or frequently feeling lethargic.

Few of the participants from the study population (22.9%) reported having a miscarriage in their previous pregnancies. Miscarriages are a traumatic experience for a mother and bring about extra caution and fear with regards to future pregnancies. Pregnant women tend to stay away from any type of activity that is not part of their daily routine (Madsen *et al*., 2007), an example of this is structured exercise. In a study on Danish pregnant women, researchers found that women who perform vigorous strenuous activity for more than 30 minutes per day and more than 5 days a week, increase the risk of a miscarriage (Madsen *et al*., 2007). It is possible that those who did not participate in any physical activity may have refrained from doing so, due to a fear of having a miscarriage. Even though they did not directly report this, they did express a concern that physical activity may harm the baby. There was no relationship between previous miscarriage and the likelihood of women exercising in pregnancy in the current study ($p = 0.242$; Fishers exact test).

Employment status played a role in participating in physical activity with the odds of exercising increasing by 1.5 times in women who were employed. Similarly, Petersen *et al*. (2005), also reports that American pregnant women who were employed, were more physically active compared to unemployed women who led sedentary lifestyles.

Similar levels of structured physical activity were present in women from both the private and public-sector clinics. This is in contrast to that reported for American women. In that population, women who attended a private gynaecological practice, resided in a higher income area and were more highly educated, were more physically active than their counterparts from lower socio-economic areas, who attended the public health facilities (Petersen *et al*., 2005). Similarly, in another study by Evenson *et al*. (2004) researchers found that, physical activity was significantly greater among women with a higher education, younger age, those who

attended a private gynaecological practice and women with good health. A possible reason for this difference is that most of the current study participants, both from the private practice and the public clinic, reported attending ante-natal classes. These classes offer a variety of advice on the well-being of the mother and the baby, and these include the benefits of exercise as well as lessons on how to exercise without causing any harm to both the mother and the foetus.

Furthermore, a large proportion of the study population (84.4%) performed house hold chores during their pregnancy. These chores comprised of washing and ironing clothes, looking after children, sweeping and scrubbing floors. Chores like scrubbing floors for 30 minutes burn 186 calories whilst sweeping burns 86 calories. The participants of this study reported to have spent an average time of 15 – 25 minutes on each chore and performed more than three chores per day. Performance of these household chores increases the total amount of physical activity performed by these pregnant women. It must be noted however that women tend to overestimate the number of calories burned whilst performing household chores and the amount of time spent therein (Taylor *et al*., 1978). It is thus recommended that the same amount of time be spent on structured exercise as that spent on housework. However, according to the American College of Sports Medicine (2006), performing any light to moderate activity during pregnancy for more than 30 minutes per day is beneficial for pregnant and non-pregnant women.

In this study, 61.2% of the study participants reported to have climbed stairs daily. Of these participants 26.6% climbed more than 3 flights of stairs daily. Climbing stairs has been reported to be beneficial during pregnancy, it has been reported that climbing stairs prior to and during pregnancy reduces the risk of gestational diabetes (Dempsey *et al*., 2004; Zhang *et al*., 2006). Furthermore, the current study indicates that women who climb stairs during their pregnancy were more likely to have exercised during pregnancy. These participants could have been more knowledgeable about exercise and were implementing other positive means of physical activity in the daily routine, in addition to the formal exercise.

The most common form of activity that was reported by the participants in the current study was walking. Of those who walked, most did so for more than 30 minutes a

day. It is noteworthy that more women from the public-sector clinics walked as part of their daily routine. Walking was either their main means of transport or in combination with public transport. Although many of these women were not involved in any exercise programme, walking as part of their daily routine provided an acceptable daily level of physical activity. Walking is beneficial during pregnancy and has been reported to reduce the incidence of gestational diabetes (Dempsey *et al*., 2004; Zhang *et al*., 2006). Moreover, a brisk walking pace and a longer duration is associated with a lower risk of GDM, compared to walking at a casual pace and for a shorter duration (Dempsey *et al*., 2004; Zhang *et al*., 2006). Walking has also been reported to be the most common physical activity among pregnant American women (American College of Sports Medicine, 2006; Petersen *et al*., 2005; Evenson *et al*, 2004). Other activities preferred by the women from the latter study were swimming, weight lifting, gardening, and aerobics. Similarly, the current study also reports swimming as the preferred activity after walking. It is noteworthy that more women from the private gynaecology practice swam compared to those who attended the public clinic. This is probably related to the availability of facilities, such as swimming pools, to women from higher socio-economic backgrounds, who also seek health care in the private sector.

5.4. Health and physical activity

Less than half of the study population (35.4%) reported to have been diagnosed with a medical condition. The most common conditions that were reported among the participants were diabetes, gestational diabetes, hypertension and anaemia. Although, many of the hypertensive patients were diagnosed with hypertension during pregnancy, the study was limited in that it did not test for proteinuria and oedema, conditions which accompany the hypertension in pre-eclampsia (Haffejee *et al*., 2013). Furthermore, the questionnaire did not ask for information on the blood pressure levels. Moreover, patients were not monitored after pregnancy to confirm that the hypertension had resolved post pregnancy, as this occurs in pre-eclampsia (Haffejee *et al*., 2013). Nevertheless, it is important to note that most of the participants who reported these medical conditions were not physically active. Sedentary lifestyle is associated with the development of both diabetes mellitus and hypertension. Furthermore, women who engaged in regular exercise have a reduced

incidence of preeclampsia and gestational diabetes, with risk decreasing as the volume of exercise increases (Marcoux *et al*., 1989). Similarly, in a different study, Sorensen *et al*. (2003) reported that light prenatal exercise reduced the incidence of preeclampsia by 24%, whereas the performance of vigorous exercise led to a 54% reduction.

Many of the women were not educated sufficiently on the conditions that they had and were unaware of lifestyle management of the conditions. Many women have a mind-set that if they have an illness there is no cure from it and that medication is the only means of controlling the condition. There are many benefits of exercise, particularly in the lowering of blood sugar levels as well as in lowering blood pressure. The majority of these women were not knowledgeable about these benefits.

Regular physical activity contributes positively to physical and psychological health. Some of the barriers that the women cited for their lack physical activity were, medical conditions and fatigue, but these have in fact been shown to be reduced by regular exercise (Poudevigne, M. S. and O'Connor, 2006). Physical activity can be beneficial to pregnant women and their foetuses, as well as give improved health post pregnancy. (Poudevigne, M. S. and O'Connor, 2006).

Available research suggests that both leisure time and work-related physical activities are decreased in pregnancy. Moreover, intensity and duration decrease both during pregnancy compared with pre-pregnancy and in the third trimester compared with the first (Poudevigne, M. S. and O'Connor, 2006). Although the current study shows a decrease in physical activity during pregnancy, this was small. Furthermore, the intensity was not measured.

5.5. Limitations

Some participants reported gestational diabetes and hypertension in pregnancy, however the study was limited in that it did not have access to medical reports for confirmation. There was no question on educational status of the participants in the questionnaire. Having knowledge of their educational level would give some indication of their knowledge regarding exercise during pregnancy. This study was conducted at two clinics: a private practice and a public clinic and the results were compared. Participants from the private practice would arrive in time for their appointment and had no difficulty or objection in filling out the questionnaire. However, participants at the public clinic were waiting for many hours for their check-up. Due to this, many women were tired and refused to participate. A larger sample size would have increased the accuracy of the data.

CHAPTER SIX
CONCLUSION AND RECOMMENDATIONS

6.1. Conclusion

The aim of the research study was to compare the knowledge and practices of pregnant women regarding exercise during pregnancy between a selected private practice and public clinic.

While larger proportions of pregnant women (83.2%) who satisfactorily exercise was found in the study compared to the US, women overestimate their exercise level. Nonetheless activities of daily living such as walking and climbing stairs are common. In health education, women can be told about the value of these activities. Furthermore, the exercise was not sufficient to meet the physically activity requirements set out by the American College of Obstetrics and Gynecologists and only 37% of pregnant women met these requirements through structured physical activity. However, in this population, a large proportion of women, were actively involved in household chores that increased their physical activity levels to meet the above criteria. Moreover, many walked instead of using transport and this walking particularly in those who did so for a minimum of 30 minutes a day would compensate for the lack of structured physical activity. However, some interventions need to be implemented to increase the knowledge of physical activity amongst pregnant women and the benefits that are associated with it. An attempt needs to be made by health practitioners to try and increase the level of physical activity among pregnant women, so that they may benefit from its effects.

6.2. Recommendations

This study was carried out to determine the knowledge of physical activity amongst pregnant women and the levels of physical activity that they were involved in. Exercise has been shown to be beneficial during pregnancy. Over the years, exercise has evolved from basic running, walking and swimming to aerobics, weight training and Pilates. Furthermore, these exercises have shown to have numerous benefits for both the mother and the foetus as well as post-partum benefits too.

While studies suggest that physical activity during pregnancy may have a positive impact on maternal and infant health, incorporating lifestyle interventions that increase physical activity during pregnancy is often difficult to deliver at primary care settings due to lack of time, lack of adequate knowledge on physical activity or negative attitudes among the patients to increase their physical activity.

Although primary care providers understood the importance of lifestyle interventions, delivery of such interventions in a form of counseling were influenced by factors such as availability of time. Maternity clinics at the public hospitals thus need to expand or more clinics need to be opened to accommodate the population. If the number of people decrease in the clinics, there will be more time available for each patient. It will also prevent patient fatigue. Future studies can elaborate on the different metabolic diseases associated with pregnancy and the effect that exercise has on it. Furthermore, measurement of blood pressure and sugar levels can be taken and recorded before and after a structured exercise routine. Other symptoms that women experience or complain of during pregnancy like, back pain, weight gain and increased irritability can be noted at the start of a longitudinal study, and any changes in these symptoms can be recorded over time. Further studies can be done to look at the physical activity in post-partum women, to determine if pregnancy has been a motivation to living a healthier lifestyle or if certain complications in the pregnancy has made them become more health conscious and physically active. Follow up studies can compare the levels of exercise amongst women who are exposed to antenatal classes. Other studies can consider a specific exercise such as yoga or water aerobics and report on the benefits of this on women with metabolic diseases. There is a need for well-designed longitudinal investigations that document pregnancy-related changes in physical activity at frequent intervals during pregnancy using validated and more precise measures of physical activity.

From a chiropractic perspective, future studies can determine the effects of exercise on the prevalence of low back pain in pregnant or post-partum women and the benefits of exercise as well as chiropractic treatment in reducing low back pain in these women.

Finally, in order to increase the knowledge and level of physical activity amongst pregnant women, especially among those attending public clinics, there should be an effort made at governmental level to introduce exercise classes in public clinics. These classes will educate women on the importance and technique of exercises during pregnancy.

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APPENDIX A: Approval from the DUT Institutional research ethics committee

Institutional Research Ethics Committee
Research and Postgraduate Support Directorate
2nd Floor, Berwyn Court
Gate l, Steve Biko Campus
Durban University of Technology

P O Box 1334, Durban, South Africa, 4001

Tel: 031 373 2375 Email: lavishad@dut.ac.za

http://www.dut.ac.za/research/institutional_research_ethics www.dut.ac.za

16 February 2017

IRC Reference Number: REC 123/16

Ms N Noor Mahomed
8 Eden Rose Walk
La-Mercy
4405

Dear Ms Noor Mahomed

Knowledge and practices of pregnant women regarding exercise during pregnancy: a comparison between private and public sector

The Institutional Research Ethics Committee acknowledges receipt of your final data collection tool for review.

We are pleased to inform you that the questionnaire has been approved. Kindly ensure that participants used for the pilot study are not part of the main study.

In addition, the IREC acknowledges receipt of your gatekeeper permission letters.

Please note that FULL APPROVAL is granted to your research proposal. You may proceed with data collection.

Yours Sincerely,

[redacted]

Professor J K Adam
Chairperson: IRE-C

DUT DURBAN UNIVERSITY OF TECHNOLOGY
2017 -02- 16
INSITUTUTIONAL RESEARCH ETHICS COMMITTEE
P O BOX 1334 DURBAN 4000 SOUTH AFRICA

APPENDIX B: Approval from the department of health (KZN)

health
Department:
Health
PROVINCE OF KWAZULU-NATAL

DIRECTORATE:
Health Research & Knowledge Management

Physical Address: 330 Langalibalele Street, Pietermaritzburg
Postal Address: Private Bag X9051
Tel: 033 395 2805/ 3189/ 3123 Fax: 033 394 3762
Email:
www.kznhealth.gov.za

HRKM Ref: 400/16
NHRD Ref: a 2016RP29 305

Date: 7 December 2016
Dear Ms N. Noor-Mahomed
Durban University of Technology

Approval of research

1 . The research proposal titled 'Knowledge and practices of pregnant women regarding exercise during pregnancy: a comparison between private and public sector' was reviewed by the KwaZulu-Natal Department of Health.

The proposal is hereby approved for research to be undertaken at Addington Gateway clinic.

2. You are requested to take note of the following:
   a. Make the necessary arrangement with the identified facility before commencing with your research project.
   b. Provide an interim progress report and final report (electronic and hard copies) when your research is complete.

3. Your final report must be posted to HEALTH RESEARCH AND KNOWLEDGE MANAGEMENT, 10-102, PRIVATE BAG X9051, PIETERMARITZBURG, 3200 and e-mail an electronic copy to hrkm@kznhealth.gov.za

For any additional information please contact Mr X. Xaba on 033-395 2805.

Yours Sincerely

[redacted]

Dr E Lutge
Chairperson, Health Research Committee
Date: 8/12/16.

APPENDIX C- Permission letter to the head of public relations at Addington Hospital

Chiropractic Department – Ritson Campus

Durban University of Technology

Durban

8 July 2016

The head of public relations at Addington Hospital

Re: Permission to carry out my research study at your institution.

My name is Nazmeera Noor Mahomed, I am a 5th year MTech Chiropractic student at the Durban University of Technology. To meet the requirements of this course, we are required to conduct a research study.

My area of interest is exercise during pregnancy and the research topic is: Knowledge and practices of exercise during pregnancy. In terms of my research I am required to obtain information on the level of exercise knowledge that pregnant woman have and the amount of exercise they practice.

With your permission, I would like to distribute my questionnaire to your pregnant patients at the antenatal clinic. This practice/ clinic is a suitable site as there are many patients that visit your practice daily. I would also like to assure you that all results will be confidential and there will be no mention of name or information regarding the patient's personal medical history.

Your kind consideration in this matter would be much appreciated.

Yours sincerely

Nazmeera Noor Mahomed

APPENDIX D: Permission letter to Dr D Sankar

APPENDIX D: Permission letter to Dr D Sankar

Chiropractic Department – Ritson Campus

Steve Biko Road

Durban University of Technology

Durban

8 July 2015

Dr D. Sankar

Re: Permission to carry out my research study at your institution.

My name is Nazmeera Noor Mahomed , I am a 5th year Mtech Chiropractic student at the Durban University of Technology. In order to meet the requirements of this course, we are required to conduct a research study.

My area of interest is exercise during pregnancy and the research topic is: Knowledge and practices of exercise during pregnancy. In terms of my research I am required to obtain information on the level of exercise knowledge that pregnant woman have and the amount of exercise they practice.

With your permission I would like to distribute my questionnaire to your pregnant patients. This practice/ clinic is a suitable site as there are many patients that visit your practice on a daily basis.

I would also like to assure you that all results will be confidential and there will be no mention of name or information regarding the patient's personal medical history.

Your kind consideration in this matter would be much appreciated.

Yours sincerely

Nazmeera Noor Mahomed

[redacted]

DR. D. SANKAR
SPECIALIST OBSTETRICIAN & GYNAECOLOGIST
M.B.Ch.B. F.C.O.G. M.R.C.O.G.

[redacted]

APPENDIX E: Letter of information and informed consent form

LETTER OF INFORMATION

Dear Madam, welcome to my study.

I am a Masters student in Chiropractic at the Durban University of Technology. This research project is part of my studies. Kindly read this document and if you don't understand anything please ask.

Title of the Research Study:

Knowledge and practices of pregnant women regarding exercise during pregnancy: a comparison between private and public sector.

Principal Investigator/s/researcher: Nazmeera Noor Mahomed (M.Tech Chiropractic)

Co-Investigator/s/supervisor/s: Dr F. Haffejee (PhD) and Professor T. Puckree (PhD)

Brief Introduction and Purpose of the Study:

Regular exercise is important to keep one physically and psychologically healthy. Continuing the exercise during pregnancy prevents many diseases, decreases the risk of complications during the pregnancy and birth and aids in a speedy recovery after the birth.

Research regarding exercise amongst South African pregnant women is required, particularly to indicate whether any barriers to physical activity exist amongst pregnant women. There is also a need to determine reasons for exercise in those individuals who are physically active and whether there has been any improvement in health benefits.

Outline of the Procedures:

Approximately 400 participants will be recruited for this study. After signing an informed consent form, you will be required to answer a questionnaire on exercise. This should take approximately 15 minutes of your time. Please answer all the questions. The researcher will be present if assistance is required. All questionnaires will be anonymous and no personal identifying information will be collected.

Risks or Discomforts to the Participant:

There is no risk or discomfort associated with participating in this research.

Benefits:

The researcher will benefit by obtaining a Master's degree. The community will benefit because results of the research will be made available and improvements to lifestyle may be made

Reason/s why the Participant May Be Withdrawn from the Study:

Participants are free to withdraw from the study at any time should you wish to do so without any consequence.

Remuneration:

Participation is voluntary and there are no payments associated with participation.

Costs of the Study:

There are no costs associated with participation in this study.

Confidentiality:

Privacy, anonymity and confidentiality will be ensured. The signed, informed consent forms will be collected separately from the questionnaire. No names or personal identifying information will be on the questionnaire. No reference will be made to specific individuals throughout the study. All questionnaires will be stored in a locked cupboard to which only the investigator will have access.

Research-related Injury:

There will be no research related injury

Persons to Contact in the Event of Any Problems or Queries:

Principal investigator:

Nazmeera Noor Mahomed Tel: (032) 9415356

Supervisors:

Dr F. Haffejee Tel: (031) 373 2395

Professor T. Puckree Tel: (031) 373 2967

Institutional Research Ethics administrator on 031 373 2900. Complaints can be reported to the DVC: TIP, on 031 373 2382 or dvctip@dut.ac.za.

CONSENT

Statement of Agreement to Participate in the Research Study:

- I hereby confirm that I have been informed by the researcher, _____ (name of researcher), about the nature, conduct, benefits and risks of this study - Research Ethics Clearance Number: _____,
- I have also received, read and understood the above written information (Participant Letter of Information) regarding the study.
- I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials and diagnosis will be anonymously processed into a study report.
- In view of the requirements of research, I agree that the data collected during this study can be processed in a computerised system by the researcher.
- I may, at any stage, without prejudice, withdraw my consent and participation in the study.
- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.
- I understand that significant new findings developed during the course of this research which may relate to my participation will be made available to me.

_____	_____	_____	_____
Full Name of Participant	**Date**	**Time**	**Signature / Right Thumbprint**

I, _____ (name of researcher) herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

_____	_____	_____
Full Name of Researcher	**Date**	**Signature**
_____	_____	_____
Full Name of Witness (If applicable)	**Date**	**Signature**

Please note the following:

Research details must be provided in a clear, simple and culturally appropriate manner and prospective participants should be helped to arrive at an informed decision by use of appropriate language (grade 10 level - use Flesch Reading Ease Scores on Microsoft Word), selecting of a non-threatening environment for interaction and the availability of peer counseling (Department of Health, 2004)

If the potential participant is unable to read/illiterate, then a right thumb print is required and an impartial witness, who is literate and knows the participant e.g. parent, sibling, friend, pastor, etc. should verify in writing, duly signed that informed verbal consent was obtained (Department of Health, 2004).

If anyone makes a mistake completing this document e.g. wrong date or spelling mistake a new document has to be completed. The incomplete original document has to be kept in the participant file and not thrown away and copies thereof must be issued to the participant.

References:

Department of Health: 2004. *Ethics in Health Research: Principles, Structures and Processes* http://www.doh.gov.za/docs/factsheets/guidelines/ethnics/

Department of Health. 2006. *South African Good Clinical Practice Guidelines*. 2nd Ed. Available at: http://www.nhrec.org.za/?page_id=14

APPENDIX F: Original questionnaire

This questionnaire was adapted using an existing questionnaire by Nusrat Kader (Kader, 2016)

Knowledge and practices of pregnant women regarding exercise during pregnancy: a comparison between private and public sector.

DEAR MADAM

PLEASE ANSWER THE QUESTIONS IN THIS FORM AS COMPLETELY AS YOU CAN. WHERE APPLICABLE, PLEASE TICK THE APPROPRIATE BOX. PLEASE PROVIDE HONEST ANSWERS. YOUR PARTICIPATION IS APPRECIATED.

THIS QUESTIONNAIRE CONSISTS OF 5 SECTIONS (A, B, C, D and E) AND 5 NUMBERED PAGES. PLEASE ENSURE YOU ANSWER ALL SECTIONS.

Section A: Demographics

1) Race:

Black ☐ Coloured ☐ Indian ☐ White ☐ Other: _____

2) Date of birth: _____

3) How many months pregnant are you?

1 month ☐ 3 months ☐ 5 months ☐ 7 months ☐ 9 months ☐
2 months ☐ 4 months ☐ 6 months ☐ 8 months ☐ I don't know ☐

4) Do you attend antenatal classes? Yes ☐ No ☐

5) Which antenatal clinic do you attend? Parklands (Dr D Sankar) ☐ Addington ☐

6) Is this your first pregnancy? Yes ☐ No ☐

If no, how many pregnancies have you had in the past? _____

7) Did you have any miscarriages in the past? Yes ☐ No ☐

8) Have you had any problems in your previous pregnancies? Yes ☐ No ☐

If yes, state what the problem was_____

9) Do you have any problems in this pregnancy? Yes ☐ No ☐

If yes, state what the problem is_____

Section B: Activities at home and at work

10) During your pregnancy do you perform any household chores? Yes ☐ No ☐

If no, please skip to Question 13.

11) If yes, please tick the work that you perform. (Can tick more than one box)

Type of chore	**Time performed per day. E.g. 15 minutes/day**
11.1 Scrubbing	
11.2 Carrying shopping bags	
11.3 Making beds	
11.4 Cleaning windows	
11.5 Washing clothes	
11.6 Ironing clothes	
11.7 Loading dishwasher/washing dishes	
11.8 Sweeping	
11.9 Vacuuming	
11.10 Looking after other children	
11.11 OTHER	

12) During your pregnancy, have you been lifting heavy objects around the house? Yes ☐ No ☐

13) Are you currently employed? Yes ☐ No ☐

If yes, how many days per week do you work? _____

14) Do you use the stairs at work or at home? Yes ☐ No ☐

If no, please skip to Question 16.

If yes, how many flights of stairs do you climb per day? _____

15) How often do you climb the stairs? E.g. thrice a day, twice a week. _____

16) What is your main mode of transport? (Can tick more than one box)

Private car ☐ Walking ☐ Bicycle ☐ Bus ☐

Motor bike ☐ Train ☐ Other: _____

17) Do you have to walk for more than 10 minutes to and from for your desired mode of transport?

Yes ☐ No ☐

18) If you use a personal vehicle, do you find that you park: Closer to the entrance ☐ Further from the entrance ☐

Other: _____

Section C: Health Status

19) Do you have high blood pressure? Yes ☐ No ☐ I don't know ☐

20) Do you have low blood pressure? Yes ☐ No ☐ I don't know ☐

21) Do you have any other diseases? Yes ☐ No ☐ I don't know ☐

If yes, name the disease_____

22) Are you taking any medication? Yes ☐ No ☐

If yes, what medication _____

Section D: Physical activity

23) Do you read any magazine articles to obtain information about exercise in pregnancy?
Yes ☐ No ☐

If yes, name the magazines_____

24) Does the relevant article provide useful information on pregnancy? Yes ☐ No ☐

25) Does the relevant article provide useful information on information on exercise during pregnancy?

Yes ☐ No ☐

Please indicate with a tick (✓) your opinion of the following statements:

	Strongly Agree	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
26) I follow an exercise programme during pregnancy					
27) Exercise is beneficial for good health.					
28) Exercise is beneficial during pregnancy.					

29) I have been involved in exercise before my pregnancy					

30) If you exercise, are you forced to exercise? Yes ☐ No ☐

31) Are you willing to try different exercise programmes? Yes ☐ No ☐

32) Please indicate with a tick (✓) if you perform any of the following exercises currently during your pregnancy :

Exercise	< ½ hour	½ - 1 hour	1 - 2 hours	2 - 3 hours	> 3 hours	How many sessions per week
32.1 Jogging						
32.2 Swimming						
32.3 Dancing						
32.4 Cardio						
32.5 Yoga						
32.6 Walking						
32.7 Weight lifting						
32.8 Cycling						
32.9 Water aerobics						
32.10 Lamaze						
32.11 Other						

33) If you **don't** exercise currently in this pregnancy, please tick any one or more of the following reasons that may explain why (you may skip this section if you exercise)

Reason	Mark with a tick (✓)
33.1 I don't know how to	
33.2 Exercise will harm the baby	
33.3 Exercise will harm me	
33.4 I feel tired when I exercise	
33.5 I feel tired after I exercise	

33.6 I feel tired all the time	
33.7 I am not well	
33.8 I don't feel that it is necessary	
33.9 I feel stupid while exercising	
33.10 My doctor has advised me to rest	

34) Are there benefits to physical activity during pregnancy? Yes □ No □

If yes, list the benefits

APPENDIX G: Permission letter to Dr Kader

Chiropractic Department – Ritson Campus

Steve Biko Road

Durban University of Technology

Durban

8 July 2015

Dear Miss Kader

I request permission to use part of your research questionnaire on exercise. I will adapt it to suit my research study entitled; “To compare the knowledge and practices of pregnant women regarding exercise during pregnancy: a comparison between the private and public sector”.

You will be duly acknowledged for this contribution.

Kind regards

Nazmeera Noor Mahomed

APPENDIX H: Permission email from Dr Kader

(no subject)

---

nusratkader@yahoo.com <nusratkader@yahoo.com> 26 May 2015 at 16:36
To: Nazmeera <nazzymo@gmail.com>

Dear Ms Noor Mahomed

Yes, that would be fine. However, please note that I have used the IPAQ and GPAQ'S to guide my drafting of the questionnaire. I advise you to read through and reference them accordingly.

Good Luck

Thank You
Nusrat Kader
M.tech Chiropractic

From: Nazmeera
Sent: Tuesday 26 May 2015 15:58
To: nusratkader@yahoo.com
Subject:
[Quoted text hidden]

APPENDIX I: Translated Zulu questionnaire

UHLU LWEMIBUZO YOCWANINGO MAYELANA NOKUZIVOCAVOCA NGESIKHATHI UKHULELWE

NGIYAKUBINGELELA NKOSAZANA/NKOSIKASZI

NGIYACELA UKUBA UPHENDULE IMIBUZO EKULELI FOMU NGOKUPHELELE NGENDLELA UNGAKHONA NGAYO. LAPHO KUFANELEKILE KHONA, UYACELWA UKUBA UBEKE UMAKA EBHOKISINI ELIFANELEKILE NGICELA UKUBA UNIKEZE IZIMPENDULO NGOKWETHEMBEKA. IQHAZA LAKHO LIYABONGEKA.

LOLUHLA LOCWANINGO LUNEZINGXENYE EZINGU 5 (A, B, C, D and E) NAMAKHASI ANGU 4 ANEZINOMBOLO ZAWO. NGIYACELA UQIKELEL UTHI UKUPHENDULE ZONKE IZINGXENYE.

Ingxenye A: Imininingwane ngobuntu

1) Ibala: Unsundu ☐ Umkhalathi ☐ Umndiya ☐ Umhlophe ☐ Okunye: _____

2) Usuku lokuzalwa: _____

3) Unezinyanga ezingaki ukhulelwe?

Inyanga eyodwa ☐ izinyanga ezimbili ☐ izinyanga ezintathu ☐ Izinyanga ezine ☐ izinyanga ezinhlanu ☐ izinyanga eziyisithupha ☐ izinyanga isikhombisa ☐ izinyanga eziyisishiyagalombili ☐ izinyanga eyisishiyagalolunye ☐ Angazi ☐

4) Ungabe uyawahamba amaklasi ezabakhulelwe nokuxukuzwa? Yebo ☐ Cha ☐

5) Uhamba muphi umtholampilo wokuxukuzwa nokukhulelwa? iParklands (Dkt D Sankar) ☐ iAddington ☐

6) Ingabe ukukhulelwa kwakho kokuqala lokhu? Yebo ☐ Cha ☐
Uma uphendule ngo cha, usuke wakhulelwa kangaki ngaphambilini? _____

7) Usuke waphuphunyelwa isisu noma sahushuka ngaphambilini? Yebo ☐ Cha ☐

8) Ingabe usuke waba nazo izinkinga ngokukhulelwa kwakho kwangaphambilini? Yebo ☐ Cha ☐

Uma uphendule ngo yebo, chaza ukuthi inkinga bekuyini_____

9) Ingabe unazo izinkinga kulokhu kukhulelwa kwakho kwamanje?

Uma uphendule ngo yebo, chaza ukuthi inkinga yini

_____

Ingxenye B: Imisebenzi oyenza ekhaya nasemsebenzini

10) Njengalokhu ukhulelwe ingabe ikhona yini imisebenzi yasendlini ekhaya? Yebo ☐ Cha ☐

Uma uphendule ngo cha, qhubekela kumbuzo 13 uyeqe lena u 11 no 12.

11) Uma uphendule ngo yebo, uyacelwa ukuba ubeke umaka kuleyo misebenzi oyenzayo kulamabhokisi alandelayo. (Uvumelekile ukukhetha izimpendulo ezingaphezu kweyodwa kulama bhokisi)

Uhlobo lomsebenzi	**Isikhathi okusithathayo ukuwenza lomsebenzi Umzekeliso: imizuzu engu15 ngosuku**
11.1 ekhuhla	
11.2 ethwele ama pakethe	
11.3 okwenza imibhede	
11.4 ukuwasha izingubo	
11.5 ayina izingubo	
11.6 ukuwasha izitsha	
11.7 zishanela	
11.8 sinakekela	
11.9 okunye	

12) Njengalokhu ukhulelwe, usuke waqukula izinto ezisindayo endlini? Yebo ☐ Cha ☐

13) Ingabe uqashiwe njengamanje? Yebo ☐ Cha ☐

Uma uphendule ngo yebo, zingaki izinsuku ozisebenzayo evikini?

_____

14) Ingabe uyazisebenzisa izitezi emsebenzini noma nasekhaya? Yebo ☐ Cha ☐

Uma uphendule ngo cha, qhubekela kumbuzo 16 umeqe u 15

Uma ngabe uphendule ngo yebo, zingangi izitebhisi ozenyukayo ngosuku?

_____

15) Uzinyuka kangaki izitebhisi ngeviki? Umzekeliso: kathathu ngeviki noma kabili ngeviki

_____

16) Ingabe uhlobo olugibelayo uma uhamba iluphi?

(Ungakhetha noma amangaki amabhokisi aqondene nempendulo okuyiyonayona beka)

Imoto encane ☐ Isithuthuthu ☐ ehamba ☐ ibhasi ☐

isitemela ☐ ibhayisikili ☐ Okunye: _____

17) ingabe uhamba imizuzu engaphezulu kwelishumi uma uyogibela lolohlobo lwesithuthi ohamba ngaso?

Yebo ☐ Cha☐

18) uma ngabe usebenzisa imoto yakho, ingabe uye uzame ukupaka maqondana noma eduze:

nesango noma nendawo yokungena ☐ kude nesango noma nendawo yokungena ☐

Ingxenye C: Isimo sezempilo

19) Ingabe unayo ihayihayi noma iBP ephezulu? Yebo ☐ Cha ☐ Angazi ☐

20) Ingabe unayo ilow low noma iBP ephansi? Yebo ☐ Cha ☐ Angazi ☐

21) Ingabe unazo ezinye izifo? Yebo ☐ Cha ☐ Angazi ☐

Uma uphendule ngo yebo, yini igama lesifo_____

22) Ingabe ikhona imithi oyiphuzayo? Yebo ☐ Cha ☐

Uma uphendule ngo yebo, muthi muni_____

Ingxenye E: Ukusebenza nokunyakazisa umzimba

23) Ingabe uyawafunda amabhuku neziqephu ezimayelana nokuthola ulwazi ngokuzivocavoca uma ukhulelwe?

Yebo ☐ Cha ☐ Uma uphendule ngo yebo, yimaphi lawomabhuku_____

24) Ingabe lezoziqeshana kumabhuku ziyakunikeza ulwazi oluwusizo mayelana nokukhulelwa? Yebo ☐ Cha ☐

25) Ingabe lezoqeshana ziyakunikeza ulwazi oluwusizo ngolwazi lokuzivocavoca uma ukhulelwe? Yebo ☐ Cha ☐

Uyacelwa ukuba utshengise ngophawu u (✓) imibono yakho ngalezizitatimende ezilandelayo:

	Ngiyavuma kakhulu	**Ngiyavuma**	**Ngiphakathi**	**Ngiyaphika**	**Ngiyaphika kakhulu**
26) Ngilandela indlela ethile yokuzivocavoca njengoba ngikhulelwe.					
27) Ukuzivocavoca ngesikhathi ukhulelwe kuyimpilo enhle yezempilo.					

28) ukuzivocavoca kunomvuzo nomthelela omuhle ngenkathi ukhulelwe.					
29) bengivele ngizivocavoca nangaphambi kokukhulelwa.					

30) Uma uzivocavoca ingabe uphoqelekile na ukuba uzivocavoce? Yebo ☐ Cha ☐

31) Ingabe uzimisele ukuzama **izindlela ezihlukile zokuzivocavoca**? Yebo ☐ Cha ☐

32) Uyacelwa ukuba utshengise ngophawu u (✓) uma ngabe uyakwenza lokhukuzivocavoca okulandelayo njengalokhu ukhulelwe:

Ukuzivocavoca	**< ½ kwehora**	**½ - 1 kwihora**	**1 - 2 amahora**	**2 - 3 amahora**	**> 3 amahora**	**Kangaki ngeviki**
32.1 ukugijima						
32.2 ukubhukuda						
32.3 edancing						
32.4 zenhliziyo						
32.5 uyoga						
32.6 ehamba						
32.7 ukubuyiseheni						
32.8 ifayela ye log weight						
32.9 amanzi ukuvivinya umzimba ngendlela						
32.10 ulamaza						

APPENDIX J: Focus group recommendations

Pre-focus group questions	Post focus group change
1. Remove: This questionnaire was adapted……. Kader 2016)	Line removed
2. Change the font and remove underline in the title	Font changed and line removed
3. Question 2, add yy/mm/dd to date of birth	Yy/mm/dd added to question 2
4. Question 3, change the order of the months	Order changed
5. Question 8, reword the question to. Have you had any pregnancy elated health problems?	Question reworded accordingly
6. Question 11, add.. "and explain how much time spent on each task" to the instructions	Phrase added to question 11
7. Question 11.1, change scrubbing to scrubbing floors.	Phrase changed to scrubbing floors
8. Question 11.5, create 2 options for washing clothes. Washing by hand or using washing machine	Change made. 2 options created
9. Question 12, remove the words "around the house" from the question	Words removed
10. Question 16, add the option of "taxi"	option added
11. Question 18, add the option of" wherever I find parking"	Option added
12. Section C, insert the questions into a table format	Table added to section c
13. Section D, change the heading to knowledge of physical activity	Section d heading changed
14. Remove question 23, 34, 25.	Question 23, 24, 25 deleted
15. Create a new section "Section E : Physical Activity"	New section created section E
16. Remove table under section D. make questions yes and no.	Table deleted. Questions have been changed to yes or no.
17. Move question 27 and 28 to to the new section D.	Questions moved to the new section D
18. Question 32. Remove Cardio. Change dancing to Zumba. Expand cycling to cycling on a stationary bicycle or cycling outdoors. Lamaze change to pilates	 Cardio removed Zumba added in place of dancng 2 options created for cycling: stationary bicycle and outdoors Pilates added in place of lamaze
19. Question 32. Add " can tick more than one option" to the question statement	Phrase added.
20. Question 33. Delete the phrase in brackets (you may skip this section if you exercise)	Phrase in brackets deleted
21. Question 33.1 Reword the question to "I don't know what exercise is"	Question reworded
22. Question 33.9 Reword the question to " I feel silly whilst exercising"	Question reworded
23. Question 34. Move this question to the new section D	Question moved and re numbered

Study No:

APPENDIX K: Final questionnaire

Knowledge and practices of pregnant women regarding exercise during pregnancy:

A comparison between private and public sector.

Dear Madam

PLEASE ANSWER THE QUESTIONS IN THIS FORM AS COMPLETELY AS YOU CAN.

WHERE APPLICABLE PLEASE TICK THE APPROPRIATE BOX. PLEASE PROVIDE

HONEST ANSWERS. YOUR PARTICIPATION IS APPRECIATED.

THE QUESTIONNAIRE CONSISTS OF 5 SECTIONS (A, B,C,D AND E) AND 4 NUMBERED PAGES. PLEASE ENSURE YOU ANSWER ALL SECTIONS.

SECTION A: DEMOGRAPHICS

1. Race: Black ☐1 Indian ☐2 Coloured ☐3 White ☐4 Other ☐5

2. Date of birth: _____(yyyy/mm/dd)

3. How many months pregnant are you?
1 month ☐ 2 months ☐ 3 months ☐ 4 months ☐ 5 months ☐
6 months ☐ 7 months ☐ 8 months ☐ 9 months ☐ I don't know ☐

4. Do you attend antenatal class? yes ☐1 no ☐0

5. Which antenatal clinic do you attend?
Parklands(Dr. D.Sankar) ☐1 Addington ☐2 Other ☐3

6. Is this your first pregnancy? yes ☐1 no ☐0
If no, how many pregnancies have you had in the past? _____

7. Did you have any/ miscarriages in the past? yes ☐1 no ☐0

8. Have you had any pregnancy related health problems in your previous pregnancies?
yes ☐1 no ☐0
If yes, state what the problem was
_____

9. Do you have any pregnancy related health problems in this pregnancy?
yes ☐1 no ☐0
If yes, state what the problem was
_____

SECTION B: ACTIVITIES AT HOME AND AT WORK

10. During your pregnancy do you perform any household chores?

yes ☐1 no ☐0

If no, please skip to question 13

11. If yes, please tick the chore that you perform and indicate the time spent. (can tick more than 1 box)

Type of chore	Tick	10min	20min	30min	>30min
11.1.1 Wiping floors: on knees	1				
11.1.2 with a mop	2				
11.2 Carrying shopping bags	3				
11.3 Making beds	4				
11.4 Cleaning windows	5				
11.5 Washing clothes by hand	6				
11.6 Ironing clothes	7				
11.7 Washing dishes	8				
11.8 Sweeping	9				
11.9 Vacuuming	10				
11.10 Looking after other children	11				
11.12 Other	12				
Specify:					

12. During your pregnancy have you been lifting heavy objects?

yes ☐1 no ☐0

13. Are you currently employed? yes ☐1 no ☐0

If yes, how many days per week do you work? _____

14. Do you use the stairs at work or at home? yes ☐1 no ☐0

If no, please skip to question 16.

If yes, how many flights of stairs do you climb per day? _____

15. How often do you climb the stairs? E.g. thrice a day, twice a week. _____

16. What is your main mode of transport? (can tick more than one box)

Car ☐1 Taxi ☐2 Bus ☐3 Train ☐4

Walking ☐5 Motorbike ☐6 Bicycle ☐7 Other ☐8

17. Do you walk for more than 10 minutes to and from your desired mode of transport?

yes ☐1 no ☐0

18. If you use a personal vehicle, do you find that you park:

Closer to the entrance ☐1 Further from the entrance ☐2 Wherever I find parking ☐3

SECTION C: HEALTH STATUS

19. Have you been diagnosed with any of the following ailments? yes □1 no □0

Please tick where appropriate and indicate

Medical conditions	Tick	When were you diagnosed
19.1 High blood pressure	1	
19.2 Low blood pressure	2	
19.3 Diabetes/ sugar	3	
19.4 Depression	4	
19.5 Anemia	5	
19.6 Thyroid disease	6	
19.7 Arthritis	7	
19.8 Other	8	

20. Are you taking any medication? yes □1 no □0
If yes, what medication?
_____

SECTION D: KNOWLEDGE OF PHYSICAL ACTIVITY

21. Do you think exercise is beneficial for good health? yes □1 no □0

22. Do you think exercise is beneficial during pregnancy? yes □1 no □0
If yes, list the benefits
_____

_____

_____

_____

SECTION E: PHYSICAL ACTIVITY

23. Do you exercise currently during this pregnancy? yes ☐1 no ☐0
If yes, answer question 25.
If no, answer question 26.

24. Did you exercise before your pregnancy? yes ☐1 no ☐0

25. Please indicate which of the following exercises you perform currently during this pregnancy and the time spent on each exercise (can tick more than one box)

Type of exercise	Tick	10min	20min	30min	>30min	How many sessions per week?
25.1 Jogging	1					
25.2 Walking	2					
25.3 Zumba	3					
25.4 Yoga	4					
25.5 Swimming	5					
25.6 Water aerobics	6					
25.7 Weight lifting	7					
25.8 Pilates	8					
25.9.1 Cycling: stationary bike	9					
25.9.2. Cycling: moving bike	10					
25.10 Other	11					

26. Please indicate the reason why you don't exercise currently during this pregnancy
(can tick more than one box)

Reason	Tick
26.1 I don't know what is exercise	
26.2 Exercise will harm the baby	
26.3 Exercise will harm me	
26.4 I feel tired when I exercise	
26.5 I feel tired after I exercise	
26.6 I feel tired all the time	
26.7 I am not in good health	
26.8 I don't feel exercise is necessary	
26.9 I feel silly while exercising	
26.10 My doctor has advised me to rest	

Thank you for your participation