

**An exploration of indigenous
contraception among the Batswana of
Ngaka Modiri Molema District
Municipality, North West Province,
South Africa**

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Thesis accepted for the degree [Doctor of Philosophy in
Indigenous Knowledge Systems](#) at the North-West University

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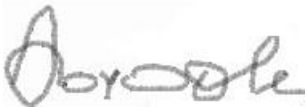
Graduation: May 2021

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DECLARATION

I, **Molelekwa Arthur Moroole**, declare that the thesis titled “An exploration of indigenous contraception among the Batswana of Ngaka Modiri Molema district municipality, North West province, South Africa” hereby submitted for the degree of Doctor in Indigenous Knowledge Systems at the North-West University is my own original and independent research work.

The thesis was carried out under the promotion of Prof. S. A. Materechera, Dr. W. OtangMbeng and Prof. O.A. Aremu. I have not previously submitted this thesis or any part of it for any degree or examination at another Faculty or University. The research work reported in this thesis does not contain any person’s data, pictures, graphs or other information unless specifically acknowledged as being sourced from those persons.

Signed:  Date: 24/11/2020

Molelekwa Arthur Moroole (Candidate)

As the candidate’s promoters, we agree to the submission of this dissertation.

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Signed:  Date: 25/11/2020

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ETHICS CLEARANCES FOR THE STUDY



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ETHICAL APPROVAL LETTER OF STUDY

Based on approval by the Health Science Ethics Committee (FAST-HSEC) on 07/08/2018 after being reviewed at the meeting held on 07/08/2018, the North-West University Research Ethics Regulatory Committee (NWU-RERC) hereby approves your project as indicated below. This implies that the NWU-RERC grants its permission that, provided the special conditions specified below are met and pending any other authorisation that may be necessary, the project may be initiated, using the ethics number below.

Project title: An exploration of indigenous contraception among the Batswana of Ngaka Modiri Molema District Municipality, North West Province, South Africa.																																														
Project Leader/Supervisor: Prof SA Materechera & Dr WO Mbeng																																														
Student: M Moroole																																														
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Application Type: Single study																																														
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Special conditions of the approval (if applicable):

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 - the required annual report and reporting of adverse events was not done timely and accurately; and/or
 - new institutional rules, national legislation or international conventions deem it necessary.
- HSEC can be contacted for further information via Lesetja.Motadi@nwu.ac.za or 018 289 2598.

The HSEC would like to remain at your service as scientist and researcher, and wishes you well with your project. Please do not hesitate to contact the NWU-RERC or HSEC for any further enquiries or requests for assistance.

Yours sincerely

Prof Lesetja Motadi
Chair NWU Health Science Research Ethics Committee (FAST-HSEC)

02 June 2020

ETHICS APPROVAL LETTER OF STUDY

Based on approval by the North-West University Animal Care, Health and Safety Research Ethics Committee (NWU-AnimCareREC) on 02/06/2020, the NWU-AnimCareREC hereby approves your study as indicated below. This implies that the NWU-AnimCareREC grants its permission that, provided the general conditions specified below are met and pending any other authorisation that may be necessary, the study may be initiated, using the ethics number below.

Study title: An exploration of indigenous contraception among the Batswana of Ngaka Modiri Molema District Municipality, North West Province, South Africa	
Principal Investigator/Study Supervisor/Researcher: Prof SA Materechera	
Student: MA Moroke - 26102508	
Ethics number:	N W U - 0 0 5 9 6 - 1 9 - A 5
Application Type: Single study	
Commencement date: 02/06/2020	Risk: Category 3
Expiry date: 30/06/2021	
Approval of the study is provided for a year, after which continuation of the study is dependent on receipt and review of an annual monitoring report and the concomitant issuing of a letter of continuation. A monitoring report is required at the end of June annually until completion.	

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 - annually on the monitoring of the study, whereby a letter of continuation will be provided annually, and upon completion of the study; and
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TURNIT-IN REPORT

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DEDICATION

I humbly dedicate this thesis to my mother, Lenah Tele Moroole for her financial and emotional support throughout my study. Thanks for teaching me to be humble and honest and also to work hard and pray.

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Disclaimer

Any opinions, findings, and conclusions or recommendations made in this material are that of the author and the NRF does not accept any liability in this regard.

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STRUCTURE OF THE THESIS

Chapter 1 introduces the study by providing background on indigenous contraception, including problem statement, aim and objectives of the study, including the contribution made by this study to knowledge and thesis structure. Chapter 2 provides literature review with focus on African indigenous contraception and medicinal plants used for contraception in South Africa, discusses philosophical and epistemological underpinnings of the study. Chapter 2 further offers conceptual framework of the study and theoretical framework centered on the following theories; holism theory, African feminism theory, Post-colonial theory and Afrocentricity theory. Chapter 3 is based on in-depth interviews conducted among Batswana Traditional Health practitioners (THP) in Ngaka Modiri Molema district municipality (NMMDM) and discuss practices, taboos and techniques of indigenous contraception, including ethno-botanical knowledge of medicinal plants used for contraception among the Batswana. Chapter 4 is based on a survey conducted among Batswana women in Mahikeng local municipality to investigate their knowledge, attitudes and perceptions towards indigenous contraception as the factors that contribute towards poor usage of indigenous contraception. Chapter 5 investigated the safety of the herbal mixture used for contraception by analyzing its cytotoxicity on Vera cells through an MTT assay, including analyzing its acute oral toxicity on rats following Organisation for Economic Corporation and Development (OECD) guidelines. Chapter 6 analysed the phytochemical composition of the herbal mixture used for contraception using gas chromatography mass spectrometry (GCMC) instrument with a focus on bioactive compounds responsible for contraceptive activity. Chapter 6 further evaluated the pre-coital contraceptive efficacy of the herbal mixture on female rats. Chapter 7 provides a general discussion conclusion and recommendations towards stakeholders.

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POSITIONALITY STATEMENT

It is reasonable to expect that the researcher's beliefs, ethnicity, cultural and educational background, gender, race, class, and socioeconomic status are important variables that may affect and influence the research process (Bourke, 2014). In addition to the technical, qualitative and quantitative research methods for ensuring validity, a preemptive and fundamental step is to critically reflect on, flesh out, interrogate, and state one's positionality (Derry, 2017). The researcher is a middle-aged male African belonging to the Batswana ethnic group of South Africa. The researcher's worry was that elderly females were not going to be completely open regarding indigenous contraception to a middle-aged man because of the sexual and cultural (ancestors and initiation schools) "sensitivity" of the topic. The lack of openness from participants because of the researcher's gender or/and age could affect the quantity and quality of the data collected. The researcher frequently visited each participant prior to interviews to build trust and clarify all doubts, misconceptions and misunderstanding among participants. Participants notified the researcher when they were ready for interviews, and hence provided data of high quality. Being a Motswana (a term used to describe a Batswana individual) might have also contributed to participant's willingness to provide with such valuable data. The researcher's IKS background allowed collection, analysis and interpretation of ethnographic (both qualitative and quantitative) data without being critical or judgmental about the "nonscientific" nature of some of the mentioned techniques. The researcher's scientific background complemented his background on indigenous knowledge systems and ensured application of modern scientific principles and methods of investigation.

ABSTRACT

Fertility regulation in pre-colonial Africa took place through a range of African cultural practices that ensured safe and effective prevention of unwanted pregnancies. One of the effective ways to prevent unwanted pregnancies was through prevention of conception, referred to as contraception. Contraception among indigenous communities in Africa was based on indigenous knowledge systems (IKS) and formed part of the African traditional medicine (ATM). This type of contraception is referred to as indigenous contraception and it includes both the natural and traditional forms of contraception. During the colonisation of South Africa, indigenous contraception was marginalised and emphasis was placed on western contraception. The aim of this study was to explore indigenous contraception among the Batswana of the Ngaka Modiri Molema district municipality (NMMDM), North West province (NWP) of South Africa with a view to establish its interface with western knowledge and systems of contraception. The study started with documenting the ethnobotanical knowledge of indigenous contraception among the Batswana and used their herbal mixtures to conduct safety and efficacy studies in the laboratory. In-depth interviews conducted with seven purposefully selected Batswana Traditional Health Practitioners (THPs) identified four practices of indigenous contraception. This includes birth spacing, virginity or postponement of first birth, stopping of reproduction and indigenous emergency contraception among others. Techniques of indigenous contraception included abstinence, use of herbs, drinking water, avoidance of certain foods, soil eating, waistbands and waist belts, burial techniques and male waist acupuncture. The ethno-botanical knowledge of medicinal plants used for contraception was documented and the most common herbs used for contraception included phate ya ngaka (*Helichrysum caespitium*), makgabenyane (*Bulbine frutescens*) and setlhokotlhoko (*Teucrium trifidum*). The knowledge, attitudes and perceptions of Batswana women in the Mahikeng local municipality towards indigenous contraception was investigated and showed that their knowledge was poor. The study revealed that the majority of young women (20-40 years) had a negative perception towards the safety and effectiveness of indigenous contraception. The safety and efficacy of the herbal mixture consisting of *H. caespitium*, *B. frutescens* and *T. trifidum*, as used by the Traditional Healing Practitioners (THPs) for indigenous contraception, was evaluated using cytotoxicity assay. The results showed a dose-dependent cytotoxicity with an increase in

concentration. However, the results confirmed that the herbal mixture was safe, with an inhibitory concentration (IC₅₀) of 755.2 ug/ml compared to the 30 µg/ml threshold placed by the American National Cancer Institute (NCI) guidelines. The safety of the herbal mixture was further evaluated with oral acute toxicity on female rats following the Acute Toxic method. The estimated LD₅₀ was 2500 mg/kg and thus the herbal mixture was classified as category 5 substance in terms of toxicity. Acute oral toxicity studies further showed that the herbal mixture was safe, with no mortality or morbidity observed. The acute oral toxicity study was followed by phytochemical analysis using a gas chromatography mass spectrometry (GC-MS) where approximately 21 phytochemicals were identified from the herbal mixture, with the presence of two bioactive compounds; phenol and 2-methoxy-4vinylphenol (a phenolic compound). The results of an efficacy study showed that only one female rat from the 21 tested in the study did not fall pregnant. This result showed that the herbal extract had a low contraceptive efficacy in rats. In addition, results from the effect on size showed a small but non-significant effect between dose (mg/kg) and weight (g). These findings are to be expected considering the holistic nature of indigenous contraception which dictates that a multiplicity of techniques and taboos be simultaneously applied to increase effectiveness. In addition, the sample size might have been too small, including low concentration range relative to the estimated lethal dose. The findings of the study revealed that the Batswana THPs in NMMDM possess rich knowledge about indigenous contraception. It is therefore, important that THPs be consulted during the drafting of policies and interventions meant to curb unwanted pregnancies in South Africa. The study further showed a need to educate and empower women by providing them with knowledge about indigenous contraception, and its safety and efficacy to change their negative perceptions. The study further showed that IKS and ATM practices were compatible with scientific principles and can be exposed to scientific scrutiny as part of knowledge expansion. This finding allows collaboration between THPs and Western health practitioners (WHPs) as well as integration of IKS and Western knowledge systems (WKSs) as part of developing a decolonised and modernised contraception in South Africa. Indigenous contraception plays a significant role in preventing unwanted pregnancies in South Africa. This study recommends further safety and efficacy studies on other herbal contraceptives, with THPs forming a central part of the investigations.

Key-terms: Batswana; Contraception; Efficacy; Indigenous; Safety; Traditional

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LIST OF ABBREVIATIONS AND ACRONYMS

AIDS:	Acquired immune deficiency syndrome
ATM:	African traditional medicine
CE:	Contraceptive efficacy
CV:	Cell viability
DOSD:	Department of Social Development
DST:	Department of Science and Technology
ESR:	Erythrocyte sedimentation rate
FAST:	Faculty of Science and Technology
FNAS:	Faculty of Natural and Agricultural Sciences
FSH:	Follicle stimulating hormone
FRC:	Faculty Research Council
GC-MS:	Gas chromatography mass spectrometry
GHS:	Globally harmonised classification system
GPT:	Glucose, cholesterol, serum glutamate pyruvate
HIV:	Human immunodeficiency virus
HPG:	Hypothalamic–pituitary–gonadal
IKS:	Indigenous knowledge systems
IPUF:	Indigenous Plant Use Forum
LH:	Luteinizing hormone
MIMMM:	Mother infant maternal mortality and morbidity
NIST:	National Institute of Standard and Technology
NMMDM:	Ngaka Modiri Molema District Municipality
NWP:	North West province
NWU:	North-West University
NWU-AnimCareREC:	North-West University Animal Care, Health and Safety Research Ethics Committee
HSEC:	Health Sciences Ethics Committee
OECD:	Organisation for Economic Corporation and Development
PCDDP:	Pre-Clinical Drug Development Platform
PCV:	Platelets, clotting time and packed volume
PharmaCen:	Centre of Excellence in Pharmaceutical Sciences

RBC: Red blood cell
SABC: South African Broadcasting Corporation
SANAS: South African National Accreditation System
SANBI: South African National Biodiversity Institute
SANS: South African National Standards
SAVC: South African Veterinary Council
SPCA: South African Prevention of Cruelty to Animals
StatsSA: Statistics of South African
STI: Sexually transmitted infections
THPs: Traditional health practitioners
TIC: Total ion chromatogram
WBC: White blood cell count
WHO: World Health Organization
WKSs: Western Knowledge Systems
WHPs: Western health practitioners
ZCC: Zion Christian Church

CONFERENCE PRESENTATIONS AND PUBLICATIONS ARISING FROM THE STUDY

Conference presentations

1. Moroole, M.A. Materechera, S.A., Mbeng W.O., Aremu, A.O. 2017. Medicinal plants used for contraception in South Africa: A review. 20th Indigenous Plant Use Forum, 9-12 July 2017, Pretoria, Gauteng Province, South Africa.

Publications

1. Moroole, M.A. Materechera, S.A., Mbeng W.O., Aremu, A.O. 2019. Medicinal plants used for contraception in South Africa: A review. *Journal of Ethnopharmacology*, 235: 19-27.
2. M.A Moroole, S.A. Materechera, W. Otang-Mbeng, AND A.O. Aremu. 2020. Practices, taboos and techniques of indigenous contraception among Batswana traditional healers in Ngaka Modiri Molema district municipality, South Africa. *African Journal of Physical Activity and Health Sciences*, 26(4): 427-437.
3. Molelekwa A Moroole, Simeon A Materechera, Wilfred Otang-Mbeng, Adeyemi O Aremu. 2019. African indigenous contraception: A review. *African Journal of Reproductive Health*, 24(4): 173-184.

CHAPTER 1: INTRODUCTION

1.1 BACKGROUND

The initiation of conception comprises two processes: fertilization and implantation (Theron and Grobler, 1998). Contraception refers to the prevention of conception, but generally means the prevention of pregnancy (Pathak *et al.*, 2005). In this study, contraception means to prevent the release of sperms in the reproductive tract of the male (ejaculation), release of egg from the ovary (ovulation), union of egg and sperm in the oviduct (fertilization), and attachment of embryo to the uterus wall (implantation). On the other hand, abortion refers to termination of the developing embryo from the uterus (Anand *et al.*, 2015). The act of controlling childbirth is as old as man has existed (Anyebe, 2014). Traditional methods of contraception have been used worldwide since time immemorial to prevent unwanted pregnancies (Maja, 2002). The Egyptians wrote the first document on contraception in 1850 BC, and used *coitus interruptus* (withdrawal) and vaginal plugs formed from magic portions, seeds and herbs to prevent pregnancy (Anyebe, 2014). The ancient Egyptians drank the seeds of a fenel-like plant called *Silphium albiflorum* A.Gray as some form of juice once a month for contraception (Raga, 2016). Some other preventive methods used by the Egyptians were sex taboos, limiting the time and frequency of sex, prolonged lactation (breastfeeding), delayed marriages and celibacy (Anyebe, 2014). Indigenous contraception among Africans was thus both magical and rational (Anyebe, 2014). Interventions to avoid pregnancy after sexual intercourse already existed among women in precolonial Sub-Saharan Africa (Agadjanian, 1999). In pre-colonial Southern Africa, women regulated their fertility through a range of cultural practices that ensured effective child spacing (Department of Health, 2012). The Maasai tribe of Kenya and the South African Tsonga tribe adopted *coitus interruptus*, including *coitus reservatus* (i.e., suppression of male orgasm) to prevent pregnancy (Dalone, 2015). The Batswana, another South African tribe (ethnic group) traditionally spaced their families by means of breastfeeding and abstinence for a period of two years after childbirth (du Pradal, 1983). Prevention of conception through *coitus interruptus* and abstinence continued until the baby began to crawl, the end of which was marked a ceremonial rite (Anyebe, 2014). Due to colonial policies and the western hegemony of

knowledge, emphasis was placed on modern contraception as a matter of course, while indigenous contraception was being ignored (Hanks, 2002).

In Apartheid South Africa, the family-planning program predictably became a focal point of racial political contestation as the national family planning program sought to provide contraception in order to reduce and decimate the black South African population while actively encouraging the growth of the white population (Department of Social Development, 1998). The sexual and reproductive health care in South Africa changed in the 1990s after participation in key world conferences and conventions (Department of Health, 2012). In addition, the new democratic South Africa with a constitution that had human rights and equity as its cornerstone created an enabling environment for health transformation, including sexual and reproductive health and rights (Department of Health, 2012).

The World Health Organization (WHO) (2002) developed Traditional Medicines Strategy 2002–2005 to integrate traditional medicine into national health care systems by developing and implementing national traditional medicine policies and programmes. The strategy by the WHO (2002) was to promote the safety, efficacy and quality of traditional medicine by expanding the knowledge base of these remedies and to increase the availability and affordability of traditional medicine among poorer populations. This led to the establishment of the Traditional Health Practitioners Act no 22 of 2007 for improving the accessibility, safety, efficacy, and quality of traditional medicine in South Africa through collaboration between Traditional health practitioners (THPs) and Western health practitioners (WHPs). The first WHO Congress on traditional medicine held in China in 2008 assessed the progress made by member states as to help these countries integrate traditional medicine into their health systems (WHO, 2008). The declaration adopted by congress emphasised further development of traditional medicine based on research and innovation to ensure its safety and effectiveness. The WHO Traditional Medicine Strategy for 2014–2023, released in 2012 intended to support member states in promoting the safe and effective use of traditional medicine by regulating, researching and integrating traditional medicine products, practitioners and practice into health systems and emphasised education and training of AIHP and WHP. These global and national developments resulted in South Africa's first contraception policy, which acknowledged

the use of traditional techniques such as the use of medicinal plants for contraception (Department of Health, 2012). The current modern fertility control methods are inadequate to meet the varied and changing personal needs of couples at different times and in differing geographical, cultural, and religious settings that exist worldwide (Sathiyaraj *et al.*, 2012). For example, the National Contraception and Fertility Planning Policy and Service Delivery Guidelines listed access to contraceptive service as one of the negative factors influencing contraceptive use in South Africa (Department of Health, 2012). Therefore, the location of a health facility and the operational hours are two of the most important factors preventing pregnant women from using family planning services (Molebatsi *et al.*, 2013). In addition, Covid-19 pandemic led to reduced supply of free contraceptives by government hospitals due the constrained funding of public health systems. As a result, indigenous knowledge of medicinal plants used to prevent pregnancy is appealing as it is part of the cheaper self-insurance contraceptive scheme for the poor.

The current contraceptive options for men are also not ideal because of vasectomy is irreversible, condoms have unacceptably high failure rate whilst withdrawal is unreliable and always problematic (Cheng and Mruk, 2010; Glasier, 2010). The Centers for Disease Control and Prevention (CDC) (2018) report on reproductive health emphasized that elements considered individually by a woman, man, or couple when choosing the most appropriate contraceptive method includes safety, effectiveness, accessibility and affordability of contraceptives. A large number of medicinal plants are used as contraceptive agents in different countries due to their readily availability and easy accessibility (Keshri *et al.*, 2003). Herbal contraceptives may further offer alternate ways for women who lack access to emergency (postcoital) contraceptives. These herbal contraceptives may also be of assistance to women who experience health problems due to risks and side effects associated with modern contraception (Anand *et al.*, 2015). About five of the 25 medicinal plants identified as being used for contraception in South Africa were found to have contraceptive activity when evaluated *in vivo/in vitro* (Moroole *et al.*, 2019). For example, *Bulbine latifolia* showed contraceptive activity in male rats by decreasing the serum testosterone and progesterone levels in rats (Yakubu and Afolayan, 2009a) whilst *Pouzilzia mixta* inhibited implantation in female rats without showing any signs of toxicity (SewaniRusike, 2013). Thus, medicinal plants hold a great promise for

the discovery of safe and effective contraceptive agents (Kumar *et al.*, 2012). Medicinal plants used for contraception that show contraceptive activity by influencing reproductive hormones without any signs of toxicity such as mortality and morbidity are potential sources for the discovery and development of accessible, affordable, safe and efficient female hormonal contraceptives (Abdilahi and Van Staden, 2012).

1.2 PROBLEM STATEMENT

The problem is poor collaboration between traditional health practitioners (THPs) and western health practitioners (WHPs). Collaboration between THPs and WHPs need to include researching and integration of indigenous and western knowledge systems. Scientific and technological developments regarding contraception be based or include Indigenous knowledge systems (IKS). The IKS policy further stated that without the input of indigenous knowledge, many valuable medical products used extensively today would not exist (Republic of South Africa, 2006). Similarly, indigenous knowledge systems (IKS) and indigenous contraception in particular, need to be subjected to scientific scrutiny and methods of investigation. This integration of indigenous and western knowledge systems will increase THP and WHP's knowledge regarding contraception. Innovative research approaches that combine indigenous and scientific methods of investigation are needed to promote collaboration between THPs and WHPs in South Africa.

1.3 AIM AND OBJECTIVES OF THE STUDY

The study aimed to explore indigenous contraception among the Batswana of Ngaka Modiri Molema District Municipality (NMMDM), North West province (NWP) of South Africa. The objectives of the study were to:

1. Document ethno-botanical knowledge, practices and techniques of indigenous contraception among the Batswana traditional healers in NMMDM
2. Assess the knowledge, attitudes and perceptions towards indigenous contraception among the Batswana women in Mahikeng local municipality.
3. Determine the cytotoxicity and acute oral toxicity of the herbal mixtures used for contraception by the Batswana traditional healers in NMMDM

4. Examine the phytochemical composition and efficacy of the herbal mixtures used for contraception by the Batswana traditional healers in NMMDM

1.4 LIMITATIONS OF THE STUDY

This study explored indigenous contraception with regard to humans only, and did not consider knowledge, practices and techniques of indigenous contraception with regard to animals, such as animal castration. Another limitation of the study lie on its lack of generalizability due to small sample sizes for both human and animal studies. In addition, the efficacy study could not be repeated because of the time and processes required to implement the study. For example, another animal ethics process will be required; accessibility facilities and availability of human resource at the vivarium are some of the factors that made it difficult to repeat the study. Costs, time and ethical consideration lead to some aspects of the efficacy initially proposed to be excluded, including testing the herbal mixture on male rats as well, conducting further postcoital contraceptive efficacy on males, drawing of blood samples for hormonal analysis, inclusion of positive and negative controls, and analysis of single species that formed the mixture. As a result, the data obtained from the efficacy study was not comprehensive, and results were too simplistic as it lacked statistical analysis. Another weakness of the study rests on the neglect done on other medicinal plants beside the herbal mixture, documented in this study as being used for contraception. The study also used only water as a solvent; other solvents should have been included such as ethanol (Sewani-Rusike, 2013). Other herbal contraceptives, including single species and herbal mixtures documented in this study did not receive adequate attention, and focus was mainly on one herbal mixture mentioned by most participants. These other documented herbal contraceptives need to be fully explored too, including their phytochemistry, toxicity and efficacy.

1.5 DEFINITIONS OF KEY TERMS AND CONCEPTS USED IN THE STUDY

African feminism: Women-oriented intellectual paradigm that bring about a change in the society on how African women are treated, discouraging discrimination and humiliation of African women and fighting for their emancipation (Ann, 2015).

African traditional medicine (ATM): The sum total of all knowledge and practices, whether explicable or not, used in diagnosis, prevention and elimination of physical, mental, spiritual or social imbalance, relying exclusively on practical experience and observation handed down from generation to generation verbally or in writing (Richter, 2003).

Afrocentricity: A revolutionary paradigm shift in thinking proposed as an adjustment to black disorientation, decenteredness, and lack of agency (Asante, 2009).

Attitude: A feeling or opinion about something or someone and a way of behaving that follows from it (Chikonso, 2012).

Axiology: The philosophical study of value (Saunders *et al.*, 2012).

Batswana: Southern African ethnic grouping distinctive from the Venda, Zulu or Xhosa that is based mainly in South Africa and Botswana, a country named after them (Pilane, 2002).

Cell viability: The quantification of the number of live cells and is usually expressed as a percentage of the control.

Colonialism: The policy or practice of acquiring full or partial political control over another country, occupying it with settlers, and exploiting it economically (Carlson, 2019).

Contraception: Prevention of conception or pregnancy (Theron and Grobler, 1998).

Contraceptive efficacy: The ability of a substance or device to prevent pregnancy.

Cytotoxicity: The degree to which an agent has specific destructive action on certain cells (Stevens *et al.*, 2008), measured in ml/kg.

Dose: The amount of test substance administered (OECD, 2001).

Efficacy: The ability, especially of medicine or method of achieving something, to produce the intended result (Cambridge dictionary).

Ethnobotany: The scientific study of the traditional knowledge and customs of a people concerning plants and their medical, religious, and other uses (Hulcombe, 2020).

Ethnography: The art and science of describing a group or culture (Fetterman, 1998).

Experiment: A scientific procedure undertaken to make a discovery, test a hypothesis, or demonstrate a known fact.

Exploration: Researchers explore when they possess little or no scientific knowledge about a group, process, activity, or situation they want to examine but nevertheless have reason to believe the phenomenon contains elements worth discovering (Altheide, 2008).

Holism: An approach to health which acknowledges that health depends upon many interrelated components which interact in such a way that the overall effect constitutes health (or illness) (Wade, 2009).

Indigenous contraception: Prevention of unwanted pregnancy through natural and traditional contraception following indigenous knowledge systems (IKS) and African traditional medicine (ATM).

Indigenous Knowledge Systems (IKS): A body of knowledge or bodies of knowledge of the indigenous people of particular geographical areas (Mapara, 2009).

Knowledge: Facts, information and skills acquired through experience or education that illustrate familiarity and understanding of a subject (Chikonzo, 2012).

Lobola: Money payed to the family of the girl to be married, usually in cows.

Modern contraception: Contrast to popular belief, modern contraception in this study, refers to collaboration of THP and WHP in the prevention of pregnancy through integration of indigenous knowledge systems and western knowledge systems.

Perceptions: A mental impression, by which a person regards, understands or interprets something (Chikonzo, 2012).

Phytochemistry: The branch of chemistry concerned with plants and plant products.

Pragmatism: An approach that evaluates theories or beliefs in terms of the success of their practical application.

Safety: The condition of being protected from possible danger, risk, or death.

Taboo: Taboo, in the context of this study, refers to the traditional custom prohibiting sexual engagements to prevent pregnancy.

Technique: Technique in the context of this study refers to a required technical skill or procedure to perform contraception.

Traditional health practitioner: According to the Traditional Health Practitioners Act (2002) "traditional health practitioner" means a person registered under this Act in one or more of the categories of traditional health practitioners.

Traditional medicine: The Traditional Health Practitioners Act (2002) define "traditional medicine" as an object or substance used in traditional health practice for the diagnosis, treatment or prevention of a physical or mental illness or any curative or therapeutic purpose, including the maintenance or restoration of physical or mental health or wellbeing in human beings (and animals), but does not include a dependence-producing or dangerous substance or drug.

Western contraception: Prevention of pregnancy based on scientific advancement and technological developments.

Western health practitioner: A medical practitioner working at western health care systems such as public or private clinics and hospitals, and obtain medical training at formal institutions of learning such as universities.

Western Knowledge Systems: Knowledge system based on scientific principles of investigation and technological developments and is usually offered at formal institution of learning such as schools, colleges and universities.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

The previous chapter listed the aim and objectives of the study, and introduced indigenous contraception. This chapter will provide a literature review of indigenous contraception, with special focus on African indigenous contraception within a South African context. The main purpose of a literature review is to show that the researcher has read original research journal articles, text-books, clinical reports, case studies, dissertations etc., and is able to show the cognizance of what is happening in the field that is being studied (Hofstee, 2006). To identify gaps, a researcher needs to understand what has been done before, the strengths and weaknesses of existing studies, and what they might mean (Beile and Boote, 2005). Randolph (2009) states that “conducting a literature review is a means of demonstrating an author’s knowledge about a particular field of study, including vocabulary, theories, key variables and phenomena, and its methods and history”. Another great benefit of literature review is that it provides a better understanding of how research findings are presented and discussed in the particular discipline (Beile and Boote, 2005).

This chapter first presents definitions of important terms and concepts in the study, followed by ontological perspective of ATM and contraception. A brief description of ATM is presented from a South African context. The chapter includes a review of African indigenous contraception, including a review on medicinal plants used for contraception in South Africa. The review on African indigenous contraception relates to the ethnographic part of the study because of its focus on practices and techniques of indigenous contraception. A review on medicinal plants used for contraception in South Africa is critical for the experimental part of the study because of its focus on *in vitro* and *in vivo* studies that investigated the toxicity and efficacy. The chapter further discusses the philosophical and epistemological underpinnings of the study, including indigenous philosophical underpinnings, include African indigenous worldviews, paradigms, cosmology, ontology, epistemological, axiology, methodologies and theories in research on IKS and the use of indigenous languages among indigenous communities. The chapter further provides the conceptual and theoretical frameworks of the study. Conceptual and theoretical frameworks make research findings more meaningful (Adom *et al.*, 2018).

2.2 ONTOLOGICAL PERSPECTIVES OF INDIGENOUS CONTRACEPTION

2.2.1 Indigenous knowledge systems (IKS) and African traditional medicine (ATM)

The term 'indigenous' is understood as being similar or synonymous to 'traditional', 'aboriginal', 'vernacular', 'African', 'Black', and 'native American' (Loubser, 2005). The phrase 'indigenous' people refers to a specific group of people occupying a certain geographic area for many generations and possess, practice and protect a total sum of knowledge and skills constitutive of their meaning, belief systems, livelihood constructions and expression that distinguish them from other groups (Nel, 2005; Masoga, 2005). Indigenous knowledge systems (IKS) refer to a distinctive body of knowledge, innovations and practices that have been developed over many generations informally without formal education, which allows indigenous communities to sustain livelihood and survive within their specific natural and cultural environmentl (Mascarenhas, 2004). Critics of the IKS claim that it is "knowledge that involves incomplete...or at worst a questionable understanding or conception of knowledge" based on the fact that part of indigenous knowledge systems largely relate to the communal and spiritual forms of knowledge transfer without necessarily having proven that empirically (Horsthemke, 2004).

Mapara (2009) stated that IKS is more than just a displaying of the knowledge and belief systems of the formerly colonised people; it is one of the forms of response to the myth of western superiority and universality. IKS is facing plethora of challenges" including tacit nature, lack of documentation and empirical literature, including the search for methodologies which are not driven by blind assertion of African ideas and concepts just to replace the Western terms without critical reflection (Mutema, 2003). Closely related to this is the second challenge of designing research methodologies that respond to the multi-disciplinary field of indigenous knowledge systems and representative of its nature in its own right and context at the same time taking account of the contemporary changes and developments in western knowledge systems (Wiredu, 1997).

Traditional medicine and traditional healers elude precise definition or description because it contains diverse and sometimes conflicting characteristics and viewpoints (WHO, 2002). According to the Traditional Health Practitioners Act 22 of 2007, "traditional medicine" refers to an object or substance used in traditional health practice for the

diagnosis, treatment or prevention of a physical or mental illness or any curative or therapeutic purpose, including the maintenance or restoration of physical or mental health or well-being in human beings. Richter (2003) described African traditional medicine (ATM) as the sum total of all knowledge and practices, whether explicable or not, used in diagnosis, prevention and elimination of physical, mental, spiritual or social imbalance, relying exclusively on practical experience and observation handed down from generation to generation verbally or in writing. According to the Traditional Health Practitioners Act (2002), a "Traditional Health Practitioner" (THP) means a person registered under this act in one or more of the categories of traditional health practitioners. McClean and Bannerman (1982) emphasise that a THP be recognised by the community as competent to provide health care based on the social, cultural and religious background as well as on the knowledge, attitude and beliefs that are prevalent in the community regarding physical, mental and social wellbeing and the causation of disease and disability.

Ulin (1975) listed two major classifications of traditional healers in Botswana: the dingaka tsa dichochwa (herbalists) and the dingaka tsa dinaka (diviner), those who throw the bones. Pretorius (1994) also categorized traditional healers according to diviner (sangoma), herbalist (Ngaka), and prophets (faith healers). Jurg (1993) identified four main types of healers: traditional birth attendants (TBAs), faith healers, spiritualists and traditional herbalists. In the same way, Mokgobi (2012) described four types of traditional healers in South Africa as Diviner (ngaka ya ditaola), Sanusi (Sedupe), traditional surgeon and traditional birth attendants (Mmelegisi). This study recognizes complexity of classifying and categorization of traditional healers in South Africa due to the overlapping of different healers across different categories, including the fact that anecdotal data show that some healers are not keen to be classified or categorised. Therefore, all traditional healers will be referred to as African health practitioners as used in the Traditional Practitioners Act of 2007, whilst western health providers will be referred to as Western Health practitioners (WHPs). There were approximately 190 000 THPs in South Africa (Gqaleni *et al.*, 2007).

2.2.2 The concept of contraception

Theron and Grobler (1998) define contraception as prevention of conception. Contraception can be classified in many ways, such as male versus female; permanent

versus reversible; hormonal versus non-hormonal; short term versus long term; modern versus conventional; and western or modern versus traditional or indigenous (Theron and Grobler, 1998). Since this study falls under indigenous knowledge systems, it is appropriate to classify contraception in this study according to indigenous against western contraception.

Western contraception is based on scientific and technological developments and is provided by Western Health Practitioners (WHPs) at clinics or hospitals. Modern techniques of contraception include sterilization (male and female); intrauterine devices and systems; subdermal implants; oral contraceptives; condoms (male and female); injectable; emergency contraceptive pills; patches; diaphragms and cervical caps; spermicidal agents (gels, foams, creams, suppositories); vaginal rings and sponge (Hubacher and Trussell, 2015). On the other hand, indigenous contraception forms part of IKS and assists indigenous communities in regulating unwanted pregnancies and its related negative consequences.

Indigenous contraception in this study is taken to refer to African indigenous contraception, in the same way IKS is considered to refer to African indigenous knowledge systems. Indigenous contraception thus follows principles and philosophies of ATM such as belief in communality, including natural and spiritual realms. Indigenous contraception is conceptualised in this study to consist of natural and traditional contraception. Traditional contraception requires intervention from a traditional health practitioner (THP) such as herbal, waistband and burial techniques of indigenous contraception. Traditional contraception thus includes religious techniques of pregnancy prevention such as drinking holy tea and water. Natural techniques of indigenous contraception mainly place emphasis on avoidance of sexual contact (Frothingham, 2018).

Natural techniques of indigenous contraception include for example, abstinence and the calendar method, Western hegemony of knowledge and its colonial policies have emphasized the use of modern contraception as a matter of course, while indigenous contraception is often ignored (Hanks, 2002). “Modern contraception” is usually associated or attributed to western contraception. However, in this study, modern contraception refers to an integrated approach to contraception, by integrating IKS and

Western knowledge systems and promoting collaboration between THPs and WHPs. Although natural techniques of contraception such as abstinence and withdrawal are recognised by WHPs, the challenge has been to integrate traditional contraceptives because of their association with spirituality.

2.2.3 Common techniques of indigenous contraception in Africa

Techniques, practices, mechanisms and reasons for use of African indigenous contraception per African country are summarized (Table 2.1). African countries have been listed alphabetically, from Angola to Zimbabwe. More than 40 techniques of African indigenous contraception are known or used across approximately 16 African countries. Results showed that few studies met the criteria in North Africa for selection in this review. This could imply that African indigenous contraception is mostly practiced in sub-Saharan Africa than in North Africa. Studies that met the criteria were mostly conducted in Nigeria. Techniques that were known or used in five or more countries were considered common techniques. These techniques of indigenous contraception from different African countries are described in Table 2.1.

Table 2.1: An overview of indigenous contraception approaches across different African countries.

Country	Techniques	Mechanism(s)	Practices	Reasons	Reference
Angola	Periodic abstinence	Unspecified	Unspecified	Unspecified	Decker and Constantine (2011)
Burkina Faso	Postpartum abstinence; withdrawal; breastfeeding	unspecified	Child spacing	For the health of the baby	Rossier and Hellen, (2014)
Cameroon	Periodic abstinence; withdrawal	Unspecified	Child spacing; stopping reproduction; postponement of first birth	To finish school or seek employment	Ekani-Bessala <i>et al.</i> (1998); Johnson-Hanks (2002)
D.R Congo	Burying menstrual blood; placing curses of sterility on mother; postpartum abstinence; periodic abstinence; withdrawal;	Unspecified	To stop reproduction; child spacing	As a punishment for marrying against the family will;	Waife (1978); Ziyane and Ehlers (2006); Bertrand <i>et al.</i> (1983)

	virginity; polygamy; drinking herbs				
Egypt	Periodic abstinence; withdrawal; breastfeeding	Unspecified	Unspecified	Unspecified	El Shamy <i>et al.</i> (2013)
Eswatini (Swaziland)	Breastfeeding	Unspecified	Unspecified	Unspecified	Ziyane and Ehlers (2003)
Ethiopia	Standard days method; periodic abstinence; withdrawal; breastfeeding	Unspecified	Unspecified	Unspecified	Tilahun <i>et al.</i> (2013)
Gambia	Total abstinence; postpartum abstinence; withdrawal; waistband; drinking of herbs	Young woman delays sexual relations for years	Stopping reproduction; Postponement of first birth	When a woman gets old; women with disabilities	Mothiba <i>et al.</i> (2012)
Ghana	Postpartum abstinence; withdrawal; drinking of herbs	Unspecified	Child spacing	Decoction of the bark is used for enema	Addai (1999); Dali <i>et al.</i> (2019)
Kenya	Postpartum abstinence; breastfeeding	Breastfeeding ovulation	Child spacing	To avoid an early future pregnancy	Rossier <i>et al.</i> (2014); Frank and McNicoli (1987)
Mozambique	Burial of the umbilical cord; Burying menstrual blood; waistband	Unspecified	Unspecified	Unspecified	Agadjanian (1999)
Nigeria	Douching; armlet; postpartum abstinence; withdrawal; waistband; drinking herbs	Unspecified	Emergency contraception	Unspecified	Ajayi <i>et al.</i> (2018); Odvwri (2016); Jinadu <i>et al.</i> (1997); Okeowo and Olujid (2014)
South Africa	Safety pin; burial techniques; soil eating; thigh sex; polygamy; drinking ashes, holy water or oil; postpartum abstinence; periodic	Focusing on the pin delays vaginal secretions: no penetration during sex; man move to	Stopping reproduction; child spacing; emergency contraception	Woman avoid sex until the child is one year old	Mothiba <i>et al.</i> (2012); Wood and Jewkes (2006)

	abstinence; withdrawal/ waistband; breastfeeding; drinking of herbs	another wife; breastfeeding reduce fertility			
Tanzania	Postpartum abstinence; withdrawal; Breastfeeding; drinking herbs	Unspecified	Child spacing	Unspecified	Keele <i>et al.</i> (2005); Silberschmidt and Rasch (2001)
Uganda	Baby's foot inserted in womb's opening; plants inserted in the vagina; wearing amulets and charms; burial of the umbilical cord and placenta postpartum; drinking herbs	To stop menstrual cycle; To prevent the semen from reaching the womb	To stop reproduction; child spacing	When the woman is old; For the health of the child	Ntozi and Kabera (1991); Kabagenyi <i>et al.</i> (2016)
Zimbabwe	Exposing testicles to above average heat; drinking of ashes drinking holy water or oil; abstinence/ withdrawal; <i>herbs</i> , <i>breastfeeding</i> ;	Heat weakens the sperms; women herbs with faith; noting ideal days for sex; prevent sperms penetration	Child spacing	Not to fall pregnant until the child is weaned	Jaravaza (2013)

2.2.3.1 Periodic abstinence

Periodic abstinence is used in this review as synonymous to calendar, moon checking and rhythm methods. When a couple use periodic abstinence to avoid a pregnancy, they abstain from sexual intercourse during the potentially fertile phase of the woman's menstrual cycle (Thapa *et al.*, 1990). Periodic abstinence is the most common technique used by women of most social categories (Johnson-Hanks, 2002). However, its use is most prevalent among the young and nulliparous, the unmarried, and the educated (Johnson-Hanks, 2002). In Cameroon, periodic abstinence accounts for more than half of all contraceptive use (JohnsonHanks, 2002). Periodic abstinence is the preferred technique in Cameroon because it is associated with self-discipline (Johnson-Hanks, 2002).

2.2.3.2 Withdrawal/*coitus interruptus*

Withdrawal, also known as *coitus interruptus* has been used as a contraceptive technique since biblical times (Rogow and Horowitz, 1995). An important advantage of withdrawal visa-vis many other methods is its safety (Rogow and Horowitz, 1995). Withdrawal might more aptly be referred to as a method that is almost as effective as the male condom, that is, at least when it comes to pregnancy prevention (Jones *et al.*, 2009). If the male partner withdraws before ejaculation every time a couple has vaginal intercourse, about 4% of couples will become pregnant over the course of a year (Hatcher *et al.*, 2007). Whilst some couples indicated the use of withdrawal to avoid male sperms entering the women, some elders in Zimbabwe indicated that it was a taboo to splash sperms outside (*Kurasa mbeu*) (Jaravaza, 2013).

2.2.3.3 Breastfeeding/ lactational amenorrhea method

Lactation is a natural defence against pregnancy (Sridhar and Salcedo, 2017). The lactational amenorrhea method (LAM) is the specific name given to use of breastfeeding as a dedicated technique of contraception (Sridhar and Salcedo, 2017). Though lactational amenorrhea can rival efficacy of the best modern approaches, women must experience pregnancy to use it (Potss and Bhiwandiwalla, 1989). If the mother is nursing, she is delaying the return of fertility (Potss and Bhiwandiwalla, 1989). Suckling induces a reduction in gonadotropin releasing hormone, luteinizing hormone and follicle stimulating hormone release, resulting in amenorrhea (Vekemans, 1997). In Zimbabwe, breastfeeding is used for child-spacing (Jaravaza, 2013).

LAM is unquestionably cost effective, as breastfeeding alone provides adequate nutrition and fluid intake through the first 6 months, and breast milk is considered a healthier option than its substitutes for infants in low-resource settings (Ntozi and Kabera, 1991; Afifi, 2008). LAM is 98-99% effective during the first six months after childbirth in women practicing exclusive breastfeeding (Silberschmidt and Rasch, 2001). While there are many benefits of LAM as a contraceptive method, an effective transition to another modern contraceptive method is critical for protecting LAM users against unplanned pregnancies during the postpartum period (Kouyate *et al.*, 2015). In controlled settings, two-thirds of women use LAM transition to another method effectively (Peterson *et al.*,

2000). However, studies have suggested that a variable proportion of women between 48% and 86% that use LAM successfully transition to another contraceptive method, indicating some challenges within the transition period (Peterson *et al.*, 2000; Hight-Laukaran *et al.*, 1997; Labbok and Hight-Laukaran, 1997).

2.2.3.4 Use of herbs

Medicinal plants are the most easily accessible health resource available to many communities (Dar *et al.*, 2017). Various parts and extracts of medicinal plants have been used as contraceptive agents in different countries globally (Keshri *et al.*, 2003). Several *madawa* (medicine men) in Tanzania confirmed the existence of certain herbs and roots that might act as contraceptives (ranging from indigenous trees to the juice of young papaya, to a cinnamon concoction) taken for several weeks after delivery of a baby (Keele *et al.*, 2005). Herbal contraceptives offer alternatives for women who have health problems - or lack access to modern contraceptives (Kaur *et al.*, 2011). In Gambia, herbal preparations, usually taken orally have probably been used as contraceptives for some time, as in much of Africa (Bledsoe *et al.*, 1994). Given that herbs vary widely in composition, and because there has been little systematic study of herbal contraceptives anywhere in Africa, no definitive statements about how these methods work or their effectiveness, if any, can be made (Bledsoe *et al.*, 1994). However, local women in Gambia generally describe them as having short-term effects and use certain herbs to ensure that the children are properly spaced (Bledsoe *et al.*, 1994).

In Zimbabwe, the roots of medicinal plants are ground and soaked in water, before being taken by women every day for child spacing (Jaravaza, 2013). Women also collect the bark of *Ziziphus mucronata*, boil it and drink the liquid every evening to prevent pregnancy (Jaravaza, 2013). It is also reported that Zimbabwean women drink the seed of *mbanje* (*Cannabis sativa*) once a year to avoid pregnancy (Jaravaza, 2013). In South Africa, herbs are mixed and taken orally for three months before engaging in sexual intercourse to prevent pregnancy in women (Mothiba *et al.*, 2012). In Nigeria, herbs used to prevent pregnancy can be drunk in the form of soup, be ground into powder, mixed with cold pap and eaten or herbal powder is rubbed in an incision near vagina (Jinadu *et al.*, 1997). It is now generally accepted that current modern fertility control methods are inadequate to meet the varied and changing personal needs of couples at different times in

their reproductive lives, and in the widely differing geographical, cultural, and religious settings that exist around the world (Sathiyaraj *et al.*, 2012). Medicinal plant extracts exhibiting reduction levels of testosterone, luteinizing hormone, and follicle stimulating hormone are thus potential agents in developing male contraceptives (Abdollahi and Van Staden, 2012). The central principle underlying male hormonal contraception involves the reversible suppression of the hypothalamic-pituitary testicular axis, resulting in suppression of spermatogenesis (Chao and Page, 2016; Roth *et al.*, 2016).

An ideal male-directed hormonal contraceptive must have high efficacy, be universally effective (i.e., can be used by all men), be equivalent to female-directed methods, be safe and reversible, have no short or long-term health risks, must not interfere with libido, potency, or sexual activity, be convenient, economical, affordable, and easily available (Liu *et al.*, 2010; Nieschlag, 2011). The discovery of plant-derived male contraceptives that are both reliable and reversible will help reduce unwanted pregnancies and risky abortions faced by women (Handelsman, 2005). Herbal contraceptives may also be of assistance to women who experience health problems due to side effects associated with modern contraception (Anand *et al.*, 2015).

2.2.3.5 Postpartum abstinence

Postpartum abstinence refers to abstaining from sexual relations after childbirth (Cleland *et al.*, 1999). This is a common technique deep rooted in the cultures of different communities worldwide with varying duration (Cleland *et al.*, 1999; Isenaiumhe and Oviawe, 1986; Dada *et al.*, 2002). A major form of contraception in pre-colonial Nigerian societies was abstinence from sex during breastfeeding (Zaggi, 2005). The practice of postpartum abstinence is closely linked to child spacing in Tanzania and Ivory Coast with additional connections to lactation and child health in Ghana, Côte d'Ivoire, and Malawi (Mabilia, 2005; Achana *et al.*, 2010; Desgrees-du-Lou and Brou, 2005; Zulu, 2001; Nieto-Andrade *et al.*, 2017). Postpartum abstinence in the D.R Congo is known in local terms as “separate beds” (Bertrand *et al.*, 1983). The period of abstinence varies from one cultural group to the next (Bertrand *et al.*, 1983). Many women, who live in *Matemwe* village in Tanzania, leave their husbands after birth of a baby (taking the child with them) and live in their maternal village for up to two years (Keele *et al.*, 2005). Women in Namibia also move in with their mothers until the abstinence taboo is over (Theron and Glober, 1998).

There appears to be some carry-over of traditional practice, in that (postpartum) abstinence is related to the age and nursing status of the last-born child for a substantial percentage of the women (Bertrand *et al.*, 1983). Although statistics reflect a strong motivation for postpartum abstinence to be used for child spacing in Republic of Congo, yet it is no longer the primary means of achieving this (Bertrand *et al.*, 1983).

2.2.3.6 Use of waistbands

One of the common techniques of African indigenous contraception is the use of the waist bands/belt, such as tying a rope containing traditional medicine around the waist (Wood and Jewkes, 2006). Women in South Africa reported that traditional healers dipped a red string in a mixture of herbs and asked them to tie it around the waist as a contraceptive (Ncube, 2012). The technique of a waistband could be found in Malawi after a study on traditional family planning (Maliwichi-Nyirenda and Maliwichi, 2010). In Uganda, herbs are tied in a belt and the belt is tied on the body so that the woman does not become pregnant (Kabagenyi *et al.*, 2016).

Women use waistbands or as armlets to prevent pregnancy in Nigeria wear traditional beads (Ajayi *et al.*, 2018). These items were usually soaked in recipes available as concoctions or decoctions, and thereafter, believed to possess certain spiritual powers to protect women from getting pregnant during sex (Sathiyaraj *et al.*, 2012). The waistbands among the Yoruba of Southwestern Nigeria involve herbal materials wrapped with animal skins and worn before sexual intercourse (Jinadu *et al.*, 1997). The taboo against this technique is that the woman must avoid wearing the waistband during menstruation (Jinadu *et al.*, 1997). In Gambia, charms are common, to which local lore attributes contraceptive properties, in the form of Quranic prayer amulets tied to the waist (Bledsoe *et al.*, 1994). Most charms are thought to have effects that are easily reversible; special instructions for resuming fecundity might be as simple as removing the medicine from the pouch and smearing it on the face, or even simply turning over the amulet and wearing it the opposite way (Bledsoe *et al.*, 1994). Women worry about their efficacy and most ritual specialists refuse to prepare them without the husband's consent (Bledsoe, 1994).

2.2.4 Less common techniques of indigenous contraception in Africa

Less common techniques of African indigenous contraception in this review are those techniques known or used for contraception in two or three African countries. For example, an umbilical cord is tied around the waist in Uganda and put in glass bottle in Mozambique (Ntozi and Kabera, 1999; Agadjanian, 1999). Holy water or tea is taken in Zimbabwe and South Africa (Jaravaza, 2013; Wood and Jewkes, 2006). A technique of avoiding sexual intercourse during a woman's fertile days, known as standard days, is used in Ethiopia (Tilahun *et al.*, 2013). Burial of menstrual blood is known in South Africa and Mozambique (Wood and Jewkes, 2006; Mabilia, 2005).

The placenta method is known in South Africa and used in Uganda (Mothiba *et al.*, 2012; Ntozi and Kabera, 1991). Self-sterilization is used in Uganda, Tanzania and Nigeria (Ntozi and Kabera, 1991; Keele *et al.*, 2005; Jinadu *et al.*, 1997). In Uganda, the baby's foot is inserted back in the opening of the womb after delivery, and the person inserting it says "*let the productivity stop here*" (Ntozi and Kabera, 1991). The last-born is carried in the firstborn's baby carrier and placed on the eaves of the house (Ntozi and Kabera, 1991). The burial technique of dead children is practiced in South Africa to prevent the mother from conceiving again (Mothiba *et al.*, 2012). Other less common techniques of African indigenous contraception include exposing testicles to heat, safety pin, eating soil, use of snail shell, milking rope, use of spearhead, traditional ring, standard days and padlock on labia (Jaravaza, 2013; Ntozi and Kabera, 1991; Mothiba *et al.*, 2012; Jinadu *et al.*, 1997; Ajayi *et al.*, 2018; Odivwri, 2016).

2.2.5 Mechanisms of African indigenous contraception

In Zimbabwe, men expose their testicles to above average heat to weaken the sperm, making it weak to fertilize the egg (Jaravaza, 2013). A safety pin is used in South Africa because the young girl will focus on the pin and not on sex, as such delay vaginal secretions (Mothiba *et al.*, 2012). Thigh sex is useful in preventing pregnancy because man ejaculate on the thighs and no penetration occurs (Mothiba *et al.*, 2012). In Uganda, a mother wears son-in-law's clothes because this is said to stop her menstrual cycle (Ntozi and Kabera, 1991). Polygamy prevents pregnancy by allowing a man move to another woman until the child is more than a year old (Mothiba *et al.*, 2012). Plant parts such as leaves are inserted in the vagina to prevent the semen from reaching the womb (Ntozi and

Kabera, 1991). Women in Zimbabwe drink holy water or oil every morning to prevent pregnancy through faith (Jaravaza, 2013).

Terminal abstinence is used in Gambia to prevent pregnancy by young woman delaying sexual relations for years (Bledsoe *et al.*, 1994). During post-partum abstinence, a woman is not allowed to sleep with her husband (Mothiba *et al.*, 2012). Women relying on the calendar technique prevent pregnancy by noting ideal days to have sex (Mothiba *et al.*, 2012). Withdrawal prevents pregnancy by preventing male sperms from entering the women (Jaravaza, 2013). The natural mechanism triggered by breastfeeding interrupts ovulation and the menstrual cycle (Sridhar and Salcedo, 2017). Breastfeeding is associated with a significant reduction in fertility and blocks ovulation (Mothiba *et al.*, 2012; Rosier *et al.*, 2014).

2.2.6 Practices of African indigenous contraception

2.2.6.1 Child (birth) spacing

Child spacing is clearly the most common practice of African indigenous contraception. Child or birth spacing means to provide adequate birth spacing between two or more consecutive pregnancies (Dunn *et al.*, 2016). Long before the influx of Western ideas, the understanding of the importance of child spacing to maternal and infant health was widespread among African cultures (Waife, 1978). Ninety-five percent (95%) of current users in a study undertaken in Nigeria reported using traditional contraceptive for child spacing (Jinadu *et al.*, 1997). Although most cultures in Africa, such as Ghana encourage large families, they disrespect a woman with closely spaced birth (Addai, 1999). Such a woman is said to produce children like a chicken, which is derogatory. She is expected to abstain from sexual intercourse after birth for some time (Addai, 1999). Therefore, a woman should practice traditional methods of family planning to ensure that children are properly spaced.

In Botswana, sexual relations between husband and wife are not forbidden, but the husband is expected to practice *coitus interruptus* until the child is weaned (Schapera, 1994). It is said that if a woman becomes pregnant again while still weaning a child (which may take two or three years), the child at her breast will become foolish or sickly

or suffer in some other way (Schapera, 1994). A child thus afflicted is known as *serathane*, which is also derogatory. A major theme in African indigenous contraception is the nearly universal practice of postpartum abstinence among traditional societies in tropical Africa (Bertrand *et al.*, 1983). The importance of spacing is deeply ingrained into the value systems of these societies, as it enhances the survival of the last-born (Bertrand *et al.*, 1983). The actual period varies from as little as two to three months to well over three years, depending on the culture (Bertrand *et al.*, 1983). The main purpose of practicing traditional contraception in Uganda was to increase birth interval (Ntozi and Kabera, 1991). In South Africa, the mother is advised to sleep with the grandmother until the child is 6 months to a year old, thus preventing the woman from sleeping with the husband because there is a possibility of her getting pregnant (Mothiba *et al.*, 2012).

Polygamy is also a method used in South Africa for child spacing, because the man will leave the pregnant woman and have sexual intercourse with other wives until the child is more than a year old (Mothiba *et al.*, 2012). In Zimbabwe, medicinal plants used for contraception are prepared, and thereafter taken every day by women for child spacing (Jaravaza, 2013). Some apostolic sects in Zimbabwe provide “holy water and oil” to women, and are instructed to drink the “holy concoction” with faith every evening to assist in child spacing (Jaravaza, 2013). Ashes of maize cobs are collected and mixed with hot water in a sieve, the liquid is then drunk everyday by women to aid in child spacing (Jaravaza, 2013). Child spacing is in no way intended to limit family size, but to increase the number of surviving children (Bertrand *et al.*, 1983).

The subject of over-population has not been considered a problem among Africans and has in fact, received least attention in folk medicine. African traditional marriages believe in having many children and a big family (Abdillahi and van Staden, 2012). However, whilst the married women have been allowed to produce as many children as possible, the unmarried ones (girls) were in general, not permitted to have children (Korwaro, 1981). A period of two years or more of contraception after childbirth is traditionally encouraged (du Prudal, 1983). Prevention of pregnancy after birth is important, as research has shown that pregnancies occurring within a year of the mother’s preceding birth are riskier for the health of both mother and child than those occurring later (Rossier and Helen, 2014).

Women who have short-interval pregnancies are at higher risk of preterm birth as well as giving birth to infants with low birth weight (Dunn *et al.*, 2016).

2.2.6.2 Postponement of first birth

A study on indigenous contraception in KwaZulu-Natal, South Africa, showed that virginity testing (*ukuhlolwa kwezintombi*) is one of indigenous techniques used mostly in rural areas to prevent teenage pregnancy (Shange, 2012). Virginity is one technique used in the D.R. Congo to prevent pregnancy for “births pacing (Waife, 1978). In this review, virginity is considered a technique for postponing first birth. Maturity examination is also one other method used by the Zulus of South Africa to prevent pregnancy (Mothiba *et al.*, 2012). Grandmothers are the ones that usually conduct maturity examination (Mothiba *et al.*, 2012). In Gambia, charms are often prepared for young married women who are deemed physically not mature enough to carry a child to term and deliver it safely (Mothiba *et al.*, 2012). Furthermore, a young woman may be allowed to delay full sexual relations (abstain) for several months or even years after the public announcement of the union (the distribution of kola nuts in the mosque), so that she can mature physically (Mothiba *et al.*, 2012). Prevention of pregnancy for postponement of first birth is important as a measure to prevent teenage pregnancy, especially among school attendees. For instance, one in three women in South Africa give birth before reaching the age of 20 years, with some schools reporting as many as 20 pregnant teenagers per annum (Ramathuba *et al.*, 2012).

2.2.6.3 Stopping of reproduction

There are indigenous techniques of contraception that are used for stopping the mother from further reproduction. These techniques are performed when the woman is considered too old to produce children, and when her children are old enough themselves to have children (Ntozi and Kabera, 1991). It appears, therefore that, women are motivated to practice contraception when they become grandmothers (Ntozi and Kabera, 1991). In the past, stopping of reproduction used to be a common practice in the society to avoid the embarrassment of “old” women competing with their daughters in child bearing, and to keep the respect of the younger generation (Ramulumo and Pitsoe, 2013; Ntozi and

Kabera, 1991). The practice of stopping reproduction in Uganda, known as the “grandmother effect”, involves five methods: putting a child on the eaves of the house, hot foods, firstborn behind the house, son in law’s clothes and baby’s foot (Ntozi and Kabera, 1991). In South Africa, burial techniques of indigenous contraception after the passing of a child were practiced so that the mother of the dead child must not conceive again (Mothiba et al., 2012). The Yoruba of Nigeria also use traditional techniques to stop reproduction, including waistband and drinking of drinking herbs (Jinadu *et al.*, 1997).

2.2.6.4 Indigenous emergency contraception

The word “emergency contraception” is generally associated with modern “morning-after” pills. Interventions to avoid pregnancy after sexual intercourse already existed among women in pre-colonial sub-Saharan Africa, such as the use of amulets and herbal decoctions (Agajanian, 1999). In South Africa, ash is mixed with water so that the woman can drink it immediately after sex to prevent her from getting pregnant (Mothiba *et al.*, 2012). Whilst Zimbabwean women drink the powdered roots of *Flueggea virosa* before sexual intercourse (Maroyi, 2013), *Pouzolzia mixta* is however, taken the morning after sexual intercourse to prevent pregnancy (Maroyi, 2013; Sewani-Rusike, 2013). *Pouzolzia mixta* therefore has post-coital contraceptive properties. Medicinal plants that have post-coital contraceptive effects can play a reproductive role in acting as contraceptive emergencies to prevent unwanted pregnancies (Bhathena, 2011).

2.2.6 Reasons for the practice and preference of African indigenous contraception over modern contraceptives

Although it is used for postponing the first birth and stopping reproduction, periodic abstinence is particularly important in Cameroon for spacing births (Johnson-Hanks, 2002). It appears that the main purpose of practicing traditional contraception is to increase the birth interval for the health of the child, rather than for family planning reasons (Ntozi and Kabera, 1991). The reason behind child spacing is that, even if the mistake can happen the next child will be born after the first one has attained two years old and more, then the mother will be able to care for the new born child” (Mothiba *et al.*, 2013). The reasons for indigenous contraceptive use among women in Urhobo land, (Nigeria) were to prevent pregnancy; for child spacing; to reduce a family size; to be

wealthier and to look healthier (in this review, child spacing is considered a practice, not a reason) (Odivwri, 2016). The reason for postponing first birth is for young married women who are deemed physically not mature to carry a child to term and deliver it safely (Bledsoe *et al.*, 1994). The other reason for postponing first birth is for young boys and girls to finish school and seek formal sector employment (Johnson-Hanks, 2002). The reason for stopping reproduction in African indigenous contraception is that the woman is too old to produce children (Agajanian, 1999; Ntozi and Kabera, 1991; Jinadu *et al.*, 1997). Another reason for stopping reproduction was to prevent another pregnancy after a series of difficult pregnancies or punish a daughter for marrying against the family will (Waife, 1978).

Some women use African indigenous contraception than modern contraceptives because of the fear of perceived side effects of modern contraceptives and opposition by husbands on the high costs associated with modern contraceptives (Jaravaza, 2013; Johnson-Hanks, 2002; Silberschmidt and Rasch, 2001; Bledsoe *et al.*, 1994; Kabagenyi, 2016; Odivwri, 2016). The difficulty in getting modern contraceptives was also another reason stated for preferring African indigenous contraception to modern contraceptives (Kabagenyi, 2016; Jinadu *et al.*, 1997; Silberschmidt and Rasch, 2001). Other women mentioned the assurance of privacy during consultation and failing to conceive when they eventually want children (Jaravaza, 2013; Jinadu *et al.*, 1997). Another reason is that modern contraceptives are perceived as things that are used by prostitutes and taking them may defile the family and anger spirit mediums (Jaravaza, 2013). Periodic abstinence is preferred over modern contraceptives because it is perceived as honourable, as it conforms almost perfectly to local notions of self-discipline, temporal management, and measured self-restraint (Johnson-Hanks, 2002).

Therefore, despite the introduction and popularity of modern contraception, indigenous contraception continues to play a reproductive role among African indigenous communities. Four of the six common contraception approaches are natural techniques. Natural techniques are cost free, safe and relatively effective compared to traditional techniques. The lack of clarity regarding mechanisms of some of the techniques raises concerns about their safety and efficacy. Practices of African indigenous contraception

such as birth spacing are important for ensuring mother and infant health. Therefore, attempts must be made to include African indigenous contraception as part of government interventions to prevent unwanted pregnancies in Africa, instead of relying only on modern contraceptives. However, more ethnographic and scientific research is needed to understand the mechanisms, efficacy, and safety of indigenous contraception.

2.2.7 Medicinal plants used for contraception in South Africa

Since time immemorial, medicinal plants have been indispensable sources of both preventive and curative traditional medicine preparations for human beings and livestock (Kokwaro, 1994). Historical accounts of traditionally used medicinal plants depict that different medicinal plants were used in Egypt BC. Most of the indigenous knowledge, from these earliest times, is also linked with the use of African traditional medicine in different countries (Aman 2000; Adams 2000). Saray (2001) and Davis (1998) indicate that the knowledge and uses of specific plants for public healthcare in African communities are an important component of African indigenous knowledge systems and culture. The use of medicinal plants by the Batswana of North West province in South Africa is summarised in Table 2.3, and there is no mention of medicinal plants used for contraception in the North West province. A review paper titled “Medicinal plants used for contraception in South Africa: A review” was published from this study and has been attached (page xxi).

The review showed that there is currently a lack of detailed information about the use of medicinal plants as contraceptives in South Africa, and the North West province in particular. For example, data regarding the use of plants as contraceptives in South Africa do not adequately address plant gender specification, age restrictions, safety and efficacy, plant storage, dosage, reasons for use, and, more importantly, mechanisms of action. The reason could be that research on indigenous contraception in South Africa lacks specialization, with most ethnographic studies focusing on indigenous contraception in general. Of the 25 medicinal plants identified, only five were found to have contraceptive activity when evaluated *in vivo/in vitro*: *Bulbine latifolia* had an influence on male reproductive hormones; *Securidaca longipedunculata* and *Typha capensis* influenced sperm parameters; and *Salsola tuberculatiformis* prolonged diestrus and *Pouzolzia mixta*

inhibited implantation. *Securidaca longipedunculata* and *Typha capensis*, therefore, acted as spermicides, whereas *Bulbine latifolia*, *Salsola tuberculatiformis*, and *Pouzolzia mixta* acted as contraceptives. A literature gap exists on medicinal plants used in South Africa by men for contraception and by women for postcoital contraception. In this review, none of the plants was specified as being traditionally used for male contraception. However, *B. latifolia*, *S. longipedunculata*, and *T. capensis* is traditionally used for conception, whereas *S. longipedunculata* and *T. capensis* are used for both contraception and conception. *B. latifolia* and *T. capensis* showed contraceptive activity when, in fact, the intention was to evaluate conception activity. *B. latifolia* and *T. capensis* thus showed contrasting results.

Furthermore, no medicinal plants were specified to be used for postcoital contraception in South Africa. However, *P. mixta* showed the postcoital contraceptive activity when evaluated *in vivo*. Therefore, although there is no evidence of medicinal plants being traditionally used for male contraception or for female postcoital contraception in South Africa, experimental data show that medicinal plants can act as male contraceptives and female postcoital contraceptives. The review further showed that in-depth ethnobotanical studies are needed in South Africa to investigate medicinal plants traditionally used by males for contraception and by women for postcoital contraception. Documentation of the use of medicinal plants as male contraceptives and as female postcoital contraceptives will assist in the preservation of indigenous knowledge in the country and act as a reference guide for designing *in vivo* and *in vitro* investigations on male and female contraception. Either one methodological concern regarding *in vivo* and *in vitro* studies observed is a constant evaluation of only one sex, i.e., male or female animals were evaluated but not both. An ideal experimental design is one for which a plant (or concoction) is evaluated *in vitro* and *in vivo*, precoitally for male animals and both precoitally and postcoitally for female animals.

The interchangeable use of the terminologies antifertility, family planning, birth control, and contraception creates conceptual challenges and concerns. Attention needs to be paid to scientific identification and isolation of active principles need to be paid attention.

Medicinal plants such as *B. latifolia* showed contraceptive activity in male rats by decreasing the serum testosterone and progesterone levels and *P. mixta* inhibited implantation in female rats without showing any signs of toxicity. These are potential sources for the discovery and development of safe male hormonal contraceptives and female postcoital hormonal contraceptives, respectively. However, some of the medicinal plants used for contraception have been reported to cause abortion and death in animals or are known to be poisonous to humans. Therefore, teenagers and couples wishing to prevent pregnancy with medicinal plants must therefore ensure that the traditional healer consulted is an expert on the use of herbal contraceptives. In addition, traditional healers need to be included when drafting government policies, initiating research projects, revising the curriculum, and developing other social or health interventions on family planning, birth control, and contraception in South Africa. *In vivo*, *in vitro*, and toxicity studies are urgently needed to ensure that an intervention in reproductive health using herbal medicines is both safe and effective, to promote collaboration between THPs and WHPs and encourage integration between IKS and WKS to develop a decolonized and modernized contraception.

2.3 INDIGENOUS PHILOSOPHICAL AND EPISTEMOLOGICAL UNDERPINNINGS OF THE STUDY

Each research project is substantiated by some philosophical and epistemological underpinnings that strengthen the position of the research within a particular context. This research project is undertaken mainly under an indigenous knowledge systems (IKS) context, although part of the research is experimental. The philosophical assumptions underpinning IKS research, including indigenous worldviews, paradigms, and cosmology are normally different from those that underpin Western knowledge systems (WKS). Similarly, the philosophical assumptions underpinning IKS epistemology is different from WKS epistemology, which is an important branch of philosophy that deals with different methods of knowing (Singh, 2019). Epistemological assumptions are concerned as to how knowledge can be created, acquired and transferred (Scotland, 2012), and is responsible for knowledge gathering and concerned about developing new knowledge in the form of new models or theories (Grix, 2002). It is therefore important to provide a brief

description on indigenous philosophical and epistemological assumptions underpinning the study.

2.3.1 Indigenous philosophical underpinnings of the study

2.3.1.1 African indigenous worldviews and paradigms

Indigenous contraception can only be fully understood when viewed mainly from an African worldview. A people's worldview is the complex of their beliefs and attitudes concerning the origin, nature, and structure of the universe and the interaction of its beings with particular reference to humankind (Okon, 2006). As regards the nature of the universe, many African societies believe that the universe is made up of the visible (material/physical) and the invisible (immaterial/spiritual) (Okon, 2006). Unlike western contraception, indigenous contraception draws its strength from both worlds, the physical (herbal contraceptives, moonchecking etc.) and the spiritual worlds (spells, burial techniques, etc).

Daniels (2001) states, "*The African worldview acknowledges affective reality as well as rationality*". Some of the practices, taboos and techniques of indigenous contraception require a traditional healer to communicate with the spiritual world before performing a particular contraceptive practice, such as stopping reproduction. A traditional healer cannot continue with stopping of reproduction, if ancestors are against such a practice at the time. The words of the ancestors thus take precedence over the wishes of a woman, or couple. When preparing some indigenous contraceptives such as waistbands, holy water and oil, traditional healers also consult ancestors the spiritual world so that the particular contraceptive could be safe and effective.

According to Van der Walt (1997), African worldview differs from Western view in that Western view generally ignores the spiritual dimension of phenomena and focuses on the visible, measurable physical reality. In western contraception, supernatural causes are not considered plausible explanations for contraception (Thabede, 2008). Therefore, indigenous contraception in this study is studied, understood and described from an African worldview that include the physical (herbal contraceptives, moon-checking etc. and the spiritual worlds (spells, burial techniques etc.). The scientific part of the study is

considered to fall within the physical realm. Therefore, the spiritual world cannot be subjected to scientific experiments because it represents a different realm within an African worldview. It is worthwhile to emphasise at this stage that African IKS is not static, but is situation dependent, continuously evolving, and actively adapting to the ever-changing world.

2.3.1.2 African indigenous cosmological assumptions of the study

Cosmology is “the sum total of people’s opinion concerning life, happiness, fears, purpose of life, death and after-life (Ekeke, n.d). As discussed in the previous section, African worldview includes not only the physical universe (space and time, solar systems and galaxies, atoms and molecules) but it also includes the social and the spiritual, the visible and invisibles, emotional and psychological, real and unreal, mystical and supernatural. A basic principle of the African indigenous cosmology is the view that all things in the universe are connected.

African indigenous cosmology involves different and specific interpretations of the movement of extraterrestrial bodies such as the sun, moon and stars and elements like winds, lightening and water. Water in the form of waterfalls is believed to have healing powers (Mokgobi, 2012). This view is particularly held by prophets in the African independent Christian churches such as the Zion Christian Church (ZCC) and apostolic churches (‘Mapasetolo’) that can walk for many kilometers in search of waterfalls or springs when given instruction to do so by prophets in some African independent Christian churches (Anderson, n.d.). It is for this reasons that indigenous contraception includes natural, religious and traditional techniques and practices of indigenous contraception. These assumptions thus prepare the researcher to accommodate without discrimination techniques and practices of indigenous contraception that might seem contradictory to western contraception.

2.3.1.3 African epistemological aspects of indigenous contraception

Epistemology is a theory of how human beings come to have knowledge of the world around them, and how we come to know what we know (Blaikie, 2007). Naamwintome and Millar (2015) identifies seven different constellations of knowledge among

indigenous people. It is generally accepted that knowledge among indigenous contraception is communal, and belongs to the collective. (Figure 2.1). Indigenous knowledge has a number of unique characteristics. Firstly, an individual does not own indigenous knowledge because it is a product of the culture, tradition and way of life of a community, and secondly, it is usually passed orally from generation to generation.

According to Hart (2010), an indigenous epistemology is a fluid way of knowing derived from teachings transmitted from generation to generation by storytelling. The African way of knowing appears to be largely communitarian in terms of discovery and experimentation and the mode of transmission and sharing is often collective rather than individualistic (Naamwintome and Millar, 2015). The community is a source of strength for the African way of knowing in terms of the discovery process and knowledge production (Naamwintome and Millar, 2015). Communal knowledge can be combined with spiritual knowledge. Indigenous techniques or practices known by the community can be implemented, and in addition, at the same time seeking spiritual guidance. This can include emphasis on abstinence, whilst including ancestral interventions. The early discourse of African epistemology or way of knowing flows from African ontology and ultimately established that Africans had an idea of God even before Europeans came to Africa (Udefi, 2014). Traditional African religion, therefore, involves a chain of communication between the worshipers and Almighty God. In many African communities, traditional healers often act, in part, as an intermediary between the visible and invisible worlds, between the living and the dead or ancestors (Abdilahi and Van Staden, 2012). Many traditional healers are of the view that the knowledge they possess is from and belong to ancestors. African mode of knowledge should pay due attention to the background of African spiritualistic and dynamic metaphysics (Udefi, 2014). Indigenous communities gain and produce knowledge through inward exploration by performing rituals or ceremonies that incorporate dreaming, visioning, meditation, and prayer (Hart, 2010).

A diviner, for example, might need to throw traditional bones, and read the pattern displayed. African religious believers can also communicate with God through the medium of the deceased relatives.

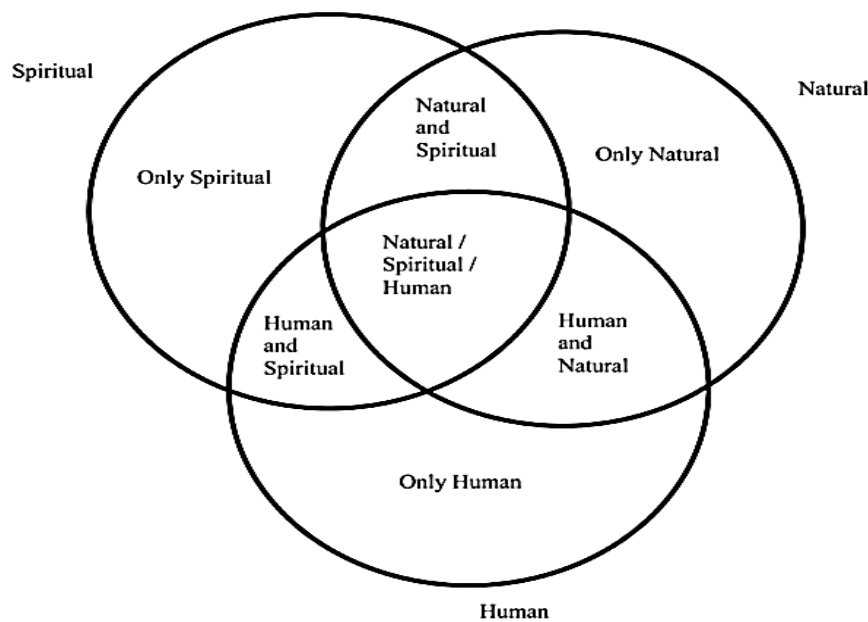


Figure 2.1: Seven constellations of knowledge among indigenous people.

Key people for this process are elders and practitioners who have undergone processes to develop this ability (Hart, 2010). Knowledge regarding indigenous contraception can result from a combination of communal, spiritual, and physical realities. This is the most cherished and sought, the perfect state which strives to be in balance or harmony with itself (Naamwintome and Millar, 2015). In this case, communal, spiritual and natural knowledge embrace and reinforce each other. Knowledge regarding indigenous contraception from any of the seven constellations will be considered valid and critical for this study.

2.3.1.5 The importance of indigenous axiology on research in IKS

Louis (2007) argued that the doors previously opened for doing research on indigenous communities in the name of science are closing and that very soon these doors would be shut for good due to the distrust between the researchers and indigenous knowledge holders such as THPs. The increase in focus on IKS has marginalized the knowledge holders and practitioners and has largely disempowered them and rendered their knowledge to be of no value to them while at the same time benefitting the researchers, the research institutions and universities, as well as resource extraction companies

(Mosimege, 2007). Indigenous axiology on research in IKS is therefore important as a measure to protect indigenous knowledge.

Masango (2010) states that ‘another reason for the protection of indigenous knowledge is that drug industries financially benefit and exploit medicinal properties in plants used by indigenous traditional people to treat certain illnesses such as cancer without the recognition of the indigenous traditional people’s knowledge of the plant and its medicinal properties’. In this study, a number of axiology on research in IKS was followed. In addition, before the commencement of the study, the researcher presented the proposed research topic (indigenous contraception), objectives, and methodology to a group of traditional healers from different traditional healers’ organization. For example, selected traditional healers took part during conceptualization of the study, the proposal stage, data collection and analysis. THPs made comments and suggestions, contributing to the study design and feasibility and further provided indigenous knowledge from which scientific investigations were based.

2.3.1.6 The importance of indigenous cultural protocols on research in IKS

One of the minimum requirements is observation of protocols with respect to the role of traditional leaders in access to knowledge holders and the protection and promotion of indigenous knowledge (Mosimege, 2007). The researcher also made sure that consent was made by traditional leaders in sites where particular medicinal plants were needed to be collected. The presence of the provincial permit and consent by traditional leaders made it easy for members of the community to participate in the study or to assist with some of the heavy tools required during plant collection. One of the protocols included harvesting of medicinal plants mainly after rainy seasons when medicinal plants have flowered and seeded. One other protocol included collection of medicinal plants early in the morning, just before sunrise, and plant collection should have been finished by mid-day. Indeed, by following appropriate protocols that prevails when doing research in indigenous communities allowed the researcher to get a lot of support and information from the knowledge holders.

Mosimege (2007) argues that lack of appropriate recognition towards the knowledge holders by those who conduct research was a regular concern raised by knowledge holders during workshops and conferences. Consequently, all knowledge holders that participated in this study have been acknowledged in this thesis and any benefit that will arise from this study will be equally shared among all six participants. It is evident that in the absence of protection mechanisms knowledge holders use their own ways to protect and prevent the exploitation of such knowledge (Mosimege, 2007).

2.3.1.7 Indigenous research methodologies

The community-based participatory research was an indigenous research methodology that underpins this study. A large body of literature confirms the claim that community-based research is useful and appropriate in indigenous contexts. Examples of such community based researches are Dickson (2000); Fisher and Ball (2003); Kildea *et al.* (2009); Laveaux and Christopher (2009); McHugh and Kowalski (2009); Poudrier and Kennedy (2008). These studies followed principles from which the community-based research as outlined by Halseth *et al.* (2016). The researchers involved and consulted with indigenous people (traditional healers) as legitimate stakeholders in research. The researchers developed shared understandings about the aims of research and methods to be used and appropriately informing indigenous people about the aims and objectives of a research project through presentations during indigenous knowledge systems and department of science (IKS-DST) workshops involving different traditional healers' organizations.

Community-based participatory approaches are increasingly being accepted as an important process in decolonising research because of its collaborative and empowering nature (Simonds and Christopher, 2013). This is important for indigenous people, who have historically been marginalised or excluded from the research process, which has resulted in research being treated sceptically and as another form of foreign colonialization and suppression (Halseth *et al.*, 2016).

2.3.1.8 The use of indigenous languages in indigenous knowledge research

Battiste and Henderson (2000) argued that language features prominently in IKS research (especially interviews) and therefore its use becomes an ethical issue when research is

conducted. The argument for usage of indigenous language is more so relevant in this study whereby interviews with knowledge holders was required, and formed a foundation from which the rest of the study relied upon. All interviews in this study were conducted in Setswana, an indigenous language belonging to the Batswana. Indigenous language was important because some of the healers did not attend formal schooling and the use of colonial languages can be viewed as an insult. In addition, indigenous contraception, unlike western contraception, includes spiritual/supernatural beliefs and practices, which can be difficult for the knowledge holder to explain in English or Afrikaans for example. Indigenous language therefore, offers not just a communication tool for unlocking knowledge; they also offer a theory for understanding that knowledge and an unfolding paradigmatic process for restoration and healing' (Battiste and Henderson, 2000). The inability to speak the language of the knowledge holders places a limitation on access to the kind of information related to the exploration of the artifact or indigenous practice (Mosimege, 2007).

2.3.1.9 Application of indigenous theories in IKS research

Setlhare *et al.* (2014) argues that an African largely finds identity and value through his community and aligns individual interests and satisfaction with community preferences, a Batswana philosophy known as Botho (Ubuntu). Ubuntu is an African philosophy, where a person becomes human only in the midst of others and seeks both individual and collective harmony as the primary task in the process of becoming a true person (Frances *et al.*, 2013).

2.3.2 A conceptual framework of the study

A conceptual framework or conceptualization of a study provide a logically written or visual presentation of how concepts and variables in the study relate to one another and explains either graphically, or in narrative form, the key factors, concepts or variables and the presumed relationship among them (Vaughan, 2008; Grant and Osanloo, 2014). This study explored indigenous contraception among the Batswana of Ngaka Modiri Molema District Municipality, North West province of South Africa by integrating IKS and ATM with western knowledge systems to promote collaboration between THPs and WHPs so that women can have access to affordable, safe and effective contraception. The dichotomous approach to contraception with western contraception on one side and

indigenous contraception on the other is currently ineffective for addressing the challenge of unwanted pregnancies in South Africa.

This study was conceptualised as an attempt to integrate IKS and ATM with western knowledge systems and medical system to promote collaboration between THPs and WHPs that was emphasised by the WHO (2008) and Traditional Health Practitioners act of 2007, with focusing on the Batswana ethnic group in the North West province. Contraception based on knowledge from THPs and scientific principles is critical for decolonization and modernization of contraception in South Africa, as well as to expand the knowledge base regarding to contraception by expanding indigenous knowledge among WHP and increasing scientific knowledge among Batswana THP with regard to contraception. The conceptual framework of the study shows that modern contraception thus includes a combination of indigenous and western contraception. (Figure 2.2.).

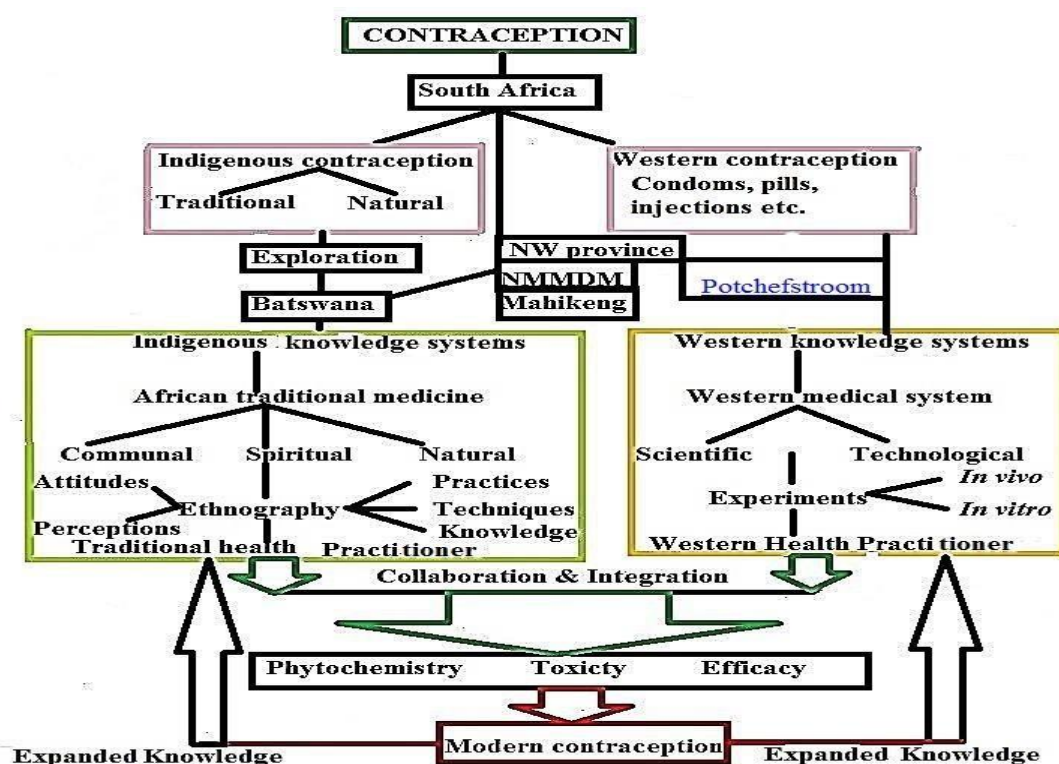


Figure 2.2: A conceptual framework of the study.

2.3.3 Theoretical framework of the study

Camp (2001) defined theory as "a set of interrelated constructs, definitions, and propositions that present a rational view of phenomena by explaining or predicting

relationships". The theoretical framework of this study is based on existing theories in indigenous knowledge systems and African traditional medicine (ATM). The theoretical framework underpinning indigenous contraception in this study includes the theory of holism, Afrocentricity theory, African feminism theory, and postcolonial theory. The postcolonial theory was chosen to critic the western hegemony of knowledge, with western knowledge systems portrait as the best knowledge system and a standard from which the "other" knowledge systems should be measured against. The postcolonial theory was chosen in this study specifically to explain the unjustified dominance and preference of western contraception to indigenous contraception in South Africa. African feminism was chosen as a theory to explain and expose gender issues related to indigenous contraception among the Batswana of Ngaka Modiri Molema district municipality. Afrocentricity theory was selected for this study to explain the central role played by the Batswana traditional healers and women in NMMDM and Mahikeng local municipality respectively. The theory of holism was chosen to emphasise the holistic nature of African traditional medicine (ATM), including indigenous contraception. This study further proposes a holistic approach to contraception that integrates western and indigenous knowledge systems.

2.3.3.1 The theory of holism

More than 2300 years ago, the Greek philosopher Hippocrates emphasized that doctors should consider the whole human being in order to treat and diagnose (Shroff, 2011). Holism is a theory that describes the living matter or reality as made up of organic or unified wholes that are greater than the sum of their parts (Tjale and De Villiers, 2008). The parts cannot be understood if considered in isolation from the whole and the parts are dynamically interrelated and interdependent (Allen, 1991). The term holism is defined, as "The sum is bigger than its parts" and was first introduced by Smuts (1926) publicly in print as an academic terminology. Holism is a theory that describes the living matter or reality as made up of organic or unified wholes that are greater than the sum of their parts (Tjale, 2008). Holism is sometimes spelled as "wholism", to accentuate the semantic connections of this word to the word 'whole (Shroff, 2011). The parts cannot be understood if considered in isolation from the whole and the parts are dynamically interrelated and interdependent (Allen, 1991). Holism relates to the study of the whole

organism or whole systems and emphasises the importance of understanding a system as a whole being, rather than breaking down, studying or treating only the component parts (Tjale and De Villiers, 2008).

Holism is a key element of all systems of African traditional medicine (ATM); therefore, conventional safety and efficacy assessment measures on indigenous contraception may not always be adequate (Kazembe, 2007). ATM is usually referred to as holistic in nature since it attempts to go beyond the boundaries of the physical body into the spiritual realm (Mapara, 2009). Religious rituals such as prayer are central for both the practitioner and patient (Shroff, 2011). Some traditional medical practices even include the provision of the means for confession, atonement, and restitution into the good graces of the family and tribe, and intercession with the world of the spirits (Kazembe, 2007). The theories and concepts of prevention, diagnosis, improvement and treatment of illness in ATM historically rely on holistic approach towards the sick individual, and disturbances were treated on the physical, emotional, mental, and spiritual levels simultaneously (Kazembe, 2007; Bhikha, 2005). Most systems of African traditional medicine may use herbal medicines or traditional religion based therapies, along with certain behavioral rules promoting healthy diets and habits (Kazembe, 2007).

In the same way, each individual technique, taboo or practice of indigenous contraception cannot function on its own, isolated or excluded from other practices, taboos and techniques. Consequently, the safety and efficacy of each practice, technique and taboo depends on inclusion of other practices, techniques and taboos. The safety and efficacy of indigenous contraception should therefore improve with increase in number of different practices, techniques and taboos applied. Therefore, whilst a woman takes herbal contraceptive, she is also expected to observe the moon, tie a waistband, avoids sex on certain days, ask man to perform withdrawal and pray that she does not fall pregnant. In addition, the theory of holism is included in this study to argue and explain the need for a holistic approach to contraception by integration of western and indigenous knowledge systems. The holistic approach to contraception implies that both western and indigenous contraception be available to women, and that both western and indigenous knowledge

systems be integrated, instead of focusing on western knowledge systems and ignoring indigenous knowledge systems.

2.3.3.2 Post-colonial theory

Fertility in pre-colonial southern Africa was regulated through a range of cultural practices (Department of Health, 2012). However, Africa's colonial past has had a strong impact on the indigenous cultures and peoples (Naamwintome and Millar, 2015). Colonialism intended to replace traditional knowledge and beliefs with western knowledge (Naamwintome and Millar, 2015). Colonization of Africa by European countries has resulted in the promotion of western medical system as dominant and universal from which "other" health care system must imitate. The colonial authorities imposed a western worldview on the people of South Africa without an attempt to determine the validity of the African worldview (Mokgobi, 2012). Consequently, there is a continued and entrenched bias towards western health care systems that has a long colonial history (Pretorius, 1994). People were encouraged to adopt modern contraceptives such as contraceptive pills, injections, intrauterine devices (IUD), condoms and sterilization as a panacea to family planning (Jaravaza, 2013).

To talk about spirits, or supernatural beings, was nonsensical, let alone to believe in them (Osume, 1976). Such beliefs were considered "unscientific" and "irrational" (Osume, 1976). Under apartheid and colonial South Africa, the practise of traditional medicine was deemed unscientific and illegal. It was considered to be uncivilised, suspect, scientifically unfounded, backward and superstitious (Le Roux-Kemp, 2010). The Witchcraft Suppression Act of 1957 and the Witchcraft Suppression Amendment Act of 1970 declared traditional medicine unconstitutional and prohibited practitioners of from doing their business (Rautenbach, 2015). The Medical Association of South Africa outlawed cooperation between conventional health practitioners (CHPs) and THPs in 1953.

In recent years, it is estimated that 63% of women in developing countries use some method of family planning, while in 1960, that number was just 10% (Molebatsi *et al*, 2013). About one out of six married women in previously colonized countries wants to postpone her next pregnancy or stop having children altogether but, for whatever reason, is not using contraception (Molebatsi *et al*, 2013). IKS are more than just a displaying of

the knowledge and belief systems of the formerly colonized, but they are one of the forms of responses to the myth of western medical superiority (Mapara, 2009). IKS are a way in which the formerly colonised reclaim their dignity and humanity that was robbed of by colonialism (Mapara, 2009).

During colonialism and subsequently the apartheid government in South Africa, the familyplanning program predictably became a focal point of racial political contestation (Kaufman, 1998). The national family planning program sought to provide contraception in order to reduce the black population while actively encouraging the growth of the white population (Department of Social Development, 1998). Family planning interventions promoting contraception were focused on the coloured and black population (Gockel-Frank, 2009). Control or reduction was only meant for the black population, whose increase was perceived as the 'swart gevaar' (black threat) (Gockel-Frank, 2009). Lindsay (1989) referred to discussions in the South African Journal of Medicine held between 1960 and 1988 when showing that the medical fraternity also followed neo-Malthusian thinking by believing that poverty was due to uncontrolled population growth. Hence, in 1994, South Africa's newly elected democratic government shifted its conceptualization of family planning from population control to redressing past neglect and violations of human rights (Ndinda *et al.*, 2017).

2.3.3.3 African feminism theory

African feminism can be attributed to contemporary African women such as; Adelaide Smith Casely-Hayford, Charlotte Maxeke, Hajiya Gambo Sawaba, Huda Shaarawi, Lilian Masediba Ngoyi Nontsikelelo Albertina Sisulu and many other African women that fought for emancipation of African women from racial and patriarchal dominance. The use of contraception is life and death for many African women and, as such, deserves much recognition (Rutherford, 1991). Approximately 76 million women in developing countries including South Africa still experience unwanted pregnancies each year, and 19 million resorts to unsafe abortions (Molebatsi, 2013). Handelsman (2005) argued that all male methods of contraception depend on mechanical means to reduce female exposure to sperm using either traditional drugs and device-free methods (abstinence, withdrawal, non-vaginal intercourse) or contemporary male methods comprising condoms and vasectomy. Unfortunately, among current male contraceptive options, the reversible

methods are not reliable and the reliable method (vasectomy) has reversibility limitations (Handelsman, 2005). No new male contraceptive methods were introduced during the 20th century contrasting with highly reliable, reversible hormonal contraceptives developed for women over the last half century (Handelsman, 2005).

There have also been calls for more research on the availability, provision, and use of postcoital contraception in developing countries (Smit *et al.*, 2001). Post-coital contraception can prevent pregnancy after (forced) unprotected intercourse has occurred (Roberts *et al.*, 2004). Post-coital contraception is freely available at public sector health facilities in South Africa, but results from studies undertaken indicate that few women know of post-coital contraception and even fewer women use it (Smit *et al.*, 2001). A study conducted in rural Limpopo found that the majority of the respondents (89.5%) did not know that post-coital contraceptives could prevent unwanted and/or unplanned pregnancies if used within 72 hours following unprotected sex (Netshikweta, 2007).

According to Addo and Tagoe-Darko (2009), although emergency contraception has great potential in further reducing rates of unwanted pregnancy and abortion; it is the least known method, reported by only 28% of women and 30% of men. It is a big challenge for poor rural black women because post-coital contraceptives, so called “morning after pills” must be taken within 72 hours of intercourse (Glasier and Baird, 1998). The location of the facility and the time of services is one of the most important factors in preventing childbearing women to use family planning services, as indicated by studies from Africa and Asia (Molebatsi, 2013). Post-coital contraception is urgently needed in South Africa, where the incidence of rape is very high (Roberts *et al.*, 2004).

2.3.3.4 Afrocentric theory

The Afrocentric theory derived from the Afrocentric philosophy traced back to the 1950s with Marcus Garvey as one of its influential figures, and popularized by Molefi Asante in his works termed “Afrocentricity” in the 1980s (Chawane, 2016). The premier center for the Afrocentric Movement is the Temple University School of scholars including Tsehloane Keto, Kariamuwelsh Asante, Abu Abarry, Ama Mazama, Theophile Obenga and Terry Kershaw. Afrocentricity is a theory of agency, the idea that African people must be viewed and view themselves as agents rather than spectators to historical revolution

and change (Asante, 2007), there is a strong emphasis on aesthetics, behavior, and ethics with afrocentric location as the key component to interpretation. However, this attention to place, to perspective, bothers many scholars and ordinary whites because they do not believe that the insistence on quality, rational thought, and control of time and space is legitimate and they rather believe that the aim of the movement is to remove the Western hegemony (Asante, 2007).

The liberation of Africa from European colonialism and the emancipation of slaves in the Americas came with calls for the liberation of knowledge by some African scholars, who proposed that knowledge should be looked at from the point of view of Africans, known as Afrocentricity (Chawane, 2016). Karenga (2002) argued that afrocentricity is a quality of, practice and perspective that perceive Africans as subjects and agents of phenomenon acting in their own cultural image and human interest. This study was conceptualized from a theoretical view that traditional healers and indigenous knowledge holders were medicinal experts and bearers of indigenous knowledge and therefore, indigenous contraception should be studied, understood and presented from an ATM perspective. Afrocentricity places African people at the center of any analysis of African phenomena (Chawane, 2016). Data from this study was analysed with African indigenous knowledge holders and the Batswana women placed at the center of indigenous contraception.

2.3.4 An introduction to the study area and the people of Batswana of the North West province

This study was conducted in Ngaka Modiri Molema District Municipality (NMMDM) situated at the center of the North West Province (NWP) of the Republic of South Africa. The North West Province, called Bokone Bophirima in Tswana and Noordwes in Afrikaans is one of the nine provinces of post-apartheid South Africa. The NWP is one of the nine provinces of South Africa and was created after the post-apartheid era in 1994 when the former homeland of Bophuthatswana was incorporated into the Republic of South Africa. NWP reside in the north of South Africa on the Botswana border, fringed by the Kalahari Desert in the west, Gauteng province to the east and the Free State to the south and Northern Cape to the Southwest.

The province covers an area of 104 882 km² and its population in 2016 was 3 748 435, an increase by 1.5% from 2011 to 2016, while at national level, the population grew at a rate

of about 1.6% over the same period (StatsSA, 2016). The following population groups exist in the NWP: 89.80% Black Africans; 7.28% Whites, 2.03% Colored; 0.59% Indians or Asians and non-specified 0.30% (StatsSA, 2016). The population in North West was predominantly male in both Census 2011 (50.7%) and CS 2016 (50.9%), whilst the female population in the North West province was 49.3% for Census 2011 and 49.1% for CS 2016. Contrarily, South Africa was predominantly a female population in both Census 2011 (51.3%) and CS 2016 (51%) compared to males (StatsSA, 2016). The main language spoken in the province is Setswana (63.4%), and Northern Sotho (2.4%) is the least spoken among the 12 languages spoken because the main ethnic group is the Batswana, who speak predominantly Setswana (Pilane, 2002).

The Tswana people form part of the greater Niger-Congo Bantu-speaking people and the Sotho-Tswana clans residing in Botswana, Lesotho and South Africa. The word Batswana was coined from the western Sotho word “*tswa*” meaning, “*go tswa*”, and in English, it means, “to break/come out”. Schapera (1994) explain that the Batswana belonged and broke out of the Basotho people that came from Central Africa near the Great Lakes of East Africa, moved southwards and entered South Africa in the 19th century. According to Kgotleng (2014), about three-fourths of the Batswana people live in South Africa, and only about one-fourth live in Botswana, the country named after them. Batswana in South Africa can be found in the eastern, western and central districts of the former Transvaal, viz. the Marico, Rustenburg, Pretoria, Ventersdorp, Lichtenburg, Mahikeng, Vryburg, Kuruman and Taung area (Pilane, 2002). Some of the Batswana ethnic groupings found in the North West province and their locations in brackets, are Barolong (Mafikeng), Bafokeng (Phokeng), Bakgatla (Moruleng), Batlhaping (Taung), Bahurutshe/Batshweneng (Lehurutse), Batlokwa (Tlokweneng) and Baphiri (Mabalstaad) (Nuri 2002).

The Batswana, like other ethnic groups such as the Zulus, Xhosa, and Venda live according to cultural laws and customs and believe that people originated from “Lowe”, their ancestor who comes from a supreme being “Modimo” (Pilane, 2002). The Batswana further believe that people who have died become ancestors (“*Badimo*”), transcend and acquire a higher status in the spiritual realm (Pilane, 2002). Although physically separated from the rest of family and community, Batswana believe that ancestors are considered

and are still one with the living, and are able to communicate with them through traditional healers to determine all successes or misfortunes (Pilane, 2002). The Batswana people are known for their rich culture that is easily distinguishable from other South African ethnic groups. Batswana people still obey and honour their traditional culture, which also includes African traditional medicine (ATM) (Pilane, 2002). Traditional health practitioners (THPs) play a significant role during initiation rites such as “*bojale*” (female ritual) and “*bogwera*” (the male ritual) where boys and girls are taught about reproductive, contraceptive and marital issues amongst others (Pilane, 2002).

THPs use a variety of medicinal plants when performing surgical operations such as circumcisions or vaginal stitching during these initiations, with most information kept secret and not allowed to be shared publicly, particularly among those who have not undergone initiation. Mander *et al.* (1995) showed that the Batswana have been in contact with their rich plants and animal biodiversity for a very long period and have over time used their indigenous knowledge on this biodiversity for sustainable community livelihood in terms of food, medicine, shelter and fuel. Chinsamy and Koitsiwe (2016) described indigenous knowledge on medicinal and food plants among the Batswana in the NWP (Table 2.2).

Batswana ceremonies include “*go isa marago kgosing*” whereby initiated girls are taken to the king/chief for selection, with those that maintained their virginity certainly preferred. The family of the women who still maintained their virginity before marriage gets a higher lobola than one who engaged in sex or has child. The practice of virginity among the Batswana is thus critical and emphasized. Furthermore, the idea of child spacing is not new or foreign to the Batswana who traditionally spaced their families by means of breastfeeding and abstinence for a period of two years after childbirth (du Pradal, 1983). According to Schapera (1994), “sexual relations between a Motswana husband and wife are not forbidden while she is suckling a child... but the husband is expected to practice coitus interruptus until the child is weaned”. If a woman for example, becomes pregnant again while still weaning a child, the child at her breast will become foolish or sickly or suffer in some way (Schapera, 1994).

Table 2.2: Some of the medicinal plants used by Batswana in the North West province.

Scientific name	Common name	Setswana name	Part used	Uses
<i>Aloe greatheadii</i> Schönland	Spotted aloe	Kgopane	Leaves, roots	Wounds, sores, and burns
<i>Cleome gynandra</i> (L)	African spider flower	Lerotho, rothwe	Roots, Leaves, Seeds	Fevers, scorpion stings, rheumatism, ear pain, anthelmintic and rubefacient.
<i>Vangueria infausta</i> Burch.	Wild medlar	Mmilo, mothwanyê	Fruits, roots, Leaves	Edible and ferment beer, ringworms, pneumonia, toothache
<i>Celtis burmanni</i> Planch.	White stinkwood	Modutu	Fruits, roots,	Edible, increase sexual desire, increase the fertility of livestock
<i>Euclea crispa</i> (Thunb.) Gürke	Blue suarri	Mohlakolo	Bark, roots, leaves	Diabetes, rheumatism, epilepsy, chronic wounds and stomachache, constipation
<i>Ziziphus mucronata</i> Willd.	Buffalo-thorn	Mokgalo	Fruits, leaves, bark, roots	Dysentery, chest complaints and lumbago
<i>Pterocarpus angolensis</i> DC.	Blood wood, paddlewood	Mokwa Morotômadi	Bark, roots	Ringworms, eye pr increase breast milk, produce cosmetics
<i>Croton gratissimus</i> Burch.	Lavender berry/lavender croton	Mologa	Leaves, Roots, Bark	Body sores, cold, bathing for protection against misfortunes, increase livestock productivity
<i>Euphorbia ingens</i> E.Mey. ex Boiss	Naboom	Monkgopo	Leaves, bark, roots	Warts and chronic ulcers, blood related diseases, clean decayed teeth
<i>Acacia karroo</i> Hayne	Sweet thorn	Mooka	Bark, roots, thorns, leaves,	Eye illnesses, wounds, cold, stomach pains, throat infections
<i>Dichrostachys akataensis</i> Villiers	Kalahari christmas	Mosêlêlêlê	Bark,	dysentery, elephantiasis, snakebite, leprosy, syphilis, gonorrhea, anthelmintic and toothache

<i>Peltophorum africanum</i> Sond.	Weeping wattle	Mosetlha	Roots, leaves, bark	Toothache, sore throat, intestinal parasites, stomach related illness, diarrhea and dysentery
<i>Pappea capensis</i> Eckl. & Zeyh.	Jacket-plum	Mothata	Fruits, leaves, roots	Treat baldness and ringworms, miscarriages, increase libido
<i>Olea europaea</i> L.	Wild olive	Motlhwane	Roots leaves	Blood pressures, kidney, treat diarrhea and sore throats
<i>Dovyalis caffra</i> (Hook.f. & Harv.) Sim	Kei Apple	Motlhono		Edible
<i>Grewia occidentalis</i> L.	Crossberry	Motsotsojane	Fruits, bark, roots	Wounds and bladder prevent hair from getting grey

According to Schapera (1994), “sexual relations between a Motswana husband and wife are not forbidden while she is suckling a child... but the husband is expected to practice coitus interruptus until the child is weaned”. If a woman for example, becomes pregnant again while still weaning a child, the child at her breast will become foolish or sickly or suffer in some way (Schapera, 1994).

The NWP comprises four districts, namely Bojanala platinum district, Dr Kenneth Kaunda district, Dr Ruth Segomotsi Mompati district and Ngaka Modiri Molema district. Ngaka Modiri Molema district municipality (NMMDM) is the central district and shares an international border with Botswana. The Cooperative governance and traditional affairs Cogta (2020) reported that in 2018, the NMMDM's population consisted of 94.34% Africans (893 000), 3.38% White (32 000), 1.56% Colored (14 800) and 0.72% Asian (6 840) people. NMMDM has a male population of 461 000 (48.69 %) and female population of 486 000 (51.31%), which is very similar to the national average of 51.05% (Cogta, 2020). The largest share of population is within a total number of 316 000 or 33.4% of the total population (Cogta, 2020). The age category with the second largest number of people is the young working age (25-44 years) category with a total share of 27.5%, followed by the older working age (45-64 years) category with 159 000 people

(Cogta, 2020). The age category with the least number of people is the retired / old age (65 years and older) category with only 63 600 people (Cogta, 2020).

According to Cogta (2020), NMMDM had 79 clinics, 16 community health centres, 5 district hospitals, 1 regional hospital and 1 special psychiatric hospital to provide care services to the district residents in 2018. Accessibility of health care services is still a challenge as some clinics do not operate on a 24 h basis and communities find it difficult to get health care services during a time of need (Cogta, 2020). Onyesho (2011) observed that in Tswaing, a local district of Ngaka Modiri Molema, there was a high incidence of teenage pregnancy among school learners, including an incidence of high sexually transmitted infections, such as HIV and AIDS. Despite a high rate of pregnancy and high incidence of sexually transmitted infections among Tswaing school learners, the majority of adolescents interviewed did not have access to sexual and reproductive health information and services (Onyesho, 2011). In Ratlou municipality, about 3000 underage school girls between twelve or thirteen years old were impregnated out of a population of 100 000, with some already having two children at the age of eighteen (Maje, 2016). NMMDM consist of five local municipalities namely, Ditsobotla, Mahikeng, Ramotshere Moiloa, Ratlou and Tswaing. Mahikeng local municipality, apart from being a local municipality, is also the capital of the North-West province and occupies an area of about 6465 km² (Osuafor and Maputle, 2017). (Figure 2.3). The black Africans constitute 88% of the population of Mahikeng local municipality, with Setswana being the most spoken language (Stats SA, 2016). For every 100 women there are 94 men, with an average household size of 3.3 and 44.4% of households being female headed (StatsSA, 2016). Osuafor and Maputle (2017) found that 16% of women in heterosexual relationships in Mahikeng used contraception against both unintended pregnancies and infectious diseases while 40% were protecting against unintended pregnancies only. Approximately, 57% of women in Mahikeng use modern contraceptive methods whilst 45% said both man and woman made the decision regarding the use of modern contraception jointly (Osuafor and Maputle, 2017). A survey of 568 women in steady relationships aged 15-49 conducted in Mahikeng local municipality found that 60% of the women were currently protecting against both unintended pregnancies and infectious diseases whilst 40% were protecting against unintended pregnancies only (Osuafor and Maputle, 2017). The survey further

found that non-barrier method use was associated with age, home language, religion, and duration of union (Osuafor and Maputle, 2017). Mahikeng local municipality consist of approximately 20 health facilities including clinics and hospitals belonging to government and private sector.

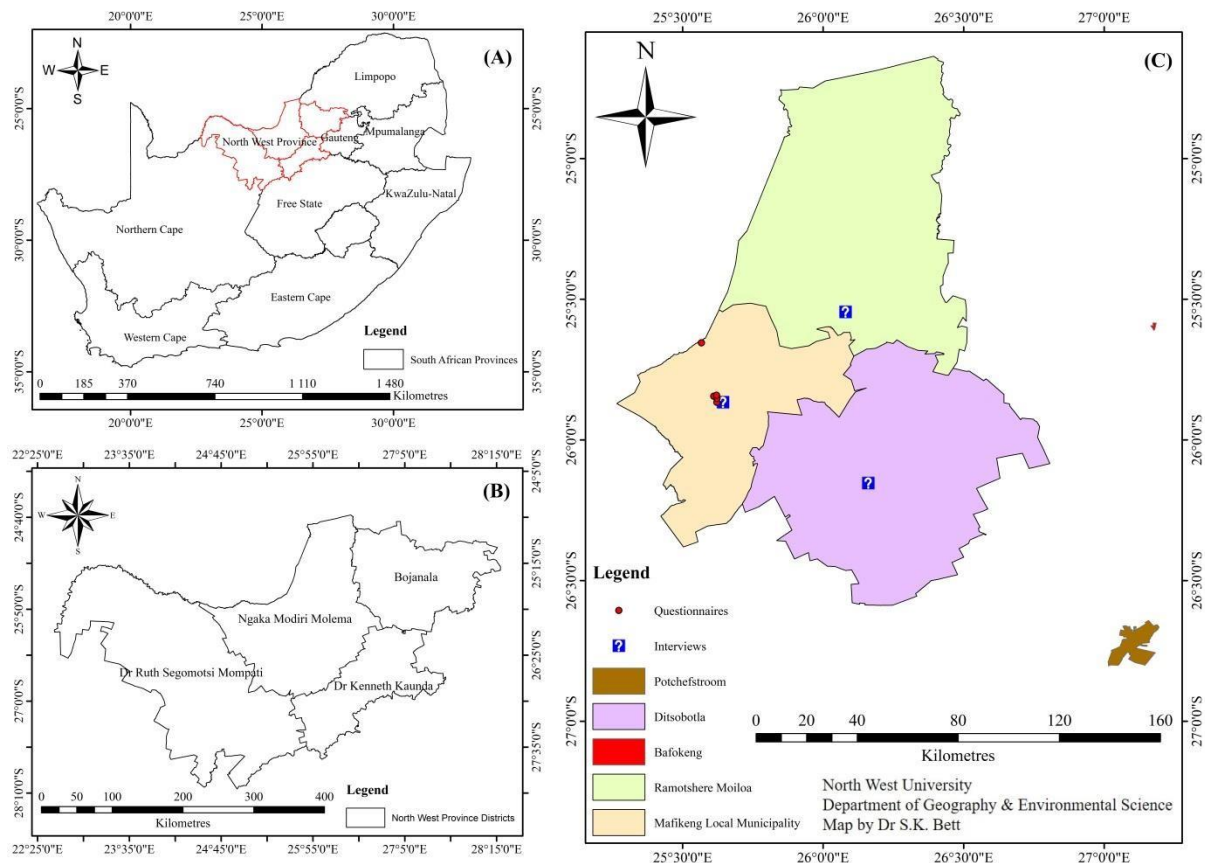


Figure 2.3: A South African map locating the North West province and showing sites where in-depth interviews and a survey were conducted.

Approximately, 57% of women in Mahikeng use modern contraceptive methods whilst 45% said both man and woman made the decision regarding the use of modern contraception jointly (Osuafor and Maputle, 2017). A survey of 568 women in steady relationships aged 15-49 conducted in Mahikeng local municipality found that 60% of the women were currently protecting against both unintended pregnancies and infectious diseases whilst 40% were protecting against unintended pregnancies only (Osuafor and Maputle, 2017). The survey further found that non-barrier method use was associated with

age, home language, religion, and duration of union (Osuafor and Maputle, 2017). Mahikeng local municipality consist of approximately 20 health facilities including clinics and hospitals belonging to government and private sector.

2.4 CONCLUDING REMARKS

African indigenous contraception continues to play a reproductive role among African indigenous communities despite the colonial legacy that emphasised western contraception. Practices of African indigenous contraception such as birth spacing were important for ensuring mother and infant health. Four of the six common techniques of indigenous contraception identified in this chapter were natural because they are cost free, safe, considered relatively effective and requires no intervention from traditional healers as opposed to traditional techniques. Furthermore, a gap exists regarding safety and efficacy of traditional techniques, including herbal contraceptives. Of the 25 medicinal plants identified, only five were found to have contraceptive activity when evaluated *in vivo/in vitro*. The ontological and epistemological philosophies associated with traditional contraceptives further make it difficult for the safety, effectiveness, mechanisms and reasons for use of indigenous contraception to be investigated. The integration of IKS and WKS is therefore important, as part of investigating the safety and efficacy of herbal contraceptives and promoting collaboration between THPs and WHPs. Such integration and collaboration are important for knowledge expansion and development between THPs and WHPs. Two review papers have been published from this chapter. The next chapter documented ethnobotanical knowledge, practices, taboos and techniques of indigenous contraception among the Batswana THPs in Ngaka Modiri Molema district municipality, North West province to form a basis from which experimental work on the safety and efficacy of herbal contraceptives was later based.

CHAPTER 3: KNOWLEDGE, PRACTICES AND TECHNIQUES OF INDIGENOUS CONTRACEPTION AMONG BATSWANA TRADITIONAL HEALTH PRACTITIONERS

3.1 INTRODUCTION

The previous chapter provides a literature review on indigenous contraception with special focus on medicinal plants used for contraception in South Africa. The review showed that very little research has been done on indigenous contraception in the North West province. The literature review further revealed that knowledge regarding the safety, effectiveness, mechanisms and reasons for use of most traditional techniques was also lacking. Knowledge in this study is classified as indigenous and western knowledge. Western knowledge systems (WKS) refers to knowledge based on science and technology, and are usually produced and transferred formally through schooling and institutions of higher learning, training and research. The word, “indigenous” refers to the root of things, and hence to something natural and innate to a specific context, for example, an indigenous plant or tree, which grows naturally in the existing environment (Higgs and van Niekerk, 2002).

Njoku (2001) points out that when one defines indigenous or endogenous knowledge, the logical assumption is that it refers to knowledge coming from local people themselves, knowledge available in the land, in its history, its culture, its memory, its geography and its linguistic heritage. IKS in general refer to intricate knowledge systems acquired over generations by communities as they interact with their environment (Higgs and van Niekerk, 2002). For example, du Pradal (1983) mentioned that the Batswana traditionally spaced their families by means of breastfeeding and abstinence for a period of two years after childbirth (du Pradal, 1983). According to Schapera (1994), sexual relations between a Motswana husband and wife were not forbidden while she is suckling a child, but the husband was expected to vpractice coitus interruptus (withdrawal) until the child is weaned.

A critical part of indigenous contraception has to do with the ethnobotanical knowledge of medicinal plants used for contraception, although the review showed that in-depth ethnobotanical studies were needed in South Africa to investigate medicinal plants traditionally used for contraception. The concept of ethnobotanical knowledge is closely

interwoven with ATM and people's cultural values. Ethnobotanical knowledge has been passed down from generation to generation and has the potential to redress some of the shortcomings of contemporary Western knowledge in relation to contraception in this case.

The Department of Health (2012) stated in its national contraception policy that knowledge regarding traditional practices and techniques of contraception used by the different ethnic groups in South Africa, including the Batswana, was lacking. Indeed, a huge gap exists on literature and research on ethnobotanical knowledge, practices and “traditional” techniques” of indigenous contraception among different ethnic groups in South Africa, particularly the Batswana and the North West province (NWP). This is so despite more than 80% of the people in sub-Saharan Africa still relying on the services of traditional healers (Green, 1997). The colonial legacy emphasised modern contraception and ignored indigenous knowledge (Hanks, 2002). In addition, the disruption of family life and break-up of viable and stable social relations led, among other things, to the frequent discontinuation of traditional practices for fertility regulation and substantial changes in sexual mores among South African ethnic groups (Department of Health, 2012).

Indigenous knowledge regarding traditional practices and techniques of indigenous contraception, including ethnobotanical knowledge of medicinal plants used for contraception among the Batswana is critical in explaining the safety, effectiveness, mechanisms and reasons for use of indigenous contraception, and traditional contraception in particular. Ethnobotanical knowledge regarding medicinal plants used for contraception in South Africa is important for scientific investigations targeting the safety, effectiveness and quality of medicinal plants used for contraception among the Batswana. Traditional health practitioners (THPs) were selected over other indigenous knowledge holders in this study because THP's are not only custodians of IKS and experts on indigenous contraception, but have knowledge and experience on traditional contraception in particular because of their intensive experience and knowledge of African traditional medicine (ATM). In ATM, the physical, psychological, spiritual and ancestral worlds are interconnected and THPs act as the link between these realms. It is for this reason that THPs have been selected as appropriate for providing indigenous knowledge regarding practices and techniques of indigenous contraception, including ethnobotanical knowledge regarding medicinal plants used for contraception among the Batswana. Reasonable consultation with THPs will not only help bridge some of the gaps

between the demand for and supply of modern pharmaceuticals, but also widen healthcare alternatives for posterity.

3.2 METHODOLOGY

3.2.1 Research approach, paradigm and design

A qualitative research approach was followed in this chapter to document knowledge, practices and techniques of indigenous contraception among the Batswana THPs in Ngaka Modiri Molema district municipality, with special focus on ethnobotanical knowledge of medicinal plants used for contraception among Batswana ethnic group. Qualitative research involves collecting and analysing non-numerical data such as text, video or audio to understand concepts, opinions and experiences (Bhandari, 2020). The research paradigm followed in this study is constructivism, suggesting that “reality is socially constructed (Young, 2020). Constructivism tends to rely upon the “participants’ views of the situation being studied” (Creswell, 2003). The research design for this study was ethnography. During ethnography, researchers observe and/or interact with the study’ participants in their real-life environment (Logan, 2020).

3.2.2 Target population

The target population for this study consisted of Batswana traditional health practitioners (THP) in Ngaka Modiri Molema district municipality (NMMDM). According to the Traditional Health Practitioners Act (2002), traditional health practitioner means, “a person registered under this Act in one or more of the categories of traditional health practitioners”. According to Rabotapi (2020) from the North West Dingaka Association, the number of traditional health practitioners in NMMDM is 480. Batswana THPs were targeted because they are knowledge holders of indigenous contraception, and experts in indigenous contraception. Each individual THP was a unit of analysis in this study, i.e. the subject of study about which an analyst may generalize. A key informant familiar with traditional healers of Ngaka Modiri Molema assisted with identification of the first THP from the population known by the community as an experienced expert and provider of indigenous contraception.

3.2.3 Sample size and sampling procedure

The study consisted of a sample size of seven participants (THPs) including four females and three males were sampled from the population. A purposive snowballing sampling procedure

was used to identify and select participants for the study. The main objective of purposive sampling or expert sampling is used in qualitative research for the identification and selection of information rich participants in relation to the phenomenon of interest (Palinkas et al., 2015). A purposive snowballing sampling procedure was used to identify and select with expertise on practices and techniques of indigenous contraception, and that possessed ethnobotanical knowledge regarding medicinal plants used for contraception.

3.2.4 Data collection tools

An interview guide, written in Setswana was used in this study as data collection tool to collect information about indigenous contraception (Appendix A). The interview guide consisted of five open-ended research questions to guide the interviews. In addition to an interview guide, the researcher field notebook was also used to note non-verbal behaviour such as laughter, approximating of volume by hands, shaking or knoding of the head.

3.2.5 Data collection methods

In-depth interviews were conducted face to face with individual participants from August to October 2018. In order to receive valid and correct responses from participants, there was a need to allow participants to use the language that they felt comfortable with, and vernacular (Setswana) was the preferred language. A voice recorder was used to record the in-depth interviews so that a verbatim account of the interview could be produced. The researcher further took additional notes when the participants used their body parts such as hand postures or knotting of the head to communicate certain messages during interviews. All interviews were conducted at a place where participants felt most comfortable, including their homes and even at their place of work. The length of interviews varied depending on the context at hand, and took approximately one-hour on average to complete. Data was collected through observation during field trips with participants for plant collection. A camera was not used in this study as part of data collection tools after an agreement with participants.

3.2.6 Data analysis

Before data could be analysed, the researcher needed to be familiar with its contents through listening of the voice recorder, reviewing and reading of transcripts. In cases where there were misunderstandings and confusions, the researcher revisited the participants for clarity before formally analysing the data. Data from the interview was transcribed from audio to a text by the interviewer (researcher) himself. The voice recorder was transcribed in its entirety to provide a verbatim account of the interviews. (Appendix G). The researcher himself carried

out translation from vernacular to English language. The researcher did not correct interviewees' words or grammar, nor changed speech patterns, and did not change content, intent or put words in the interviewee's mouth. The researcher directly transferred data from audio to a typed document that could be safely stored on a computer.

Data was analysed using a thematic analysis (Creswell, 2003) because thematic analysis is a method of analysing interview transcripts by closely examining the data to identify common themes i.e. topics, ideas and patterns of meaning that come up repeatedly (Caulfield, 2019). The thematic analysis process involved coding, generating initial categories, reviewing categories, defining and presentation of themes (Clarke and Braun, 2017). Each interview transcript was coded by identifying words, sentences, ideas and paragraphs that had the same meaning. Codes of the same meaning were reviewed and grouped together into categories (Clarke and Braun, 2017). Categories of the same meaning were reviewed and formed themes. Each theme was revised and further divided into related sub-themes.

3.2.7 Validity and reliability

The reliability of a study in qualitative research can be measured by its credibility, transferability, dependability and confirmability (Guba, 1981). Credibility establishes whether the research findings represent plausible information drawn from the participants' original data and is a correct interpretation of the participants' original views (Anney, 2014). In this study, credibility of the study was ensured by employing credible data collection methods accompanied by prolonged and persistent engagement during interviews, a field journal and triangulation. The researcher elucidated the entire research processes, from data collection, context of the study to the final report. The rich and extensive set of details concerning the methodology, background of participants, and the research context are included in the research report for transferability. Member checking was used to verify interview data with participants during and after data collection ensured dependability. Confirmability was ensured through an audit trail by detailing the process of data collection, data analysis, and interpretation of the data. The researcher further kept and maintained a reflexive journal, to reflect on what happened in the research process.

3.2.8 Ethical considerations

The importance of upholding ethics principles when conducting research is important in order to protect the NWU, the researcher and participants. The Faculty Research Council (FRC) of the Faculty of Agriculture, Science, and Technology (FAST) issued the certificate of approval

of research proposal and title registration for this study on 30 May 2017 (Appendix B). The approved proposal was thereafter sent to the Health Science Research Ethics Committee of the Faculty of Agriculture, Science, and Technology (FAST-HSEC), which issued an ethical clearance on 07 August 2018 for the part of the study that involved humans. (Page ii). The Indigenous Knowledge Systems (IKS) Centre provided the researcher with an introductory letter that allowed fieldwork to resume (Appendix C).

The introductory letter, certificate of proposal approval and an ethics clearance for the human study were presented to village leaders as supporting documents to request that research be conducted in their villages, including collection of medicinal plants. After obtaining permission from village leaders to conduct the study, participants were approached to determine if they had knowledge of indigenous contraception, and in particular, ethnobotanical knowledge of medicinal plants used for contraception among the Batswana. A prior informed consent form that requested consent to participate in the study was given to each participant with knowledge on indigenous contraception (Appendix D). The aims and objectives of the study were clearly explained, including the role the participant will play in the study. Professional honesty in research is important and the researcher was honest to participants about the research goals, intentions, and research methods and procedures of the study, including acknowledging the work of other researchers. All participants gave consent to participate in this study voluntarily and were all made aware that they were free to withdraw their participation at any time without negatively affecting their involvement in future services or the current study with any of the researchers or research bodies involved.

Other documents that accompanied the consent form were an introduction letter from the IKS Centre, FRC approval certificate and an ethical clearance certificate for study involving humans. A confidentiality agreement was signed between the researcher and participants that each participant's right to privacy will be respected by ensuring that matters revealed to the researcher in confidence not be disclosed to the public without the informed consent of the participant. (Appendix E). The researcher received a plant collection permit to collect plants for scientific curating and research from the North-West Provincial Department of Rural Environment and Agricultural Development (Appendix F). As part of the cultural protocols among the Batswana, the researcher had to offer participants adequate time and space to consult and receive consent from the ancestors as owners of the knowledge. Other cultural

protocols included removal of shoes and hat when entering the traditional surgery, throwing of traditional bones for guidance. The researcher provided lunch for participants after interviews as a token of appreciation. A sample of an in-depth interview transcript from the study has been attached. (Appendix G).

3.3 RESULTS

3.3.1. Introduction

Thematic analysis of data revealed the following themes: taboos of indigenous contraception, practices of indigenous contraception, techniques of indigenous contraception and ethnobotanical knowledge regarding medicinal plants used for contraception in Ngaka Modiri Molema district municipality. The theme regarding practices of indigenous contraception consists of three subthemes, including the practice of birthspacing, postponement of first birth (virginity), and stopping of reproduction. The theme on techniques of indigenous contraception discuss abstinence, animal intestine, burying menstruation, burying child technique, drinking water, vaginal stitching, waist rope, waist belt, waist acupuncture, avoidance of certain food, withdrawal and soil eating as techniques used by the Batswana to prevent pregnancy. The themes identified in the ethnobotanical knowledge of medicinal plants used for contraception included plant identification and naming, plant availability and accessibility, plant collection and conservation, herbal preparation, administration and dosage, and herbal safety and efficacy.

3.3.2: Theme 1; Taboos of indigenous contraception

Taboos in this study refer to prohibition and restriction from engaging in sexual intercourse under particular circumstances or conditions. If such contraceptive taboos are not followed, there are chances for mother and infant maternal mortality and morbidity. This taboo is applicable to both man and woman. The THPs mentioned that the Batswana have a strong belief that human being's gall bladder (*gala*) lives on after death, and only breaks six months after the person has died. Therefore, no sexual intercourse is allowed for either a man or woman, whose spouse has died. It is a taboo for a woman to fall pregnant after death of spouse, and a taboo for a man to impregnate another woman after death of her spouse. Women normally put on a black dress and become isolated for six months to a year without engaging in sexual activities. The THPs mentioned that sexual activities when a woman is on a monthly period are not allowed. Two more healers also emphasised that it is a taboo to

engage in sexual intercourse when a woman is in her menstruation. The birth attendant mentioned that,

*Ha motho wa mme a le mo matsatsing a gage a kgwedi, ra re o na le moeng, mme rre wa gage wa itse gore ga a tshwanela go mo tshwara go fitlhela a fetsa ka gonne madi a gage a leshwe. Se se ka ama le botona ba gage mashwe/ **When a woman is on her monthly periods, we say she has a visitor, and his man knows that she must not touch her until after she has finished, because her blood is not clean. It can also affect the penis of the man badly.***

Similarly, couples that divorce are expected to abstain from sexual intercourse for three to six months after separation. It is a taboo for a woman to fall pregnant or man to impregnate another woman within six to a year after divorce. The THPs emphasised that,

*Le ha baka nagana go boelana ba tshwanela ke go ntshafatsa dikano tsa bona ka morago ga lobaka ba gaogane, ba tshwanela go tlhapisiwa pele ga ba tsena mo thobalong / **Even when they decide to renew their vows after a long separation, they need to be cleansed first before they can engage in sexual intercourse.***

There is belief that couples must not engage in sexual intercourse when the child is still breastfeeding. One diviner said,

*Ke lona lobaka le dirang gore monna wa mosadi a tswanela ke go robala ka mo kamoreng e nngwe, kgotsa moimana o ya go nna le batsadi ba gage, mme ka ga ntsi ke bo mmemogolo. Fa b aka dira thobalano, kgonegalo e teng ya gore mosadi a kai ma gape/**That is why the man of the woman sleep in a different room, or the woman is taken to live with his or her parents, in most cases the grandparents. If they still sleep together, there is a chance that an unwanted pregnancy may occur.***

A woman, who has just experienced miscarriage, must prevent pregnancy for a period of six months to a year by not engaging in sexual intercourse. A THP explained,

*Pitsa ya apewa gore mosadi a e new ka nako eo a ikelelang. Pitsa le dirituele di a dirwa go tlhapisa mosadi. Ha mosadi o ne a imile a ka latlhagelwa ka hetelwa ke ngwana a sa tlhapisiwa, a ka tloga a latlhegelwa ke ngwana o mongwe ha a nna mo mmeleng/**Medicine is prepared for the woman to take during that period of abstinence. The medicine and traditional rituals are performed in order to***

cleanse and clean the body. If a woman who had just experienced miscarriage fall pregnant again, without being cleansed and with no rituals performed, a secondary miscarriage will occur, or worse, she might die.

Pregnancy after abortion must also be prevented. The woman must first be cleansed. It is important to note that such a pregnancy is not risky only to the woman, but the man engaging sexual acts with such a woman is at risk of incurable diseases. An herbalist emphasised that,

Wena o akanya gore bana b aba nang le bogole ba bo tsaya kae? Ke ka ntlha ya basetsana b aba tsenang mo thobalanong morago ga go timetsa mpa, ebe ga ba itsese batlhankane ba bone /Where do you think all these children with disabilities come from? It is because young girls engage in sexual acts immediately after she has experienced abortion, and they don't tell their new boyfriends.

3.3.2: Theme 2; Practices of indigenous contraception

The participants identified several indigenous contraception practices, which will now be described as follows:

3.3.2.1 Birth-spacing

All participants knew and agreed on the practice of birth spacing among the Batswana. However, there was no consensus among traditional healers on the precise duration allowed for a woman or couple to have the next pregnancy or child. Some healers are of the view that the duration a woman must take before the next pregnancy or next child depends on breastfeeding, what is referred to in Setswana as *Botsetse*, others said that duration depends on the development (age) of the child. *Botsetse* refers to the period after the delivery of a child, which differs from three and six months to a year. In this case, the birth spacing will be one year for a three months *botsetse*, and one year six months for a six months *botsetse*. One healer said with regard to *botsetse*;

Ka nako engwe go anyisa go tsaya dikgwedi tse tharo, mme morago ga go anyisa monna o robala le motsetse, ebe o nna mo mmeleng. Gape go nale e ya dikgwedi tse tshelela, mo botsetse bo tsayang dikgwedi tse tshelela /Sometimes breastfeeding becomes three months, and just after botsetse when the husband

meets the wife, then she falls pregnant. Then there is the other one, of six months, that a woman is breastfeed for six months.

Other healers are of the view that the duration a woman must take before the next pregnancy or next child depends on the “development” of the child. In this case, a child that develops slowly will increase the duration of birth spacing, while a child that develops quickly will shorten the birth spacing. In this case, birth spacing duration ranged from two years to five years.

3.3.2.2 Virginity

A young girl is not expected to fall pregnant before marriage. There is a concept of go tlhoma lethlokwa (traditional engagement) among the Batswana, which differs from western engagement. Parents and uncles are responsible for organizing the marriage. A *lobola* (cows) is paid during the marriage negotiations, and a girl with her virginity still intact receives a higher lobola than one with one or more children. A girl, who is still a virgin is more valuable and her family will receive a higher number of cows. One THP referred to the bible and said:

Ha se beibele fela e buang ka seno, fela re batla go tlhaolganya seno ka sekwalejwale, fela fa o lebelela mo beibeleng, dikgang tseno di a tsamaisana sentle le se setso sa rona se se buang / It is not only biblical, and we (people in general, not particular THPs). take the bible and want to misinterpret it with modern issues, but when you get to look at the bible, it correlates exactly with what our culture and tradition ask of us.

There is a concept of go tlhoma lethlokwa (engagement) among the Batswana. This engagement in a traditional sense differs from the western engagement in that, traditionally, engagement (tlhoma lethlokwa) takes place when the boy and the girl are still very young, in fact, and this arrangement takes place without their knowledge and awareness. The healer said;

Eya, le ya go gola lotlhe, mme le ya go simolola go dira thobalano morago ga gore batsadi ba le tlhakanye le gore ba dumelane/Yes, you are going to grow together, and you are going to start experiencing sexual intercourse after the parents have allowed you to do so.

Furthermore, it is the parents that decide and uncles as negotiators that organize the marriage. During the negotiations of lobola, uncles decide on the number of cows to be offered for the

girl, and the virginity or not of the girl dictate the number of cows that must be offered. A girl, who managed to secure her virginity and therefore postponed her first pregnancy is traditionally considered valuable than one who has engaged in sexual intercourse before.

According to traditional healers, there is no specific age required for a girl and boy to start contraception. Some healers are of the view that parents start with prevention immediately they realize that their girl has started experiencing her monthly periods. Other traditional healers hold the view that prevention of pregnancy only begin when the child begin engaging in sexual relations. There is also no consensus among traditional healers with regard to the specific age required for the child to end the prevention. This stage of initiating pregnancy only starts when the parents and uncles have agreed upon issues relating to lobola and marriage has been arranged.

3.3.2.3 Stopping of reproduction

An irreversible contraceptive means that the woman cannot fall pregnant again, as such stop reproduction. The female THP said;

Ka gantsi re simolola ka go tlhaloganya mabaka gore gonneng mme a batla go se tlhole a nna le bana, ebe re motlhaloetsa ditlamorago tsa go thibela pelegi gotlhe gotlhe, thata yang fa e le mosetsana o monnye mo dingwageng. Basetsana ba banye gantsi ba itemogela mathata a go imelwa ke botshelo ba be ba tsaya di tshwetso ka gangwe, thata yang fa go sena mongwe wa lelapa go motlhokomelang/We normally first try to understand why the woman want to stop reproduction, and explain to her the consequences of stopping reproduction, especially if it is a young woman. These young girls are sometimes stressed by life and take harsh decisions, especially if there is no family support structure.

Several interviews take place between the woman wanting to stop reproduction and the healer offering service before any service can be provided. As it is the case for indigenous contraception in general, her spouse, parents, must accompany a woman seeking assistance before reproduction can be permanently stopped. This practice of stopping reproduction is not common among the Batswana, since only one healer mentioned it.

3.3.3: Theme 3; Techniques of indigenous contraception

In this theme, the participants identified several techniques used for indigenous contraception by the Batswana of NMMDM as follows:

3.3.3.1 Abstinence

Abstinence is a common technique for indigenous contraception in general, and known by all participants in this study. It was the only technique that was applicable to all three practices. Some healers view indigenous contraception as abstinence, since this technique is applicable to all taboos and all practices of indigenous contraception. During the beginning of the interview, one herbalist said when asked if Batswana prevent pregnancy,

Eya, thibela pelegi mo Batswaneng e teng mme e dirwa ka “go ila” kgotsa “go ikelela/Yes, prevention of pregnancy among the Batswana is through abstinence, you must abstain from sex for some time.

This “go ila” implies abstinence, and abstinence with regard to taboos and practices of indigenous contraception. Abstinence is applicable to both men and women, as well as to the young and old. Therefore, among other techniques of indigenous contraception among the Batswana, abstinence can be considered the most revered among all techniques of indigenous contraception.

3.3.3.2 Animal intestine

This reversible male technique of indigenous contraception has not been reported in literature. The animal intestine technique is used in the same way the western condom is used. The small intestine of an animal encloses the penis, so that male sperms do not enter the woman. A male healer stated that;

Re ne re dirisa karolo e ngwe ya phologolo, malana. Motho wa monna o kgona to tsenya botona ba gage fao a be a robalana le motho wa mme kago sa mo imise/We used to use a certain part of the animal, intestines. A male person is able to put it on his penis and sleep with a woman without impregnating her”.

The type of animal used depended on the age of the man, or the size of his penis.

3.3.3.3 Burying menstruation

This reversible female technique of indigenous contraception involves burial of a girl's menstruation. One herbalist stated that,

Fa re sa battle mosetsana go ima re tsaya ledi la gage la kgwedi, re le tlhakanya le ditlhare re tsenye mo botlolong e tswalegang, fa re fetsa re le epela fa felong le riling kgots ka morago ga ntlo re be re ribela ka leje. Fa mosetsana a le monakong a matshwanedi go ima, re ya fale re tseye botlolonyana ele re tshele metsi re tlhapse mosetsana/If we don't want a young girl to fall pregnant we take her menstruation blood, mix with herbs, collect in a small bottle, and bury it at a secret place around the house, with a stone placed on top. When she is ready to fall pregnant, we collect buried bottle, mix her-menstruation with water and wash the girl.

3.3.3.4 Burying child technique

This technique is also rarely mentioned in literature. A herbalist mentioned that,

Ngwana o re sileng a apesiwa ka kobo e mmage a neng a epaere fa ngwana a ne a tsalwa. Se ke sephiri se se tona, le ena ga re mo bolelele/ A dead child is wrapped with a cloth that her mother was wearing when she gave birth. This is a secret; we don't tell her.

The participant whispered when explaining this burial technique, especially when people passed by. This is an irreversible female technique.

3.3.3.5 Drinking water

This reversible male and female technique is also a rarely mentioned technique of indigenous contraception. A male herbalist explained,

Ke nwa metsi le mosadi o nwa metsi pele ga thobalano, fa re fetsa ke robala le ena. Fa re fetsa ka thobalano, mme o nwa metsi gape. Di speme tsele dinna metsi e ne di ka se dire mme a ime/ I drink and the woman also drinks water before sex, and we then engage in a sexual intercourse after drinking that water. After engaging in sexual intercourse, the woman again drinks a lot of water. Those sperms will be watery, and I will not make her pregnant.

When asked how much water is taken, the healer replied,

Re tsaya jeke, wa bona jeke ya metsi, fa re sa battle go dirisa ditlhare/ We take a jug; you see a jug (participant use hands to measure about 2 l container) of water, if we don't want to use medicines.

3.3.3.6 Vaginal stitching

This female reversible technique of indigenous contraception is performed to young girls that have attended the initiation school for girls. According to one healer,

Karolo ya kuku mo mosetsaneng ya segiwa, be go rokiwa. Basetsana bat la dula ba tlholwa gangwe le gape go bona gore a ditlhale tsele di santse di le teng/The clitoris of a young girl is “cut” and stitched. These girls are regularly brought for virginity testing to be examined if the stiches are still present.

When the girl is ready to fall pregnant, stiches are removed and the girl is ready to fall pregnant.

3.3.3.7 Waist rope

This reversible female technique is prepared by tying two small pieces of *mabophe* to the traditional waist rope. The participant showed the researcher one small piece (5 cm) of the medicinal plant and explained;

Se bitswa mabophe, mme nna ya ka ngaka ke tshanetse ke itse gore ke di fasa yang mo mosetsaneng. Ka gonne go dira lebanta leno, tlhaka e ngwe e dula kamo pele mo mokhubung, mme engwe e dula ko morago, ebe wa itse gore o mofasitse, fa a batla go dira thobalano wa letsenya/It is called mabophe, and as a healer, you must know how you put them, on the girl. Because for the rope, one stalk should come in the front (illustrating with her hand), and the other one be put on the back, and you know that you have tied her, when she knows that she is going to sleep with a man (male).

The waist rope is tied whenever the woman knows she is going to engage in sexual intercourse, otherwise, the rope can be removed if the girls go to school for example.

3.3.3.8 Waist belt

A waist belt is prepared by smearing the fat of porcupine on a traditional rope. Unlike the waist rope, which is for a short term, the waist belt is for a long term. As a result, the girl is expected to tie the belt until she is ready to fall pregnant. A healer emphasised,

Batsadi ba tlhola mosetsana ka dinako tsotlhe go netefatsa gore lebanta le ntse lele teng ka gonne fa a ka lentsha, go tla nna botlhofo gore a nne mo mmeleng

/Parents must always examine the girl to ensure that the waist belt is on her waist at all times because if she removes, it will be easy for her to fall pregnant.

3.3.3.9 Waist acupuncture

This uncommon and rarely reported technique is for male contraception. The sharp spines or quills of the porcupine are dipped in the porcupine's fat and gently picked around the waist of a man or boy. A male healer said;

Le monna ram o bereka mo lethekeng gore a se tthole a nna le bana le gore a se ke a imisa motho wa mme. Fela re kgona go mo thusa gape ge a batla go nna le ban aka go mo nosa melemo e riling/Even for the man we can work on his waist using sharp spines of porcupine dipped in its fat. I can operate him so that he is not able to make a woman fall pregnant. Then when we want him to make a woman pregnant, we reverse the process, using other medicinal plants.

3.3.3.10 Avoidance of certain food

Certain foods, especially those with proteins are not offered to young teenagers due to the belief that such foods make teenage boys and girls fertile and prone to pregnancy at a young age. A healer explained,

Basimane le basetsana ka bebedi ba ne ba sa tshwanela ke go ja dijo tse tshwanang le matokomane, tshisi, le mahe go thibela pelegi. Mogodimo ga moo, malana a phologolo a ne a sa jewe ke basimane ka gonne go dumelwa gore botona ba bone bo tla nna boleele ka jalo gonne botlhofo go imisa mosetsana /Both boys and girls are not allowed to eat foods like peanuts, cheese and eggs to prevent pregnancy. In addition, animal intestines are also not supposed to be eaten by boys because it is believed that their reproductive organ will be longer making it easier for such a boy to impregnate a girl.

3.3.3.11 Withdrawal

One indigenous technique used to prevent pregnancy among the Batswana was withdrawal. A healer stated,

Le bo ntate baka thusa go thibela pelegi ka go ntshetsa kwa ntle, eseng mo teng gam me gore mme a se ime / Even men can help prevent pregnancy by withdrawing when they feel that time has come (time of ejaculation) so that they do not impregnate the woman.

3.3.3.12 Soil eating

One male healer told the researcher that women also eat soil to prevent pregnancy. The healer stated,

Go nale mhuta mongwe wa mmu oo jewang ke basetsana go thibela pelegi. Hela go na le mefuta e mentsi ya mmu o jewang, o tshwanela ke go itse gore o thibelang pelegi keo heng/There is a specific type of soil eaten by women purely for the purpose of contraception. But there are many different types of edible soil; you must know which soil to use for contraception.

3.3.4: Theme 4; Ethnobotanical knowledge of medicinal plants used for contraception

3.3.4.1 Plant identification and naming

In total, nine plants belonging to six botanical families were known and their vernacular names used to identify them. The compositae was the most prominent plant family, and the roots being the most widely used plant part. One traditional healer did not disclose the names of the plants, but contributed immensely to the study. One female THP mentioned *Elephantorrhiza burkei* Benth as one plant she knows is used for contraception. A second female healer mentioned *Helichrysum caespititium* (DC.) Sond. ex Harv., *Bulbine frutescens* (L.) Willd. and *Berkheya setifera* DC. The same female THP also mentioned *Acridocarpus natalitius* A.Juss. and *Cannabis sativa* L. A third female healer mentioned *Helichrysum caespititium* (DC.) Sond. ex Harv, *Bulbine frutescens* (L.) Willd. and *Teucrium trifidum* Retz.. One male THP mentioned *Disparago anomala* Schltr. ex Levyns and *Dicoma anomala* Sond. and another mentioned *Teucrium trifidum* Retz. . *Helichrysum caespititium* (DC.) Sond. ex Harv, and *Bulbine natalensis* were mentioned by two THPs. Two THP also mentioned *Teucrium trifidum* Retz.

All plant names were known by Setswana, except for *Berkheya setifera* DC. The plant *Berkheya setifera* DC. was referred to as Mavhumbuka, a Venda name. The Venda is another ethnic group in South Africa. *Acridocarpus natalitius* A.Juss is referred to in Setswana as *mabophe*, or *mabopha*. The name *Mabophe* (a) implies to tie, or to fasten, “go bopha”. The plants name, *mabophe*, is therefore directly related to its purpose as contraceptive waistband. *Cannabis sativa* L. is the only one plant that has been reported to be used for contraception in Southern Africa.

3.3.4.2 Plant availability and accessibility

Despite the fact that identified medicinal plants were used for contraception and for other health related purposes, majority of the plant species were readily available and easily accessible to traditional healers, the researcher and the community at large. The availability and accessibility of these medicinal plants increased during summer, when it is rainy seasons (September to March). The availability and accessibility of these plant species decreased during winter (May to July).

Table 3.1: Medicinal plants identified as being used for contraception in Ngaka Modiri Molema district municipality.

Scientific name	Local name	Frequency	Botanical family	Part used	Administraction	Pre/postcoital
<i>Acridocarpus natalitius</i> A.Juss	<i>Mabophe</i>	1	Malpighiaceae	Stem	Single species	Precoital
<i>Elephantorrhiza burkei</i> Benth	<i>Mositsana</i>	1	/Fabaceae	Roots		
<i>Cannabis sativa</i> L.	<i>Matekwane</i>	1	Cannabaceae	Seed		
<i>Dicoma anomala</i> Sond.	<i>Tlhoenya</i>	1	Asteraceae	Bulb	Herbal mixture 1	
<i>Disparago anomala</i> Schltr. ex Levyns	<i>Mojakabomo</i>	1	Asteraceae	Roots		
<i>Teucrium trifidum</i> Retz.	<i>Setlhokotlhoko</i>	2	Poaceae	Leaves	F (Single species)	Pre or Postcoital
<i>Bulbine frutescens</i> (L.) Willd	<i>Makgabenyane</i>	2	Xanthorrhoeaceae	Root	Herbal mixture 2 (FGH)	
<i>Helichrysum caespititium</i> (DC.) Sond. ex Harv.	<i>Phate ya Ngaka</i>	2	Asteraceae	Leaves		
<i>Berkheya setifera</i> DC.	Mavhumbuka	1	Asteraceae	Roots	Herbal mixture 3 (GHI)	

Cannabis was not readily available because possession of the plant, even for medicinal purposes could lead a person to prison in South Africa, or the person can incur a fine. Therefore, the plant is not easily accessible nor readily available for and from most traditional healers who want to use cannabis for prevention of pregnancy, or any other medicinal purpose. Furthermore, one healer mentioned that *Acridocarpus natalitius*, a medicinal plant species that is used for contraception as a waistband is not readily found in Ngaka Modiri

Molema district municipality. The healer said she ordered the medicinal plant from Zimbabwe. *Berkheya setifera*, referred to as *mavhumbuka*, is also not collected within the district but rather is ordered from Venda, in the Limpopo province of South Africa. Three of the nine medicinal plants used for contraception by the traditional healers were not readily available or easily accessible.

3.3.4.3 Collection and conservation of medicinal plants

In South Africa, plant collection permit must be applied for from the Provincial Department of Environmental Affairs at the province where the plants are to be collected. The permit is applied online, takes three to four weeks before it is issued, and is valid for two years. However, traditional healers did not necessarily apply for such permits; instead, request is made to community traditional leaders where plants are collected. Elderly healers employed young herbalists as plant collectors. Most plants were collected within Ngaka Modiri Molema district municipality, except *Acridocarpus natalitius* and *Berkheya setifera*. According to traditional healers, plant collection during midday was forbidden. Plants were collected either early in the morning or late during the afternoon, and preferably after rainy days. Only the parts of the plant required for a specific purpose were collected.

Traditional healers knew when each medicine was ready to be collected, such as when it is flowering for example. In most cases, medicinal plants used for contraception are collected after rainfalls. Furthermore, medicinal plants used as contraception are collected only before sunrise or during sunset. During plant collection, traditional healers do not harvest the whole plant, if only the top part of the plant is needed. If leaves are required, only those leaves of the plant that have matured will be collected, and the young still growing leaves will be left behind. All identified medicinal plants are assessed as least concern (LC) based on the South African National Biodiversity Institute (SANBI) red list conservation status, except *Cannabis sativa*, which is not assessed. During the interviews, no plant was known to be under conservation threat.

Through participatory tours that took place during the plant collection, the researcher observed that few medicinal plants showed signs of being over harvested, in particular, *Helichrysum caespitium*. The problem is that the same medicinal plants used for contraception are also used for other various illnesses. Two female elderly traditional healers were too old to go for plant collection. As such, these elderly healers buy medicinal plants

from young herbalists that work as plant collectors. The particular healer indicated which medicine is needed, and how much is required. Plant collectors collect the required medicine and distribute it among healers that are unable to go collect the plant species for a certain fee.

3.3.4.4 Preparation, administration and dosage of herbal mixtures

Acridocarpus natalitius was the only plant administered externally in the form of a contraceptive waist belt. Two small pieces of the plant are cut from its stem, and each is attached to the traditional waist rope such that one piece is placed at the front and the other piece is placed at the back. The woman is expected to tie the waist belt before sexual intercourse, and remove it if she knows she will not engage in any sexual activities. *Elephantorrhiza burkei Benth* is mixed with a small amount of dry traditional clay and the mixture is added to cold water. The mixture is allowed to boil and thereafter be taken three days to a week before sexual act. One healer mentioned that one seed of *Cannabis sativa* is taken by a woman to prevent pregnancy for a year. The use of cannabis for contraception has a long-term effect, but reversible. One diviner explained that the fresh leaves of *Helichrysum caespititium* are mixed with the roots of *Berkheya setifera* and *Bulbine frutescens* (herbal mixture) and crushed into small plant pieces. A handful of mixed plant material consisting of both leaves and roots is added to 2-litre volume of cold water in a pot. The mixture is placed on fire until it reaches near boiling point. The mixture is allowed to cool off and transferred to a 2-litre container. The herbal mixture is taken orally three to five days before or after sexual intercourse. Approximately 200ml to 250ml of the herbal mixture is taken twice a day, one cup in the morning and another in the evening.

One herbalist explained that the same leaves of *Helichrysum caespititium* and the roots of *Teucrium trifidum* and *Bulbine frutescens* (herbal mixture) are mixed and crushed into powder. A handful of the plant material is also placed in a 2-litre volume of water. The mixture is heated until the mixture reaches evaporation point. The herbal mixture is also taken orally three times a day, three to five days before or after sexual intercourse. Traditional healers advised and emphasized that the medicine be taken immediately after sexual intercourse until it is finished, and not wait longer time before visiting the healer. One herbalist stated that the roots of *Dicoma anomala* and *Disparago anomala* are mixed and crushed into powder. The mixed roots of both plants are then added to cold water and heated. After the mixture has reached boiling point, the herbal mixture is allowed to cool and is transferred to a 2-litre container. A woman takes two cups of the concoction three days before

sexual intercourse. The herbalist said the herbal mixture was safe and efficient. The herbal mixture of *Dicoma anomala* and *Disparago anomala* was the only herbal mixture in this study that consisted of species belonging to the similar plant family.

Elephantorrhiza burkei is mixed with a small amount of dry clay and the mixture is added to cold water. The mixture is allowed to boil and taken immediately before sexual intercourse. Contraceptive effects from all herbal mixtures were reported to be reversible, except for the herbal mixture (*Bulbine frutescens*, *Helichrysum caespititium* and *Berkheya setifera*). Contraceptive effects of herbal mixture GHI was reported to be irreversible when the womb of the horse was added. The horse womb was first dried, and crushed into powder. The powder from the horse womb was mixed with the herbal mixture, added to water and heated until just before boiling point. The woman is expected to drink the medicine on a daily basis, twice or three times a day until the medicine is finished. She can then engage in a sexual intercourse without falling pregnant. However, the healer emphasized that they first try to convince the woman otherwise, and when the decision is taken the woman's spouse must be present. If it is a young woman, the parent or guardian must be present.

3.3.4.5 Safety and efficacy of herbal mixture

All traditional healers were convinced that medicinal plants used for contraception were safer than modern contraceptives. Traditional healers in this study reported of the tendency among young women to request contraceptive services after sexual intercourse and before pregnancy. One healer explained how they as traditional healers decided to no longer offer services for post-coital contraception, and that those women seeking post-coital contraception are advised to visit clinics or hospitals. One female healer explained that:

*Basadi bangwe ga ba bui nnete gore ba heleditse leng go dira thobalano ba be
dira ekare ba batla go thibela pelegi. Ba tla be ba re ke maobane empa e le
dibeke kgotsa dikgwedi/Some women are not truthful about the period from day
of sexual act to day of seeking for herbal contraception. They will say its
yesterday, when it is weeks or months back.*

The decision by traditional healers (traditional associations) not to offer post-coital contraception anymore is due to the dishonesty and misleading of patients who want to abort, but pretends to have come for post-coital contraception. All traditional healers said they are against abortion, and do not participate in such acts. The duration after sexual intercourse allowed by traditional healers for post-coital contraception differed from one healer to

another, from immediately after sex, to days, weeks and months (3 maximum). When asked how would they know if the client speaks the truth or lie about the period for last engaging in sexual intercourse, two solutions were given. One female healer said she was taught by her trainer to look at the face of the client, and be able to determine the truth or lie spoken. Another male healer said he would tell the client that he must first consult the bones, and that the woman must come the following day. In most cases, those who lie never come again for contraception. All traditional healers further agreed on the effectiveness of all herbal contraceptives, taken orally or as a waistband. However, all traditional healers in this study stated that medicinal plants used for contraception were effective when used by women only, and not by men.

The traditional healers emphasized that medicinal plants used for contraception become conceptive when taken by men. In fact, one of the THPs was not even convinced of other male methods of contraception due to his belief that contraception is a feminine practice and responsibility. The belief that medicinal plants used for contraception are only effective on women and not on men reflect gender roles associated with indigenous contraception among the Batswana, herbal contraception in particular. However, the Batswana in this study view contraception as mainly a responsibility of women alone, while the responsibility of men is conception. It is for this reason that a woman is usually the one blamed for falling pregnant, and rarely the spouse. Although women are expected to use herbal contraception and not their counterparts, traditional healers require the woman's male partner to be part of decision and agreement made regarding prevention of pregnancy. Therefore, with regard to herbal contraception, women are not allowed to make decisions regarding their reproductive health without the consent of men. These findings further illustrate gender roles associated with herbal contraception. The responsibility placed on women for ensuring conception, seems to be placed on them for contraception. These results illustrate the view of the Batswana with regard to reproduction, that, it is a feminine responsibility.

3.4 DISCUSSION

Some of the taboos mentioned by traditional healers have been reported in other studies undertaken in South Africa and other parts of the continent. Refraining from sexual activities during menstruation is a common contraceptive taboo followed in South Africa (Wood and Jewkes, 2006) and in Gambia (Bledsoe *et al.*, 1994). Refraining from sexual activities during menstruation is a common taboo because there is a belief and perception that the menstrual

blood is unclean. In this study, there was a belief among participants that sexual intercourse during breast-feeding is forbidden to avoid unwanted pregnancy. Batswana believe that sex during breastfeeding can damage or contaminate the milk. Consequently, the child that will be taking that breast milk will be affected negatively with regard to general health and growth. Postpartum abstinence is a common technique of indigenous contraception practiced in Tanzania (Keele *et al.*, 2005); Democratic Republic of Congo (Bertrand *et al.*, 1983; Bledsoe *et al.*, 1994; Dunn *et al.*, 2016), Namibia (Gockel-Frank, 2009), South Africa (Mothiba *et al.*, 2012), Kenya (Frank and McNicoli, 1987), Burkina Faso (Rossier and Hellen, 2014), Nigeria (Odivwri, 2016) and Ghana (Addai, 1999).

Sexual intercourse among the Batswana is generally forbidden after death of partner for a certain time because Batswana believe that the gull bluder in a human lives on to about six months after death. One elderly female healer was the view that sexual activity can take place during such circumstances, provided withdrawal is applied or herbal contraceptives are taken. Schapera (1994) argued that sexual relations between a Motswana husband and his wife are not forbidden while she is suckling a child (breastfeeding), provided they practice withdrawal. The WHO (2018) further recommends that after a self or induced abortion, the recommended minimum interval before the next pregnancy is at least six months in order to reduce risks of adverse maternal and perinatal outcomes. Borges (2014) also state that a minimal inter-pregnancy interval of six months after abortion is required, to minimize the risk of adverse health outcomes such as maternal anaemia, premature birth, and low birth weight. About 50% of the one million conceptions occurring every day worldwide remain unplanned, of which 150,000 are terminated by abortion, an intervention that will end fatally for 500 of these women (Nieschlag, 2011).

Child or birth spacing means to provide adequate birth spacing between two or more consecutive pregnancies (Dunn *et al.*, 2016). The idea of child spacing is not new or foreign to the Batswana who traditionally spaced their children by means of breastfeeding and abstinence for a period of two years after childbirth (du Pradal, 1983). Virginity testing (*ukuhlolwa*) was identified as one of the most effective ways of preventing unwanted pregnancies among teenagers in KwaZulu-Natal (Ncube, 2012). However, there have been concerns within the political fraternity that virginity testing infringes on a girl child's right to privacy, is gender discrimination, and violates the right to bodily integrity. The importance placed on virginity, traditionally and culturally, prevents boys and girls from engaging in

sexual relations and activities until they are married. Defiance of this custom brings shame and dishonour mainly to the girl and her family. Hence, it is considered a pride for a girl to retain her virginity until marriage. Therefore, a Motswana girl is traditionally not allowed to fall pregnant before she is married.

Some of the techniques were known in South Africa or across the continent. For example, burial techniques of a dead child were practiced in Limpopo, South Africa (Mothiba *et al.*, 2012). Mothiba *et al.* (2012) further mentioned burial of menstrual blood as a contraceptive technique performed in South Africa. Burial techniques prevent the mother from conceiving again (Wood and Jewkes, 2006). It was found that medicinal plants were taken orally for contraception in the Limpopo province of South Africa (Mothiba, 2012). Only one medicinal plant in this study was found to be used as a waistband, while the rest of the plants were administered orally. The use of medicinal plants as waistbands contraceptives is known in South Africa, and common in Africa. Herbal contraception among the Batswana is administered in two ways, orally and as a waist belt. It was reported that a rope containing traditional medicine is tied around the waist as a contraceptive in South Africa (Wood and Jewkes, 2006).

In another study in Kwa Zulu Natal, women said traditional healers dipped a red string in a mixture of herbs and asked them to tie it around the waist as a contraceptive (Ncube, 2012). These women stated that the waist contraceptive was not effective, and women reported the inefficiency of the waist belt as a contraceptive (Ncube, 2012). However, traditional healers put the blame on women and argued that many clients who require assistance with prevention of pregnancy do not follow instructions as prescribed by the healer (Ncube, 2012). The technique of a waist belt is practiced in Uganda and Nigeria (Jinadu *et al.*, 1997; Kabagenyi *et al.*, 2016). Although traditional healers emphasized the safety and efficacy of the waist belt contraceptive, its mechanism could not be explained. The administration and dosage of medicaments used for contraception in this study is similar to that reported by Mothiba *et al.* (2012). In Nigeria, herbs are taken orally in the form of soup or are mixed with cold pap and eaten (Jinadu *et al.*, 1997). Medicinal plants are not administered only orally or waistband contraceptives. For example, in Uganda, plants are inserted in the vagina to prevent the semen from reaching the womb (Ntozi and Kabera, 1991). We documented that cannabis seed was taken once to prevent pregnancy for one year. Similarly, women in Zimbabwe also take *cannabis* seed once to prevent pregnancy for one year (Jaravaza, 2013). The use of *cannabis*

seed for natural contraception in Zambia has also been reported (Nyundo *et al.*, 2018). The species *Elephantorrhiza burkei* is used as an abortifacient in Venda, South Africa (Arnold and Gulumian, 1984).

THP's proposal to eradicate the use of medicinal plants after unprotected sexual interaction could lead to loss in ethnobotanical knowledge. There were safety concerns about University female students that seek post-coital contraception when they know that they are already pregnant. All healers were very much against abortion; hence, these young females become dishonest about their last time of engaging in sexual activities. However, if no longer practiced, the ethnobotanical knowledge regarding herbal prevention of pregnancy after sexual contact will eventually fade away among the Batswana. It was clear in this study that herbal contraception was gender discriminative, with only women allowed to use medicinal plants for contraception. These gender biases in herbal contraception among the Batswana illustrate the burden and responsibility placed on woman regarding contraception. However, the belief that herbal contraception only for women is a local belief because medicinal plants used as single agents or as herbal mixtures for male contraception have been reported in Nigeria (Adebisi and Bello, 2011). For example, method of application for male herbal contraception in Nigeria was ring, decoction and incision (Adebisi and Bello, 2011). Therefore, the belief by the Batswana that herbal contraception is for women should not deter research on the development and discovery of male herbal contraceptives.

As stated before, indigenous contraception functions holistically, with practices, techniques, and taboos functioning as a unit. Each technique of indigenous contraception has one or more related practices or/and taboos of indigenous contraception. However, abstinence was the only technique applicable to all practices and taboos of indigenous contraception. Abstinence is applicable to both men and women of all ages, and can be considered an important technique of indigenous contraception. This explains why some participants viewed indigenous contraception as mainly *go ila* or *go ikelela*, meaning or implying "abstinence" or taboo. The use of herbal contraceptives is the only technique applicable to all practices except for taboos, and can be considered second to abstinence in terms of the central role it plays to indigenous contraception.

3.5 CONCLUSION

The Batswana traditional healers of NMMDM possess rich and diverse ethnobotanical knowledge regarding indigenous contraception. Some of the practices and techniques have previously been reported in South Africa. There was no mention of any medicinal plants taken by men for contraception and only women were required to drink herbal contraceptives. In addition, women had to be accompanied or get consent from their husband, parent or gurdian before she can be assisted by a traditional health practitioner. It is therefore important that the knowledge, attitudes and perceptions towards indigenous contraception among Batswana women be investigated. The next chapter investigated the knowledge, attitudes and perceptions towards indigenous contraception among the Batswana women. Part of this chapter has been accepted for publication. (Page xxi).

CHAPTER 4: KNOWLEDGE, ATTITUDES AND PERCEPTIONS OF BATSWANA WOMEN TOWARDS INDIGENOUS CONTRACEPTION

4.1 INTRODUCTION

Good knowledge of contraception has been associated with increased contraceptive use (Gosavi et al., 2016). Okeowo and Olujide (2014) found a significant relationship between the utilization of family planning methods and knowledge of contraception. Indigenous knowledge is often contrasted with "scientific," "western," "international "or" modern" knowledge, the latter referring to the knowledge developed by universities, research institutions and private firms using a formal scientific approach (Mathias, n.d).

The implication being that utilization of family planning methods is greatly dependent on the knowledge respondents have about the various family planning methods (Okeowo and Olujide, 2014). Thus knowing at least one method of contraception is an essential precondition for practice of contraception. Htay et al. (2018) illustrated that increased knowledge on contraception had an influence on women's perception of contraception. Tran and Vo (2018) also showed that students with a good level of knowledge regarding contraception generally showed positive attitudes toward the utilization of contraceptives. Htay et al. (2018) and Tran and Vo (2018) found that there were statistically significant association between the participants' knowledge of contraception and their perceptions or attitudes regarding contraceptives.

Kashyap (2016) defines a perception as a process by which individuals organize and interpret their sensory organs in order to give meaning to their environment. We can describe perception as being able to process information that we receive from our senses (Hoy, 2021). Attitude refers to the positive or negative feelings or tendencies of an individual about an idea, an object or a symbol (Sensoy et al., 2017). According to Eagly and Chaiken (1993), attitude is a psychological tendency that is expressed by evaluating a particular entity with some degrees of favor (positive) or disfavor (negative). Unintended pregnancies have remained a challenge to both developing and developed countries because of negative attitudes towards contraception (Singh et al., 2010). If attitudes lead to behavior, then behavior toward contraception might be influenced by changing individuals' perceptions of

the object. A schematic framework illustrates the influence of demographic variables on knowledge, attitudes and perceptions, which in turn influence each other, and finally affect behavior and contraception.

Kalpeni and Zulu (1993) found that indigenous contraception was perceived by women as good for mother's health; that it improves family economic situation; increases provisions to each child; brings family happiness; and offered a chance for mother to work (Kalpeni and Zulu, 1993). Other women perceived indigenous contraception as against religion; harmful to the woman's health; required too much effort and costs; and a desire for large families (Kalpeni and Zulu, 1993). Netshikweta (2007) identified lack of knowledge, incorrect perceptions and negative attitudes as some of the main barriers to utilization of contraception. Similarly, lack of knowledge, incorrect perceptions and negative attitudes among Batswana women could be some of the main barriers to utilization of indigenous contraception. Good knowledge accompanied by positive attitudes and perceptions towards safety, efficacy, quality, accessibility, and affordability of indigenous contraception can increase the use of indigenous contraception among the Batswana women in the North West, a province with high rate of unwanted pregnancies. The objective of this study was to establish women's knowledge, attitudes, and perceptions towards indigenous contraception among the people of Mafikeng local municipality as part of understanding the poor usage of indigenous contraception among Batswana.

4.2 METHODOLOGY

4.2.1 Research approach, paradigm and design

A quantitative research approach was followed in this study. Quantitative research can be defined as research that explains phenomena according to numerical data, which are analysed by means of mathematically-based methods, especially statistics (Yilmaz, 2013). From a broader perspective, it can be defined as a type of empirical research into a social phenomenon or human problem, testing a theory consisting of variables that are measured with numbers and analysed with statistics in order to determine if the theory explains or predicts phenomena of interest (Creswell, 1994; Gay and Airasian, 2000). This study was guided by a post-positivistic research paradigm. The post-positivist paradigm is concerned with the subjectivity of reality and moves away from the purely objective stance adopted by the logical positivists (Ryan, 2006). A cross-sectional survey was used to investigate the

knowledge, attitudes and perceptions of women towards indigenous contraception. Surveys that are carried out at a just one point in time are known as a cross-sectional in design (Mathers *et al.*, 2007), and describes a method of data collection in which questionnaires were delivered in person by the researcher to collect information on people's knowledge, opinions, perceptions, attitudes, and values (Burns and Grove 2001; Polit and Hungler, 1999).

4.2.2 Target population

The target population for this study included all women in Mafikeng local municipality. According to Stats SA (2016), the population of women in Mafikeng local municipality is 161 300. Women were targeted for this study because in most relationships in South Africa, it is women that bear the burden of contraception. The inclusion criteria for participation were women in Mafikeng aged 20 years or older and live in Mafikeng. Women aged 20 years or older were included in this study because majority were accessible, had reached or were beyond reproductive stage, and were either aware, engaging or had engaged in sexual and contraceptive practices. The population (N) for this study was 101 495 (Stats SA, 2016).

4.2.3 Sample size and sampling procedure

A sample size of three hundred and eighty three women from a population of 101 495 was determined using a *Raosoft calculator* (Mokwena and Bogale, 2017). Three hundred and eighty three (383) women from the study population were sampled using a stratified probability sampling technique. Stratified sampling is only possible when we know what proportion of the study population belongs to each group we are interested (WHO, 2004). The sample was stratified according to women's age (20-29; 30-39; 40-49; 50-59; and 60+) because the proportion of the study population belonging to each age group of women in Mafikeng was known. An advantage of stratified sampling is that it is possible to take a relatively large sample from a small group in the study population (WHO, 2004). This makes it possible to get a sample that is big enough to enable researchers to draw valid conclusions about a relatively small group without having to collect an unnecessarily large and hence expensive sample (WHO, 2004).

4.2.4 Data collection tools

A structured research questionnaire written in vernacular was used as a data collection tool in this study. (Appendix H). The research questionnaire consisted of four sections that included sections A; B; C and D. Section A investigated women's knowledge regarding indigenous

contraception using multiple-choice questions, whilst sections B and C investigated their attitudes and perceptions respectively using a 5-point Likert scale. The last section of the questionnaire requested women to provide their demographic information. The research questionnaire consisted of 18 items with closed ended questions based on the four themes discussed in the previous chapter. The Likert scale is one of the most commonly used psychometric scales for examining self-reported perceptions and attitudes.

4.2.5 Data collection methods

Data was collected from May 3, 2017 to July 6, 2017 by requesting participants to complete the research questionnaire. All research questionnaires were distributed by the researcher and administered face to face to participants. Participants completed most of the questionnaires in the presence of the researcher, whilst few were collected hours and even days after completion.

4.2.6 Data analysis

Data analysis in quantitative studies is conducted to reduce, organize, and give meaning to the data to address the research objectives (Burns and Grove, 2003). Before data analysis, the researcher arranged the questionnaires chronologically and went through each questionnaire again to verify that it was correctly completed. The raw data from the research was recorded on an Excel program 2016 version the same day after the questionnaires were administered. Data from the Excel spreadsheet was imported into the IBM-Statistical Package for Social Science (SPSS version 24.0) data sheet for statistical analysis. Additional data cleaning was done on SPSS through frequency analysis to detect errors such as missing values and wrong coding. Descriptive statistics was considered most appropriate for analyzing data because the study explored the knowledge, attitudes and perceptions. The possible associations between dependent (knowledge, attitudes and perceptions) and independent variables (demographic characteristics) were determined using Pearson's *Chi-square* (χ^2) test of independence. For statistical significance, P-value < 0.05 was considered in all cases.

4.2.7 Validity and trustworthiness of the study

The research questionnaire was validated by conducting a pilot study before the data collection. The pilot study was conducted among Setswana speaking African female students and staff at the NWU Potchefstroom campus in January 2019. The Potchefstroom campus of NWU belongs to Dr Kenneth Kaunda district municipality. The respondents were asked to

complete the research questionnaire to the best of their knowledge and were further given time to scrutinise the questionnaire and make notes where necessary. Based on the pilot study, the research questionnaire had to be modified in terms of the quantity and quality of the research questions. It took respondents relatively long time to complete the research questionnaire. There were also complains from respondents that some questions lacked clarity. The number of questions was reduced from 30 to 18 to reduce time required for completion. In addition, questionnaire items were brief, readable, with clarity and comprehensiveness. All items in the questionnaire were derived from data obtained from literature and during in-depth interviews with traditional healers in Ngaka Modiri Molema district municipality to ensure its validity. Supervisors further evaluated the research questionnaire to ensure that it included the appropriate content and lacks ambiguity. The reliability of the study has already been discussed in section 3.2.7 measured by its credibility, transferability, dependability and confirmability Guba (1982).

4.3 RESULTS

4.3.1 Introduction

The results of this study are divided into four sub-sections, including demographic characteristics of participants in the study, knowledge regarding indigenous contraception ,attitudes towards indigenous contraception,, and perceptions regarding indigenous contraception among women in the study area.

4.3.2 Demographic characteristics of participants in the study

The demographic characteristics of participants in the study showed that almost 60% of women were between the ages of 20 and 39 years. Therefore, majority of women in this study were still within their reproductive age. Women aged 40 to 49 constituted 17% of the respondents, whilst 24% of the participants 50 years and above. Eleven percent (11%) and 13% of respondents were 50 to 59 years and 60 years and above respectively. Majority (56%) of women who participated in this study were single, followed by those who were married (33%). About 8% of participants were widows. Only 3% of women were divorcee. Approximately 26% of women in this study had no children, whilst 44% had one to three children. Approximately 5% of women had four to six children in this study. The percentage of women that had more than six children was like to that of women that had four to six children. About 4% of participants had no formal schooling, whilst 14% of women had

primary education. Approximately 45% of women had secondary education whilst 37% had higher education. Many of the respondents in this study, approximately 72% had either secondary or higher education. This high percentage of women that had secondary or higher education could also be attributed to high proportion of the youth in this study. About 57%, of the women in this study were unemployed, only 24% employed and 19% self-employed. The percentage of self-employed women (19%) was close to that of the employed (24%) (Table 4.1).

Table 4.1: Demographic characteristics of participants in the study (383 women)

Variables		Frequency	%
Age (in year)	60+	50	13
	50--59	41	11
	40--49	66	17
	30—39	92	24
	20--29	134	35
Marital status	Single	216	56
	Married	125	33
	Divorced	42	11
Number of children	0	100	26
	1--3	169	44
	4--6	94	25
	6+	20	5
Employment status	Unemployed	217	57
	Employed	92	24
	Self-employed	74	19

4.3.3 Knowledge regarding indigenous contraception among women in the study

Each participant knew at least one of the practices, taboos or techniques of indigenous contraception documented in chapter 4. However, women's knowledge regarding each practices of indigenous contraception was very poor. Results illustrate that the most known practice of indigenous contraception among the participants was birth spacing, 39.9% of the women, followed by taboos and virginity with 35.2% and 25.3% respectively. Women also knew all six taboos of indigenous contraception. The most known taboo of indigenous

contraception, known by majority of the women (51.7%) was birth taboo (no sex after birth), followed by menstruation taboo (44.4%) and abortion taboo (27.2%) respectively. The least known taboo was divorce taboo, which is known by only 7.6% of the women. Women also knew most of the techniques of indigenous contraception documented in this study. Abstinence was the most known technique of indigenous contraception (61.1%), followed by the use of medicinal plants (35.5%). The least known techniques were male waist and child burial techniques with 2.3% and 3.1% respectively. (Figure 4.1).

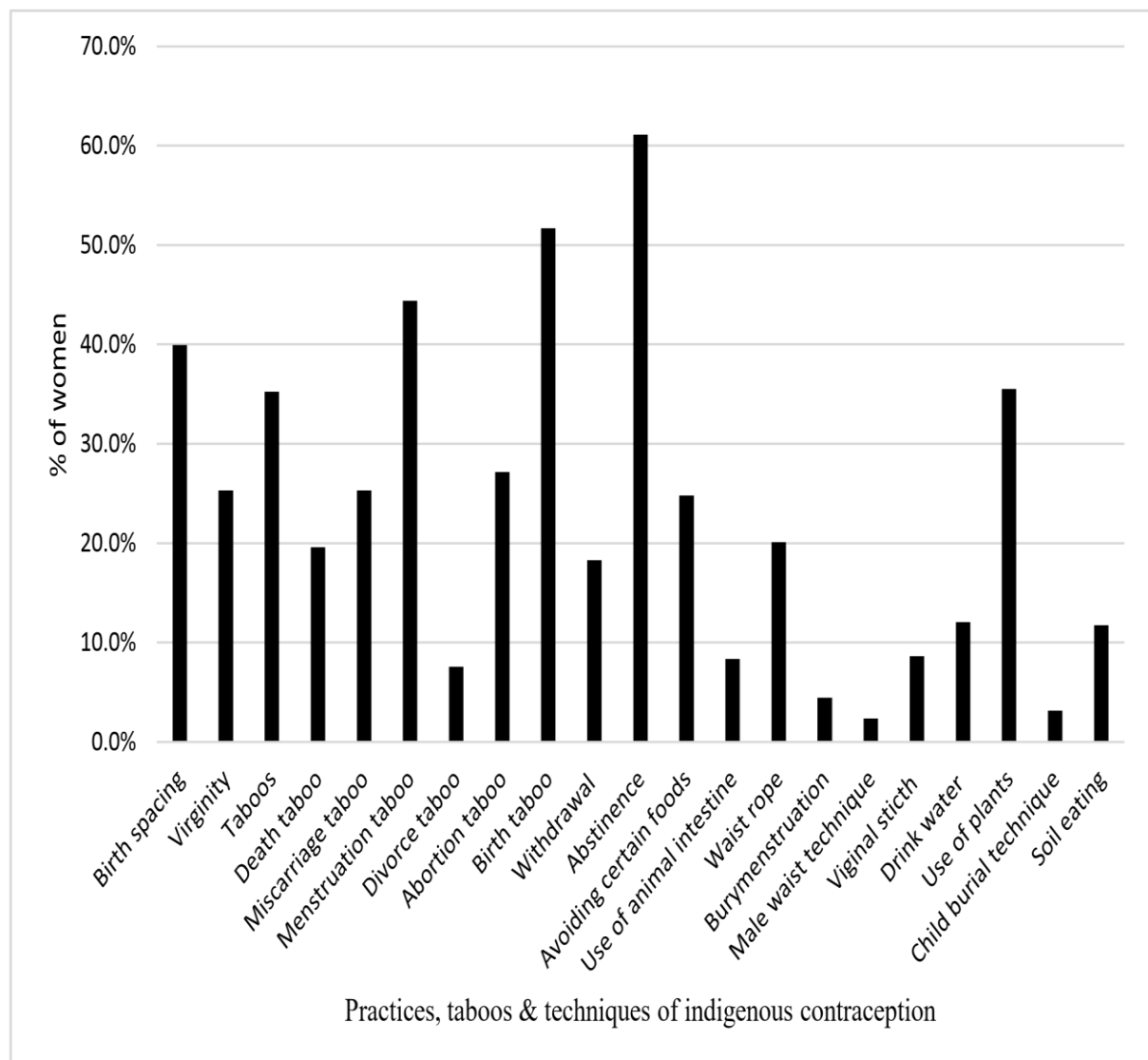


Figure 4.1: Knowledge concerning practices, taboos and techniques of indigenous contraception.

The most known aspect of indigenous contraception was abstinence, followed by birth taboo. The least known aspects of indigenous contraception were male waist and child burial techniques respectively. About 70.5% of women knew the roots as part of the plant used for contraception, followed by the leaves (28.7%) and seeds (7.8%). About 15% of women did not know part of the plant used for contraception. Only 9% of women knew medicinal plant(s) used for contraception, despite 35.5% knowing the technique of using medicinal plants for contraception. Results showed that the knowledge level of women regarding the specific medicinal plants used for contraception was very poor. Women's ethnobotanical knowledge of medicinal plants used for contraception was therefore very poor

4.3.4 Attitudes towards indigenous contraception among women in the study

The study showed that about 90% of the women aged 20-29 years strongly disagreed while 81.8% disagreed towards usage and documentation of indigenous contraception. The study further showed that about 66.7% strongly disagreed towards provision of indigenous contraception at clinics and 10.5% strongly disagreed towards teaching of indigenous contraception. About 43.3% of women, aged 20-29 years old agreed and 27.8% strongly agreed towards indigenous contraception being taught in schools. Women aged 20-29 years old therefore felt that indigenous contraception needed to be taught at schools before it is provided at clinics or used by the community. On the other hand, none of women aged 30-39 years old strongly disagreed towards documentation of indigenous contraception, whilst 13.6% strongly disagreed towards usage of indigenous contraception. About 47.4% of women aged 40-49 years old strongly disagreed towards teaching of indigenous contraception at schools. Only 4.5% of women aged 60 years and above strongly disagreed towards usage of indigenous contraception.. This figure is significantly lower when compared to that for women aged 20-29 years old (81.8%). None of women aged 50-59 years old strongly disagreed towards usage of indigenous contraception and documentation of indigenous contraception, including its usage at clinics or being taught at school. Results showed that women aged 20-49 years old had a negative attitude towards indigenous contraception compared to older women aged 50-60+ years old (Figure 4.2). Cross tabulations for illustrating associations between women' attitude towards indigenous contraception with age is in Appendix I.

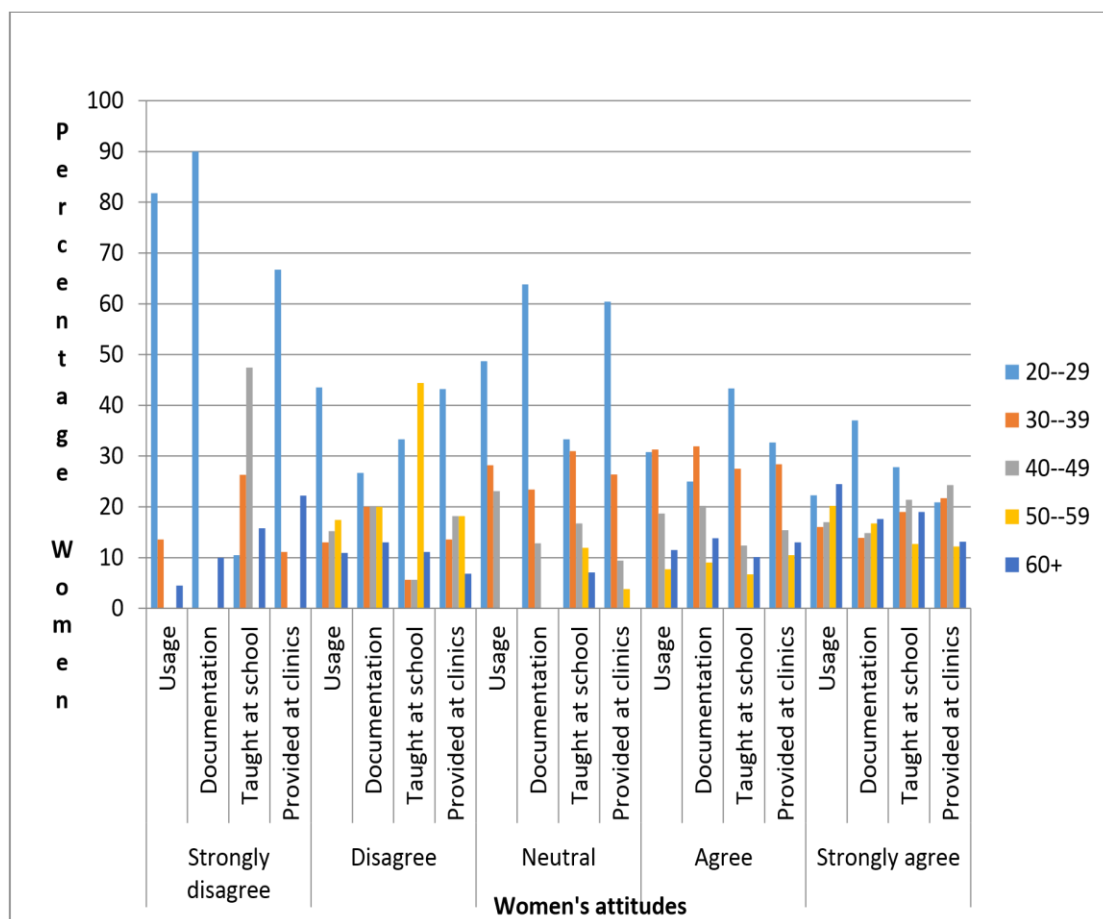


Figure 4.2: Women's attitudes towards indigenous contraception.

4.3.5 Perceptions regarding indigenous contraception among women in the study

In perception regarding indigenous contraception, 45.2% and 41.9% of women, aged 20-29 years had a very bad perception towards the safety and effectiveness of indigenous contraception respectively. Approximately 61.9% and 67.1% of these women (20-29 years old) had a bad perception about the safety and efficacy of indigenous contraception. The study showed that 28.2% and 22.9% of women aged 20-29 years old had a good perception about the safety and effectiveness of indigenous contraception respectively. Approximately 17% of these young women perceived the safety of indigenous contraception as very good, whilst none perceived its effectiveness as very good. Only 1.6% and 8.5% of women aged 60+ years old perceived the safety and effectiveness of indigenous contraception as bad respectively. Majority (57.1%) of women aged 40-49 years old perceived the effectiveness of indigenous contraception as very good, whilst 34% perceived its safety as also good. However, only 4.5% and 31.3% had a very good perception towards the affordability and accessibility of indigenous contraception. Majority of women perceived indigenous contraception as very

accessible, whilst 37.5% perceived the affordability of indigenous contraception as very good (Figure 4.3). Therefore, results showed that majority of young women had a negative perception towards safety and effectiveness of indigenous contraception, with majority also perceiving indigenous contraception as very accessible.

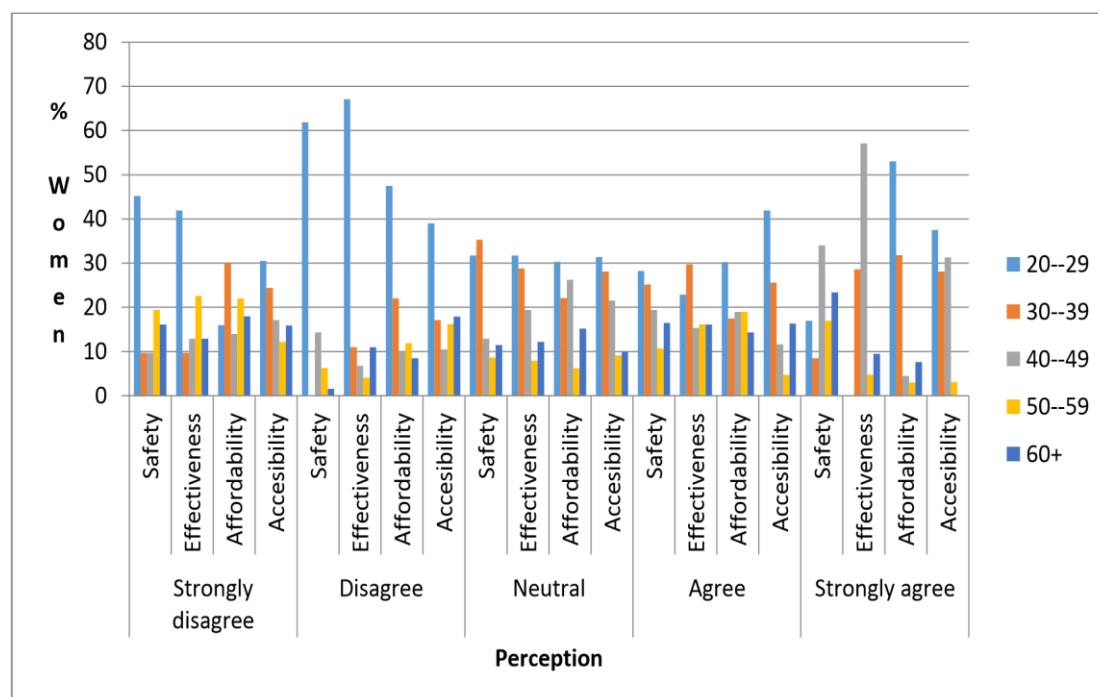


Figure 4.3: Perceptions of women towards indigenous contraception.

4.4 DISCUSSION

Indigenous contraception in this study is considered to consist of four aspects: practices, taboos, techniques and herbal contraception. Knowledge regarding indigenous contraception must therefore be based on all four aspects of indigenous contraception; practices, taboos, techniques and herbal contraception. Three practices of indigenous contraception among the Batswana were documented in the previous chapter as virginity, birth spacing and taboos. Women's knowledge regarding the three contraceptive practices was investigated. Results show that all three practices were known among women in Mafikeng, which was good. However, less than 50% of women knew each practice. It is not surprising that the practice of birth spacing was the most known of the three practices. According to Bertrand *et al.* (1983), a major theme in African indigenous contraception is the nearly universal practice of birth spacing among traditional societies in Africa. Long before the influx of Western ideas, the importance of child spacing to maternal and infant health was widespread among African cultures (Waife, 1978). The percentage of women in this study that knew birth spacing was

far less than that found in Nigeria, where majority of the women were noted for reported use of traditional contraceptive for child-spacing (Jinadu *et al.*, 1997).

Schapera (1994) reported the use of birth spacing among the Batswana of Botswana. It is said that if a woman becomes pregnant again while still weaning a child (which may take two or three years), the child at her breast will become foolish or sickly or suffer in some other ways. A child thus afflicted is known as *serathane*, which is also derogatory (Schapera, 1994). Mothiba *et al.* (2012) also reported birth spacing as one of the indigenous practices in Limpopo province, South Africa. In Zimbabwe, the roots of the Mukina tree (what is the scientific name of the tree?) are grounded and soaked in water, and thereafter taken every day by women for child spacing (Jaravaza, 2013). Ashes of maize cobs are collected and mixed with hot water in a sieve, the liquid is then drunk everyday by women to aid in child spacing (Jaravaza, 2013).

The actual period for birth spacing varies from as little as two to three months to well over three years, depending on the culture (Bertrand *et al.*, 1983). A very small percentage of women in this study knew the required time for birth spacing as six months. The percentage of women who knew the time required for birth spacing as one or two years was also very low, with majority of women knowing three to five years as the required period for a woman to take before the next pregnancy. These findings were consistent and in line with the observation by du Pradal (1983) and Jinadu *et al.* (1997), who observed that a period of two years or more of contraception after childbirth was traditionally encouraged in Africa.

The practice of virginity is not restricted to the Batswana only in South Africa. A study on indigenous contraception in KwaZulu-Natal, South Africa, showed that virginity testing (*ukuhlolwa kwezintombi*) is one of indigenous techniques used mostly in rural areas to prevent teenage pregnancy (Shange, 2012). Maturity examination is also one other method used by the Zulus to prevent pregnancy (Mothiba *et al.*, 2012). This practice is usually conducted by grandmothers who ask girls to show their bottoms as a symbol of being proud of being virgins" (Mothiba *et al.*, 2012). The second most known contraceptive practice among women in this study was the practice of taboos. In this study, all six taboos of indigenous contraception among the Batswana were known among women. The most known contraceptive taboo in this study was "birth taboo" (no sex after birth). This is known by about 51.7% of women. The least known contraceptive taboo was divorce taboo (no sex after divorce). Nevertheless, since more women knew about taboos than virginity, it shows the

importance of these taboos among the Batswana as a practice for indigenous contraception. In this study, all twelve techniques of indigenous contraception documented were known among women. Ntozi and Kabera (1991) found that minority of women in Uganda knew the use of medicinal plants for contraception. In this study also, few women knew that medicinal plants are used for contraception. The results for knowledge regarding the use of medicinal plants in both cases are almost similar. In Uganda, nearly half of the participants knew abstinence and withdrawal (Ntozi and Kabera, 1991).

In this study, abstinence was the most known technique of contraception among women, with withdrawal and waist rope the least known techniques respectively. Abstinence was the most known technique because than the waist rope because it is a natural technique. The literature showed that natural techniques of indigenous contraception are more common among women than traditional techniques. The reason is that most natural techniques are cost free, and can be applied from home without a need for a healer's presence. Abstinence is also mostly known because it forms part of western contraception. The percentage of women that knew withdrawal technique in this study was too small when compared to that of women in Nigeria that knew the technique of withdrawal (Ajayi *et al.*, 2018). The reason why abstinence is so much known in South Africa could be that abstinence is also encouraged and promoted from a modern (western) perspective of contraception, especially among the teenagers.

The least known technique of indigenous contraception was the male waist technique. These results can be expected since the technique of male waist has rarely been mentioned in literature. Results seemed to suggest that natural techniques are better known than traditional techniques. The reason why natural techniques are more known than traditional techniques could be that natural techniques are self-regulatory, i.e. a woman can use these techniques without a need for assistance or intervention from a traditional healer. In contrast, traditional techniques of indigenous contraception, such as male waist technique, burying of menstruation, child burial technique, each known by less than 5% of women because each need the intervention of a traditional healer, and one with expertise on indigenous contraception.

The results of this study have shown that a small percentage (%) of women strongly agreed to the use of indigenous contraception by the community. The attitude of women towards the usage of indigenous contraception was almost similar to their attitude towards documentation

of indigenous contraception, whereby almost half of participants agreed and less percentage strongly agreed for documentation of indigenous contraception. Very few women disagreed or strongly disagreed towards documentation of indigenous contraception. Therefore, more women were positive about usage and documentation of indigenous contraception. The same observation is made for provision of indigenous contraception at clinics and for indigenous contraception to be taught at school. Women had a positive attitude towards indigenous contraception. Results show that the mean attitude scores for documentation and teaching of indigenous contraception at schools were higher than attitude scores for usage and provision at clinics. More women wanted indigenous contraception to be taught at school and be documented, than it be used by the communities and be provided at clinics. The percentage of women that had a bad or very bad perception towards the safety of indigenous contraception was less than that of women that had a neutral, good or very good perception towards the safety of indigenous contraception. The percentage of women that were neutral regarding the safety of indigenous contraception was higher than women who perceived it as bad or very bad. In addition, more women perceived the safety of indigenous contraception as good as those that perceived it as bad. This was however less than the percentage of women that was neutral regarding the safety of indigenous contraception. The percentage of young women that perceived the safety of indigenous contraception as bad or very bad was higher than older women. However, the percentage of older women that perceived the safety of indigenous contraception good or very good was higher than those younger women. Older women perceived the safety of indigenous contraception favourably than their younger counterparts. A relationship between the perception towards the safety of indigenous contraception and age was established, and this relationship was tested to be statistically significant.

The efficacy of herbal contraceptives was investigated by means of a questionnaire administered on the traditional health practitioners. All respondents agreed that the herbal contraceptives were effective and that they had no side effects (Bablola, 2009). Older women perceived the accessibility of medicinal plants as very good and few perceived it as bad or very bad. The WHO (2016) has long promoted a human rights-based view of the importance of access to sexual and reproductive health (SRH) care, this include a reliable method for managing the spacing of children. It normally requires transport to go and collect medicinal plants for contraception since most are not homegrown. As such, elderly woman would find such a task more difficult hence; the elderly had a bad perception towards accessibility of medicinal plants used for contraception.

Young women (20-29 years) in Mafikeng had a perception that medicinal plants used for indigenous contraception was inaccessible. In fact, the percentage of women who were neutral regarding indigenous contraception was higher than the women that perceived indigenous contraception as good or very good and bad or very bad.

4.5 CONCLUSION

There is a need for women empowerment workshops and seminars on indigenous methods of family planning, contraception and birth control to increase awareness regarding other techniques of indigenous contraception beside abstinence. The safety and efficacy of these techniques need to be clarified, particular for traditional techniques. Awareness campaigns regarding indigenous contraception will assist in the improvement of women's attitudes and perceptions towards indigenous contraception. It is therefore crucial that indigenous contraception be included as part of curriculum development as well as be taught and eventually provided at western health care facilities. The next chapter evaluated the cytotoxicity and acute oral toxicity of the herbal mixture used for contraception among the Batswana to assess its safety.

CHAPTER 5: CYTOTOXICITY AND ACUTE ORAL TOXICITY OF THE HERBAL MIXTURE USED FOR CONTRACEPTION BY BATSWANA

5.1 INTRODUCTION

South Africa has a large floral biodiversity and is home to over 30,000 species of higher plants with 3 000 of these used in traditional medicine across the country (Van Wyk *et al.*, 1997). The literature and in-depth interviews in this study showed that herbal mixtures played a significant part of indigenous contraception among the Batswana of Ngaka Modiri Molema district municipality (NMMDM). Herbal mixtures are concoctions of two or more plant species with the same or different medicinal uses (Cano and Volpato, 2004). The main aim of making these herbal mixtures seems to be increasing the therapeutic capacity of a herbal product by mixing plant species of common or different uses (Cano and Volpato, 2004).

Plants commonly used in traditional medicine are assumed to be safe due to their long usage in the treatment of diseases (Otang *et al.*, 2012). However, research has shown that a significant proportion of the purported “safe plants” have *in vitro* mutagenic or toxic and carcinogenic properties (Ajaiyeoba *et al.*, 2006). Based on existing literature, some of the medicinal plants used for contraception in South Africa are poisonous and could be lethal (Wink and Van Wyk, 2008). For example, *D. dregeana* have been reported to be poisonous to humans and monkeys (Wink and Van Wyk, 2008). To assume that crude plant extracts or natural products are safe for use could be misleading and dangerous (Makhafola *et al.*, 2012). It is therefore imperative that initiatives be put in place in all countries using traditional medicine, including African countries, to provided capabilities for safety, efficacy, and quality evaluation of these herbal medicine (Gadaga and Tagwireyi, 2014).

The strategy by WHO (2002) was to promote the safety, efficacy and quality of traditional medicine by expanding the knowledge base of these remedies. This led to the establishment of the Traditional Health Practitioners Act no 22 of 2007 for improving the safety, efficacy, and quality of traditional medicine in South Africa through collaboration between traditional health practitioners (THPs) and western health practitioners (WHPs). South Africa is one of the few countries that have made an effort to carry out research based on WHO guidelines on the safety and efficacy of herbal medicines (Gadaga and Tagwireyi, 2014). However, only

four medicinal plants used for contraception in South Africa have been investigated for toxicity. Furthermore, no published evidence relating to toxicity of medicinal plants used for contraception in the study area could be found. The toxicity and adverse effects of African medicinal plants in use may arise due to inherent poisonous phytochemicals, adulteration of the medicines, contamination with various chemicals and heavy metals, herb-herb interactions, and poor quality control of herbal products (Jordan *et al.*, 2010).

Toxicity refers to the detrimental effect on whole organism, such as an animal (acute; chronic; sub-acute; sub-chronic etc.), bacterium, or plant, as well as the effect on a substructure of the organism, such as a cell (cytotoxicity) or an organ (organ toxicity), such as the liver hepatotoxicity (Auwal *et al.*, 2012). Cytotoxicity was selected for this study over other *in vitro* toxicity studies because of its relative speed, reduced cost and potential for automation (Aslanturk, 2017). Cytotoxicity studies are useful initial step in determining the potential toxicity of a test substance, including plant extracts or biologically active compounds isolated from plants (McGaw *et al.*, 2014). Cytotoxicity can be assessed using dye exclusion, colorimetric assays, fluorometric assays, and luminometric assays (Auwal *et al.*, 2012). The MTT colorimetric assay was selected for this study because it is easy to use, safe, and has a high reproducibility (Aslanturk, 2017). There are different types of *in vivo* (animal) toxicity studies, including acute, sub-acute, chronic, sub-chronic, chronic, carcinogenicity testing, two-generation reproduction, toxic kinetics, genetic, and developmental toxicity studies (Parasuraman, 2014).

The acute oral toxicity study was selected because it is quick, cost less and provides a guideline for selecting doses for the sub-acute, chronic and efficacy studies (Janbaz *et al.*, 2002; Hasumura *et al.*, 2004). Acute toxicity refers to those adverse effects occurring following oral administration of a single dose of a substance, or multiple doses given within 24 hours (OECD, 2001). Over the years, acute toxicity testing has been taken to be synonymous with the lethal dose, yet the LD₅₀ is only one of many indices used in defining acute toxicity. The median lethal dose (LD₅₀) of a substance is the amount required to kill 50% of a given test population of living organisms (Gadaga and Tagwireyi, 2014). The determination of LD₅₀ with 95% confidence limit has been described as wasteful in terms of number of animals sacrificed, and it does not take into account toxic effects that do not result in death but are nonetheless serious (Gadaga and Tagwireyi, 2014).

Standard guidelines for the conduct of animal (*in vivo*) toxicity tests have been harmonized by the Organization for Economic Cooperation and Development (OECD) as part of continuous efforts to internationally harmonize toxicity test guidelines (OECD, 2001). A number of other methods that use fewer animals as alternatives to estimate the acute lethal dose have been developed over the years, and include the OECD 423 or also referred to as acute toxic class (ATC) method. The ATC method emphasizes humane treatment of animals undergoing testing and utilizes morbidity, pain and suffering as endpoint other than mortality as its determining point (Huggins, 2003). The objective of the study was to investigate the cytotoxicity and acute oral toxicity of the herbal mixture in order to determine its safety, and form a basis for herbal concentrations in the efficacy study.

5.2 MATERIALS AND METHODS

5.2.1 Selection criteria for herbal mixture

It was discussed in chapter 4 that traditional healers in Ngaka Modiri Molema district municipality administered 11 herbal contraceptives, as individual species and/or as herbal mixtures. Not every individual species or herbal mixture identified in this study could be investigated. Consequently, a criterion was required to select one individual species or herbal mixture for safety test. The criteria were based on the following conditions: the plant or herbal mixture had to be known by most healers (highest frequency of mention), be orally administered, be locally available, and each individual plant be known by Setswana language. The herbal mixture mentioned in Chapter 4, are *Helichrysum caespititium*, the roots of *Teucrium trifidum* and *Bulbine frutescens*. They met the criteria and was selected for experimental analysis. According to Alonso-Castro *et al.* (2012), it is common for traditional health practitioners to use herbal mixtures that comprise different plants. Fabricant and Farnsworth (2001) emphasised that, if the plant is selected on the basis of traditional uses then the extract need to be prepared as described by the traditional healer(s) in order to mimic as closely as possible, the traditional ‘herbal’ medicine.

5.2.2 Collection and preparation of plant materials for herbal mixture

The plant samples were collected in Ngaka Modiri Molema district municipality between August and September 2019. The participants requested that the specific plant collection sites should not be disclosed to the public. The leaves of *T. trifidum* were collected approximately

10 km outside of Mafikeng town whilst the roots of *B. frutescens* and the leaves of *H. caespititium* were collected in the Ditsobotla local district. All species were washed under a running tap water and shade-dried for approximately 3-4 weeks. Dried plant parts of each species were first cut into smaller pieces. The samples were thereafter pulverized to powder using a 1200 W power mechanical blender (Bennett Read, South Africa) (Plate 5.1A). A kitchen sieve with 1 mm pores was used to remove solids (Plate 5.1B).



Plates 5.1 A -F: The Apparatus used for extraction and lyophilisation of the herbal extract.

Approximately 35 g of each of the three powdered species was measured and each added in a beaker to form the herbal mixture. **About 100 g of dried and pulverized plant materials were placed in a glass beaker and 2 liter of distilled water added.** The mixture was heated until boiling point. The extract was allowed to cool and to settle overnight before being transferred into another beaker. The beaker was covered with a foil to prevent contamination of the extract. In the following day, a TD-600 Benchtop low speed centrifuge (Sichuan Shuke lab, China) was used to remove the solids remaining in the extract (Plate 5.1C). The extract was filtered using a vacuum filter (Plate 5.1D) and lyophilized using a ViTis AdVantage 2.0 BenchTop Freeze Dryer / Lyophilizer (United Scientific, USA) operated at temperatures ranging from -55°C to -85°C (Plate 5.1E). After 96 h, lyophilized plant material was stored in dry and tightly closed small glass containers for experimental analysis (Plate 5.1F).

5.2.3 *In vitro* cytotoxicity test based on MTT assay

The Vero cell line (African green monkey; kidney; normal; epithelial) frequently used to screen natural products were supplied by NWU, Potchefstroom. Briefly, cells at passages 1112 were seeded at 3 000 cells per well of a 96-well plate and incubated for 24 h in 5% CO₂ at 37°C, to adhere to the surface area. The cells were treated every 24 h at serial dilutions of concentration ranging between 5 ug/ml and 2000 µg/ml for a duration of 72 h before the cytotoxicity assay was initiated. The extract was dissolved in complete culture media at 2000 µg/ml, filtered through a 0.22 µm syringe filter, from which working solutions were prepared in complete culture medium prior to treatments. At the end of the incubation period, treated cells were rinsed twice with 100 µl phosphate buffered saline (PBS), and 200 µl MTT (3-(4,5-dimethylthiazol-2yl)-2,5-diphenyl tetrazolium bromide) solutions at a final concentration of 0.5 mg/ml was added to each well according to the standard operating procedure (SOP). Treated cultures were incubated for 4 h, after which excessive MTT solution was removed and discarded appropriately. Subsequently, 200 µl of DMSO was added to dissolve the water insoluble formazan and the plate was incubated for 1 h. Before measurement of absorbance, the plate was placed on the shaker for 15 min and absorbance was measured at 2 wavelengths, 560 nm cell signal and 630 nm background signal.

The assessment of the cytotoxicity of the herbal mixture used as contraceptive was done *in vitro* cell culture model, using the standard cell viability assay. The herbal mixture was tested on three technical repeats and two biological replicates. In addition, 0.2% Triton X-100 was used as the positive control. To measure the effect of TX-100, at the end of the experiment, untreated cells were rinsed following the same method as other experimental groups and exposed to TX-100 for 15 min prior to an addition of MTT solution. All MTT experiments were performed in six-fold (two biological repeats of three technical repeats each). Cell survival rate expressed relative to untreated cell control, was calculated according to the following equation (Patel *et al.*, 2009),

$$\text{Cell survival rate (\%)} = (\Delta \text{ Absorbance} - \Delta \text{ Blank} / \Delta \text{ Control} - \Delta \text{ Blank}) \times 100 \quad [1]$$

whereby,

$$\Delta \text{ Absorbance} = \text{Absorbance at 560 nm} - \text{Absorbance at 630 nm}$$

$$\Delta \text{ Blank} = \text{DMSO blank at 560 nm} - \text{DMSO blank 630 nm}$$

Δ Control = Untreated cells at 560 nm – Untreated cells at 630 nm

5.2.4 *In vivo* toxicity test using rat model

In this study, the preferred species and strain of rat used was *Rattus norvegicus* and a female Sprague-Dawley. The rats are relatively small, easily housed and maintained, and easily adapt well to new surroundings. Furthermore, rats are relatively inexpensive, generally mildtempered and docile, making them easy for researchers to handle. Scientists from a wide range of biomedical fields use rats as a model because of its close genetic and physiological similarities to humans. Literature surveys of conventional LD₅₀ tests show females are generally slightly more sensitive (Lipnick *et al.*, 1995). In addition, the female rat is the preferred animal for testing acute oral toxicity Laboratory conditions and treatment of the experimental rats followed OECD (2001). Healthy young adult nulliparous and non-pregnant rats (8-10 weeks) were randomly marked for identification and kept in cages for 5 days prior to dosing for them to acclimatize to the laboratory conditions The temperature in the experimental animal room was 22°C (+ 3°C) The relative humidity was at least 30% and not exceed 70%. Lighting was artificial, the sequence being 12 hours' light, 12 hours' dark. For feeding, conventional laboratory diets were used with an unlimited supply of drinking water.

Animals were group-caged by dose, but the number of animals per cage did not interfere with clear observations of each animal The OECD 423 (ATC) method was followed in this study to analyse the acute oral toxicity of the herbal mixture (Figure 5.2). The OECD 423 guidelines provide four different experimental procedures for evaluating acute oral toxicity according to sample starting concentrations (5, 50, 300 or 2000 mg/kg). The appropriate starting concentrations for this study were determined by mathematical manipulation of results based on the cytotoxicity test. The cytotoxicity results showed that 755.2 µg/ml of the herbal mixture was toxic to cells. The equivalent dose level for acute oral toxicity for this study was therefore 755.2 mg/kg. The required starting dose for acute oral toxicity investigation in this study was therefore 2000 mg/kg. The maximum volume of liquid administered was 2 ml/100 g body weight (OECD, 2001). An aqueous solution was chosen because the use of an aqueous solution/suspension/emulsion is recommended wherever possible, followed in order of preference by a solution/suspension/emulsion in oil (e.g. corn oil) and then possibly solution in other vehicles (OECD, 2001).

Doses were prepared shortly prior to administration because the stability of the preparation over the period during which it will be used was unknown. Mean amount of the herbal

mixture required per body mass (BM) was 394.6 mg x 4 doses to provide for spills, which amounted to 1579.84 mg. A mean dose volume of 3.95 ml was administered by oral gavage. Thus, 1579.8 mg of the sample was measured, and gradually added deionised water until fully dissolved in a maximum volume of 16 ml. The concentration was therefore 98.74 mg/ml (1579.84 mg/16 ml). The details for the acute toxicity study have been attached (Appendix I). Rats were fasted prior to dosing with food but not water withheld over-night. Following the period of fasting, the animals were weighed and the herbal mixture administered. The test substance was administered in a single dose orally using a suitable intubation canula. After the herbal mixture has been administered, food was withheld for a further 3-4 hours (OECD, 2001). Food was supplied approximately three to four hours after herbal administration. The desired concentrations for this experimental study were based on results of acute oral toxicity.

The weight measurements of the rats played a critical role as part of data collection as an indicator for morbidity, or pain. A 10% loss in body weight is considered critical and indicates the toxicity of the test substance. The weight of each rat was measured after 30 minutes, 2 hr and 3 hr after the herbal mixture was administered. All observations were systematically recorded with individual records being maintained for each animal. At the end of the test, surviving animals were also weighed and humanely killed (OECD, 2001). Clinical indicators were observed for each animal. (Addendum 31) using the DST/NWU Preclinical Drug Development Platform (PCDDP) severity index for clinical signs, which assign values to each clinical indicator depending on the severity of the indicator. The starting dose for this study was 2000 mg/kg. (Figure 5.2).

5.2.5 Data analysis

The relative percentage viable cells were calculated and were expressed as percentage cell viability relative to the untreated control (assumed 100% viable). The 50% cell viability lethal concentration (LC50), relative to the untreated control (presumed to be 100% viable) was calculated via probit analysis. SPSS statistical analysis software (IBM Analytics, Version 25), in conjunction with the Probit Analysis Method, were used to calculate LC50 (50% viability) values and 95% confidence limit ranges from the MTT analyses.

Data for acute oral toxicity was analysed based on the changes in weight and clinical indicators. Percentages in body weight (BW) loss for each rat was calculated and compared to the 10% threshold. Morbidity and mortality were measured using a severity index that

allocates scores (0-3) for each of the 20 observed clinical indicators. Data was further analysed according to Global Harmonised Classification System (GHS) (OECD, 2001).

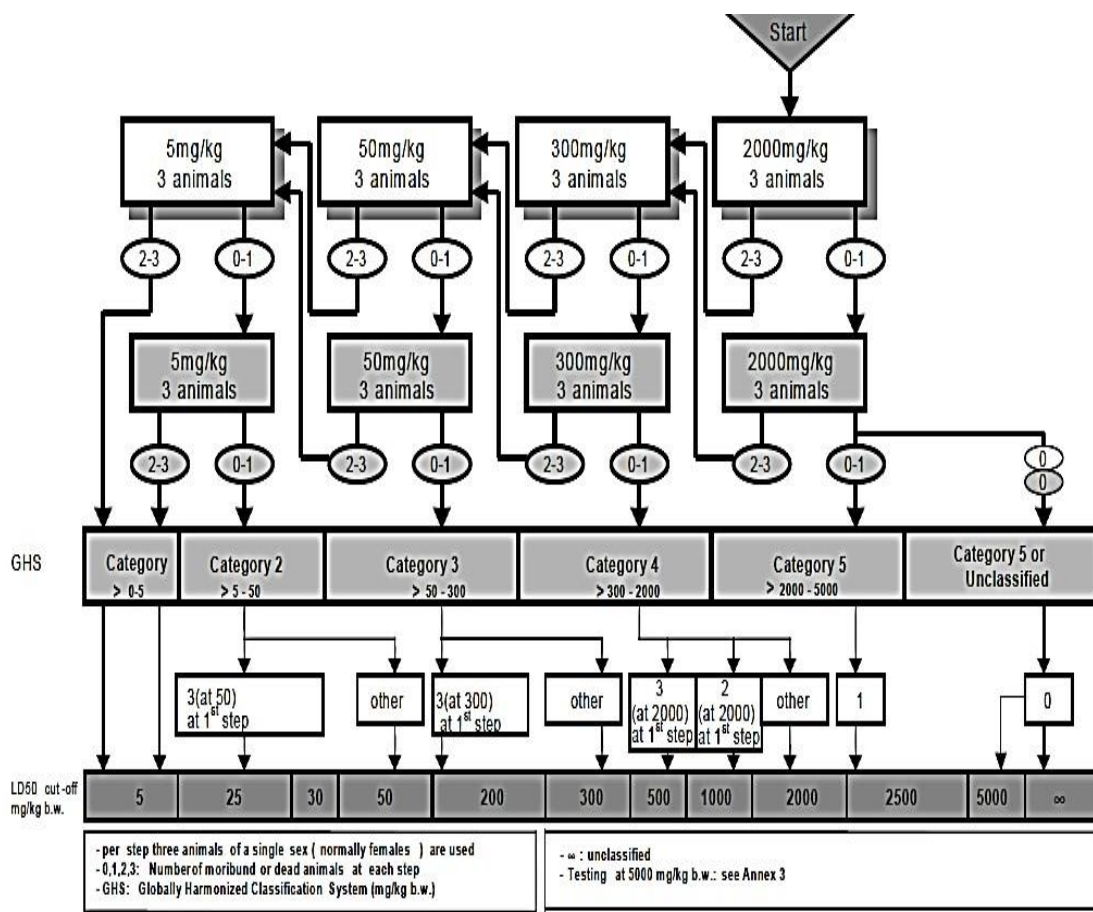


Figure 5.2: Experimental procedure of acute oral toxicity study.

The GHS use the concentrations that cause mortality to categorise the substance from category 1 to category 5. Finally, data was analysed by interpreting the LD₅₀ cut-off for the herbal mixture based on the GHS category (OECD, 2001).

5.2.6 Ethical considerations

The North-West University Animal Care and Health Research Ethics Committee (NWUAnimCareREC) issued an ethics approval letter to conduct research on animals (page iii). All *in vivo* experiments took place at the NWU vivarium managed by DST-NWU Preclinical Drug Discovery and Development Platform (PCDDDP) and registered with the South African National Accreditation System (SANAS) and South African Veterinary Council (SAVC). (Appendix J).

5.3 RESULTS

5.3.1 The cytotoxicity of the herbal mixture

The effect on cell survival percentage following treatment of Vero cells with different concentrations of the herbal mixture has been attached as part of supporting data for toxicity study as Appendix I. The herbal mixture demonstrated a dose-dependent response with an increase in cytotoxicity as the concentration of the herbal mixture increased. The inhibitory concentration (IC_{50}) value of the herbal mixture on Vero cells in this study was found to be 755.2 $\mu\text{g/ml}$. According to the American National Cancer Institute (NCI) guidelines, a substance is considered toxic if its IC_{50} is less than 30 $\mu\text{g/ml}$ after an exposure time of 72 h (Suffness and Pezzuto, 1990). The IC_{50} value of 755.2 $\mu\text{g/ml}$ determined for the herbal mixture is therefore higher than the NCI's threshold IC_{50} value of 30 $\mu\text{g/ml}$. Based on these findings, that the cytotoxicity of the herbal mixture is less than the threshold placed by the NCI, the herbal mixture can be considered to be safe. These findings are in line with the assurance made by traditional healers during interviews that the herbal mixture was safe. A report summarising methods and results for the cytotoxicity study has been attached. (Appendix K).

5.3.2 The acute oral toxicity of the herbal mixture

The first 3-4 hours after administration of the sample are considered most important for acute toxicity studies (OECD, 2002). The body weight of all three animals decreased during the first three hours after herbal administration. (Figure 5.3).

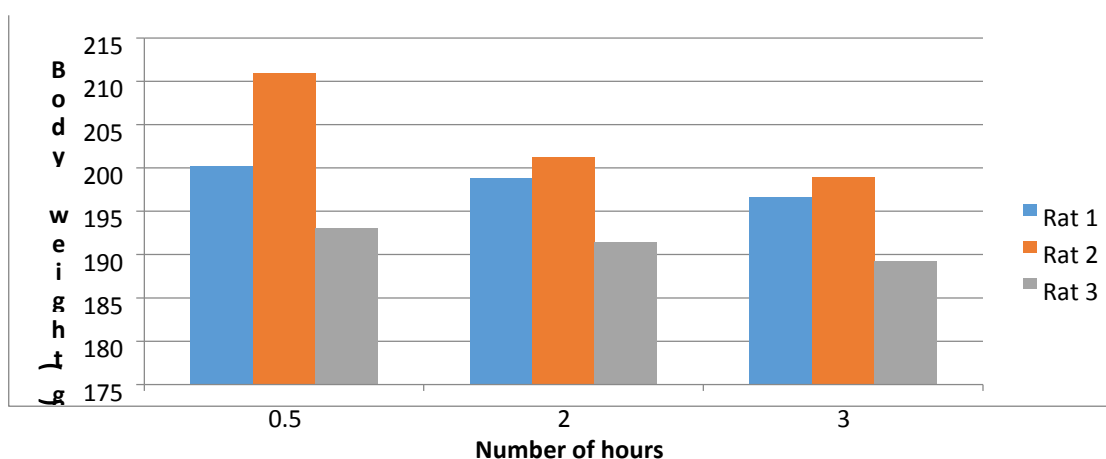


Figure 5.3: Changes in body weight in the first 3 h after oral administration of the herbal extract.

After 2 h of herbal administration, the percentage in loss in body weight of animals was on average of 2.07%, whilst the percentage loss in body weight after 3 h was 3.17 % on average. However, only one rat showed vocalisation when handled within the first 2 h after herbal administration. After 3 h of herbal administration, the weight of the rats decreased further by an average of 3.0 % and all rats showed vocalization when handled. The body weight loss of less than 10% threshold was considered critical in this study. (Figure 5.4).

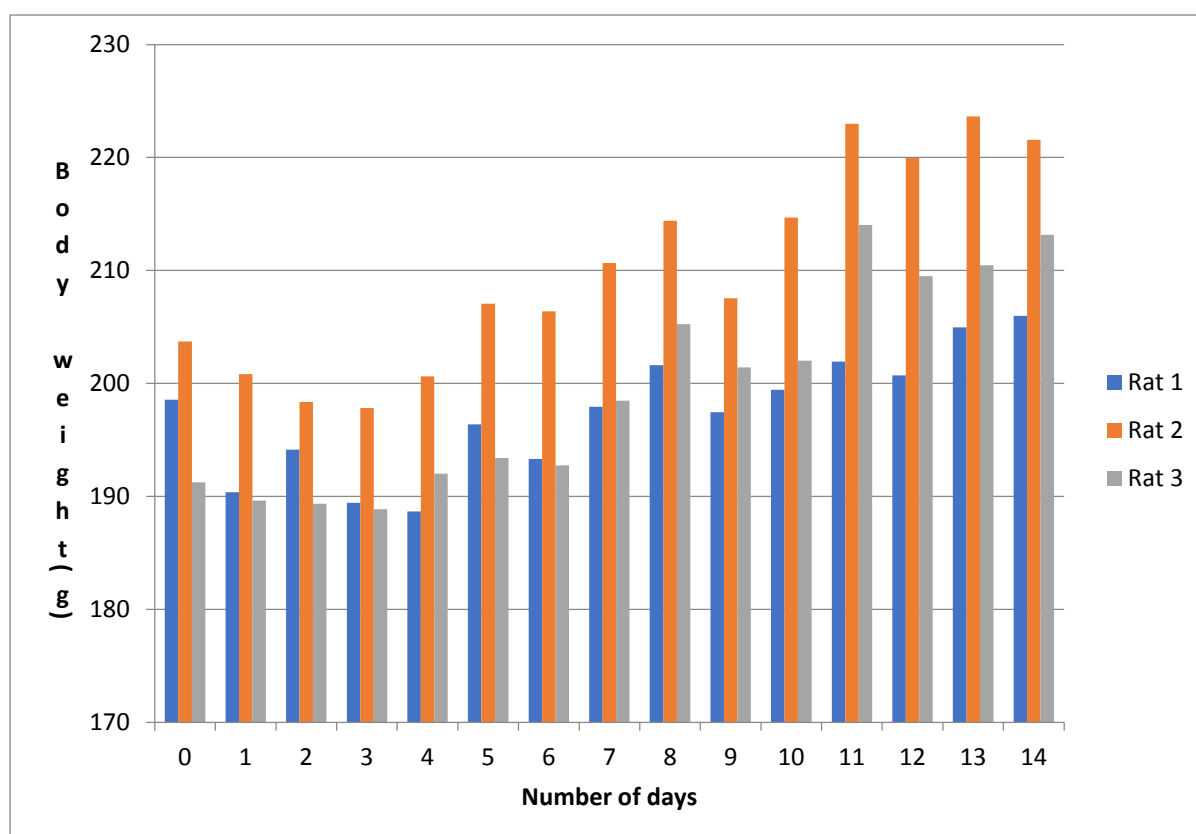


Figure 5.4: Changes in body weight in 14 days after oral administration of the herbal extract.

In addition, and more importantly, no morbidity or mortality observed in all rats within the first three hours after administration of the herbal mixture. Animals were observed daily for the next 14 days and the weight of each animal measured. (Figure 5.4). The percentages in loss of body weight for each rat during the 14 days were calculated. Results show that after day 1, the percentage loss in body weight was approximately 2.51% on average. However, after day 2 of the herbal administration, the body weight of all three animals started to increase. However, only rat 1 lost weight during day 4 whilst the weight of rat 2 and rat 3 increased. All three animals gained on average about 2.78% body weight during day 5, but the bodyweight of animals suddenly decreased by approximately 0.82% on average during day 6. The weight for all three animals increased during days seven and eight, but decreased

during day nine. The weight of each rat increased during day 10 and day 11 but again, decreased during day twelve. The weight of the rats further increased again during day thirteen and continued to increase in day fourteen. In all cases and throughout the study, the percentage loss in body weight was far less than the 10% threshold.

More importantly, no mortality or morbidity was observed in any of the rats. This shows that the herbal mixture dose of 2000 mg/kg was safe when administered orally on female rats. The interpretation of the data using ATC method or procedure shows that the lethal dose (LD₅₀) of the aqueous extract of the herbal mixture is 2500 mg/kg and that the herbal mixture is a category 5 substance in terms of toxicity. A report summarising extract preparation and administration for acute oral toxicity study has been attached (Appendix L). A report summarising results for the acute toxicity study has also been attached (Appendix M).

5.4 DISCUSSION

Gertsch (2009) argues that *in vitro* bioassays of biological extracts that possess IC₅₀ values greater than 200 µg/ml are not considered meaningful, as it is unlikely that such concentrations will be reached *in vivo* because high concentrations of plant extracts will significantly have an impact on the cell viability independent of the extract itself leading to artificial toxicity. Depending on the dosage and duration of treatment, the cytotoxic effects of the herbal mixture may be considered relatively weak (but not entirely absent) and less of a toxicity risk (Otang-Mbeng *et al.*, 2014). Mamabolo *et al.* (2018) investigated the cytotoxicity (MTT assay) of *H caespititium*, one of the species that formed the herbal mixture and found the cytotoxicity of its extracts to be 428.77 µg/ml (Hexane extract), 82.86 µg/ml (Dichloromethane extract), 357.39 µg/ml (Methanol extract) and 394.36 µg/ml (water extract) (Mamabolo *et al.*, 2018).

Different studies have also been conducted to determine the cytotoxicity of medicinal plants used for contraception in South Africa. The IC₅₀ of *Cordia monoica* and *Garcinia livingstonei* were determined to be 67.19 µg/ml and 105.9 µg/ml respectively (Dhiya *et al.*, 2018; Komolafe, 2014). In addition, results showed that the ethanol extract of *Securidaca longipedunculata* significantly ($p < 0.01$) inhibited proliferation of U87 cell line with an IC₅₀ of 20.535 µg/ml (Ngulde *et al.*, 2019). The cytotoxic effect of *Withania somnifera* crude water extract was evaluated on human malignant melanoma cells, A375 (Halder *et al.*, 2015). The MTT assay found a significant reduction of cell viability in case of treated cells (for 24,

48 and 72h) as compared to that of the control or vehicle treated cells (Halder *et al.*, 2015). The calculated IC₅₀ value for 24 h was 350 µg/ml, for 48 h was 250 µg/ml and for 72 h was 200 µg/ml (Halder *et al.*, 2015). Similarly, few studies have been conducted to determine the acute toxicity of medicinal plants used for contraception in South Africa. For example, no behavioral changes and no mortalities in all control and treated mice at doses 2000 and 4000 mg/kg body weight extract doses of *P. mixta* were observed during the investigation of acute toxicity in mice (Sewani-Rusike, 2013). In the same way, no behavioral changes and no mortalities were observed in all rats treated at doses 2000 mg/kg b.w of the herbal mixture in this study. The crude ethanol extract of *Salsola tuberculiformis* was a highly toxic extract in rats with an intraperitoneal lethal dose (LD₅₀) value of 14.14 mg/kg (Ngulde, 2013). Pharmacologically, a median lethal dose (LD₅₀) of 14.14 mg/ kg is an indication that the plant is toxic. The aqueous root bark extract of *S. longipedunculata* was slightly toxic to albino rats, and a lethal dose (LD₅₀) of 771 mg/kg was determined when the extract was administered orally to rats in two phases: as 10, 100, and 1000 mg/kg and as 250, 400, 600, 700, and 850 mg/kg. The lethal dose of 771 mg/kg illustrate that *Securidaca longipedunculata* is relatively comparable in more toxicity to that of the herbal mixture with LD₅₀ value of 2500 mg/kg. However, the limit dose of *S. longipedunculata* did not cause any mortality or signs of acute toxicity in any of the mice tested in the short-term (48 h) and long-term (14 days) observatory days (Etuk *et al.*, 2006). It is clear based on the lethal values determined from the listed studies that the herbal mixture is far safer than the other herbal contraceptives. No behavioral changes and mortalities were observed in all mice treated with 2000 and 4000 mg/kg of *Pouzolzia mixta* (Sewani-Rusike, 2013).

5.5 CONCLUSION

This study showed that the herbal mixture used for contraception among the Batswana of Ngaka Modiri Molema district was safe when taken orally. The conclusion that the herbal mixture is from a scientific analysis and context, is in line with the asurity made by traditional health practionners regarding the safety of herbal mixture when taken oral for contraception. However, the cytotoxicity of the herbal mixture increased with increase in concentration, which can imply some toxicty at higher concentrations. Therefore, consultation with traditional health practitioners is critical. The next chapter assessed the phytochemical composition of the herbal mixture and determined its contraceptive efficacy.

CHAPTER 6: PHYTOCHEMICAL ANALYSIS AND CONTRACEPTIVE EFFICACY OF THE HERBAL MIXTURE USED FOR CONTRACEPTION BY BATSWANA

6.1 INTRODUCTION

Information on the phytochemistry of herbal contraceptives is critical for identification, isolation, characterization of bioactive phytocompounds and more importantly for discovering the actual significance of folkloric remedies (Nandagopalan, 2015). “Phytochemicals” are used interchangeably with phytocompounds to refer to any chemical compound derived from plant or plant extract. Bioactive compounds are phytochemicals with biological activity (Guaadaqui *et al.*, 2014). Bioactive phytocompounds include alkaloids, glycosides, phenolic compounds, steroids, and terpenoid derivatives (Kadam, 2018).

Phenolic compounds are well known as important bioactive agents that have long create interest in researchers due to their benefits for human health, curing and preventing many diseases (Tungmunthum *et al.*, 2018). Some of the bioactive phytocompounds induce contraception by suppressing various hormones that are responsible for the regulation of the reproductive cycle in humans and animals (Bala *et al.*, 2014). For example, alkaloids are one of the bioactive phytocompounds responsible for altering the reproductive system in humans and animals (Bala *et al.*, 2014). Swart *et al.* (2003) identified the active substances in *Salsola tuberculatifomis* that involved in contraception and the prolonged gestation observed in Karakul sheep. The chemicals in the plant were isolated by solvent partitioning and decomposed under acidic conditions to yield three compounds that included 4-hydroxyacetophenone (1(4-hydroxyphenyl)-ethanone), 4-hydroxy-3-methoxyacetophenone, (1-(4-hydroxy-3methoxyphenyl)-ethanone), and 4-hydroxybenzaldehyde (Swart *et al.*, 2003).

There are approximately 250,000 species of plants growing on earth and therefore, some criteria are to be laid down for selecting the plants that have anti-fertility potential (Nripendra *et al.*, 2019). The first option involves investigation of plants that have folkloric/traditional reputation as contraceptives (Nripendra *et al.*, 2019). The second option involve evaluation of plants that are known to contain constituents, which theoretically affect the female cycle to produce anti-fertility effects e.g. estrogenic sterols, isoflavones, and coumastranes or that

have potential to contract uterus (Nripendra *et al.*, 2019). The third option is a random collection of plants for mass screening for fertility regulation (Nripendra *et al.*, 2019). In this study, selection of medicinal plants for contraceptive efficacy is based on the first option, which involves investigation of plants that have folkloric/traditional reputation as contraceptives. Sewanki-Rusike (2013) also investigated the contraceptive activity of an herbal contraceptive in female Wistar rats.

The contraceptive efficacy of medicinal plants can be investigated in a variety of ways such as, investigation of sex hormones, assessment of sperm motility and viability and evaluation of anti-implantation activity (Shah *et al.*, 2016). The type of herbal contraceptive under investigation influences the type of investigation selected for contraceptive efficacy. Bala *et al.* (2014) classify herbal contraceptives according to antifertility plants (prevent fertilization), antioviulatory plants (inhibits ovulation), and anti-implantation plants (block implantation). The objective of this study was to investigate the phytochemical profile and contraceptive efficacy of herbal mixture prescribed by traditional healers in Ngaka Modiri Molema district municipality (NMMDM).

6.2 MATERIALS AND METHODS

6.2.1 Sample preparation

Sample preparation for this chapter was similar to the one followed in the previous chapter, as discussed in section 5.2.2, on collection and preparation of plant materials.

6.2.2 The phytochemical analysis of the herbal mixture

The GC-MS analysis was performed at the Faculty of Natural and Agricultural sciences, North West University, Potchefstroom campus in November 2019. This was done using Agilent Technologies GC systems with GC-7890A/MS-5975C model (Agilent Technologies, Santa Clara, CA, USA). One milligram (1 mg) of each of the herbal mixture was weighed and dissolved in 1 ml of methanol. The GC capillary column Low bleed capillary column (HP-5 MS, 30 m × 0.25 mm i.e., 0.25 µm) was used. High purity helium (99.996%) was used as carrier gas at a flow rate of 1.25 ml/min and a linear velocity of 37 cm/s. A milligram of each sample was weighed, and thereafter dissolved in 1 ml of methane. An aliquot of 1 µl of each of the four samples was injected into the column with an inlet temperature of 250°C and splitfewer modes at time of 30 s. An initial oven temperature of 35°C was set and programmed to increase up to 285°C at the rate of 10°C per min with a holding time of 3min

at each increment. The ion source temperature maintained at 230°C was employed while electron impact (EI) mass spectra were obtained at the acceleration energy of 70 eV. The MS transfer line temperature was 280°C with the MS solvent delay time of 5 min, mass acquisition range of 40–550 DA and data acquisition rate of 10 spectra/S.

6.2.3 Experimental procedure to evaluate contraceptive efficacy

In order to help reduce the stress in animals, rats were allowed to undergo acclimatization period of seven (7) days while housed in a well ventilated cage with relative humidity 45%-55%, under room temperature of 25 ± 10 °C and a 12 hours light and dark cycle, with males separated from females. Good hygiene was maintained through constant cleaning of the cages by removal of faeces and supplied feed on a daily basis.

The study consisted of four experimental groups, including control (group A) and three test groups (B, C and D). Each group consisted of seven female rats after a sample size of 28 animals was determined statistically using power analysis. The rats in the control group had an average mass of 194.83 g whilst group B, C and D had average mass of 197.93 g, 196.51 g and 191.75 g respectively. The control group (A) received oral administration of distilled water, while experimental groups B and C received oral administration of 5 mg/kg and 50 mg/kg extract respectively once a day for three consecutive days. Group D received 300 mg/kg of the extract once a day for three consecutive days. The three doses were selected because they were less than the lethal dose (LD₅₀) of 2500 mg/kg determined from the acute oral toxicity study. Oral administration of the extract was done by oral gavage, and not in drinking water. Female rats were caged with males on a ratio of 1:1, i.e. one female paired with one male for six days (16/09/2020 - 21/09/2020). The weight of each female rat was measured before herbal administration and once after every seven days from the 21/09/2020 - 12/10/2020 and observed for pregnancy. All animals were euthanised on 12/10/2020.

6.2.4 Data analysis

The relative quantity of the chemical compounds present in the herbal mixture was expressed as a percentage based on peak area produced in the chromatogram. The spectrum of the compounds detected in the herbal mixture was compared with the spectrum of National Institute of Standard and Technology (NIST) library database (Nandagopalan, 2015). The contraceptive efficacy (CE) percentage was determined by using a formula adapted from Sewanki-Rusike (2013):

Contraceptive Efficacy (CE) % = number of non-pregnant rats/ total number of rats x 100

Statistical analysis could not be considered for the efficacy study because data points were too few for the necessary analysis. However, practical significance between dose (mg/kg) and weight (g) was determined with the help of a procedure called effect sizes. The effect is a formula that is calculated between each pair of groups and the resulting value (denoted by d).

6.3 RESULTS

6.3.1 Phytochemical composition of the herbal mixture

The chromatogram for the herbal mixture illustrates the presence of different phytochemicals. These phytochemicals include 2,3-butanedione, acetic acid, 2,3-butanediol, an unknown compound, phenol, two unknown compounds and benzaldehyde. The first and last compounds to be detected were 2,3-butanedione (130.9 s) and benzenethanol (1725.2 s). The most abundant compound in the herbal mixture was 2,3 butanediol with a retention time of 679.6 s and peak area of 44.660%. (Table 6.1).

The least abundant compound was benzenethanol with a peak area 0.0030 %. Benzenethanol was the last compound to be detected with a retention time of 1725.2 s. Of the 21 phytochemicals present in the herbal mixture, nine compounds were unknown. In this study, two bioactive compounds, phenol and 2-methoxy-4-vinylphenol (a phenolic compound) were identified in the herbal mixture. Results showing phytochemicals detected from the aqueous extracts of *Teucrium trifidum*, *Helichrysum caespititium* and *Bulbine frutescens* is attached (Appendix N).

6.3.2 Contraceptive efficacy (CE) of the herbal mixture

Results show that all seven rats in the control group fell pregnant. Similarly, all rats in groups B and D also fell pregnant. However, one rat in group C did not fall pregnant. A report showing the number of pregnant rats from the efficacy study has been attached. (Appendix O). Therefore, one rat from seven in Group C did not fall pregnant. In total, only one female from 21 tested animals (excluding the control) did not fall pregnant. According to the formula adapted from Sewanki-Rusike (2013), the contraceptive efficacy was:

CE = total number of non-pregnant rats /number of pregnant rats/ x 100 [3]

$$0/7 \times 100 = 0\%$$

Table 6.1: Phytochemicals detected in the herbal mixture.

Peak	Name	Molecular formula	Molar mass(g/mol)	Retention time (s)	Area %
1	2,3-Butanedione	C ₄ H ₆ O ₂	86.09	130.9	0.0904
2	Butanic acid, methyl ester	C ₄ H ₈ O ₂	88.11	136.5	0.0184
3	Acetic acid	C ₂ H ₄ O ₂	60.05	314.7	5.9440
4	Unknown 41	-	-	316.3	2.8014
5	2-Propanone, 1-hydroxy-	C ₃ H ₆ O	58.08	357.1	0.5446
6	2,3 Butanediol	C ₄ H ₁₀ O ₂	90.12	624.4	0.6070
7	2-Propanone, 1-hydroxy-	C ₃ H ₆ O	58.08	631.9	0.8804
8	Unknown 42	-	-	669.9	7.4327
9	Unknown 43	-	-	674.4	19.942
10	2,3 Butanediol	C ₄ H ₁₀ O ₂	90.12	679.6	44.660
11	Unknown 44	—	—	680.2	1.7356
12	Pyrrolidin-1-acetic acid	-	-	695.1	0.5558
13	Unknown 45	-	-	849.3	0.8718
14	2,5-Dimethyl-4-hydroxy-3(2H)-Furanone	C ₆ H ₈ O ₃	128.13	1003.6	1.5595
15	Unknown 46	-	-	1079.4	2.3000
16	Phenol, 4-ethyl-	C ₆ H ₆ O	94.11	1163.4	0.2300
17	2-Methoxy-4-vinylphenol	C ₉ H ₁₀ O ₂	150.17	1219.1	2.6723
18	Glycerin	C ₃ H ₈ O ₃	92.09	1232.9	4.8424
19	Unknown 47	—	—	1298.1	0,4270
20	Benzaldehyde, 3-methyl-	C ₇ H ₆ O	106.12	1308.2	1.1407
21	Unknown 48	-	-	1549.8	0.3190

Therefore, water had no contraceptive effect on rats and was ineffective in preventing pregnancy. In the same way, the contraceptive efficacy for group B and D was zero, meaning that the 5 mg/kg and 300 mg/kg herbal extract respectively were ineffective in preventing pregnancy in rats. However, for group C;

$$\text{Contraceptive efficacy} = \frac{1}{7} \times 100$$

$$= 14.2\%$$

The average contraceptive efficacy for all tested animals (Groups B, C and D) was:

$$\text{CE} = \frac{1}{21} \times 100$$

$$= 4.67\%$$

The contraceptive efficacy of the herbal mixture used for contraception by the Batswana of the Ngaka Modiri Molema district municipality is very low, less than 15% per group of 7 rats and less than 5% for all tested rats.

Therefore, empirical data from this efficacy study showed clearly that the herbal mixture used by Batswana traditional health practitioners was less effective in preventing pregnancy in rats. The weight of the rats in the control increased on average from 208.93 g to 370.46 g in four weeks, an increase in body weight of 56% whilst rats in the group B (5 mg/kg) had an increase in body weight of 57% on average (Figure 6.1). Results from the effect on size showed a small effect without practical significance between dose (mg/kg) and weight (g).

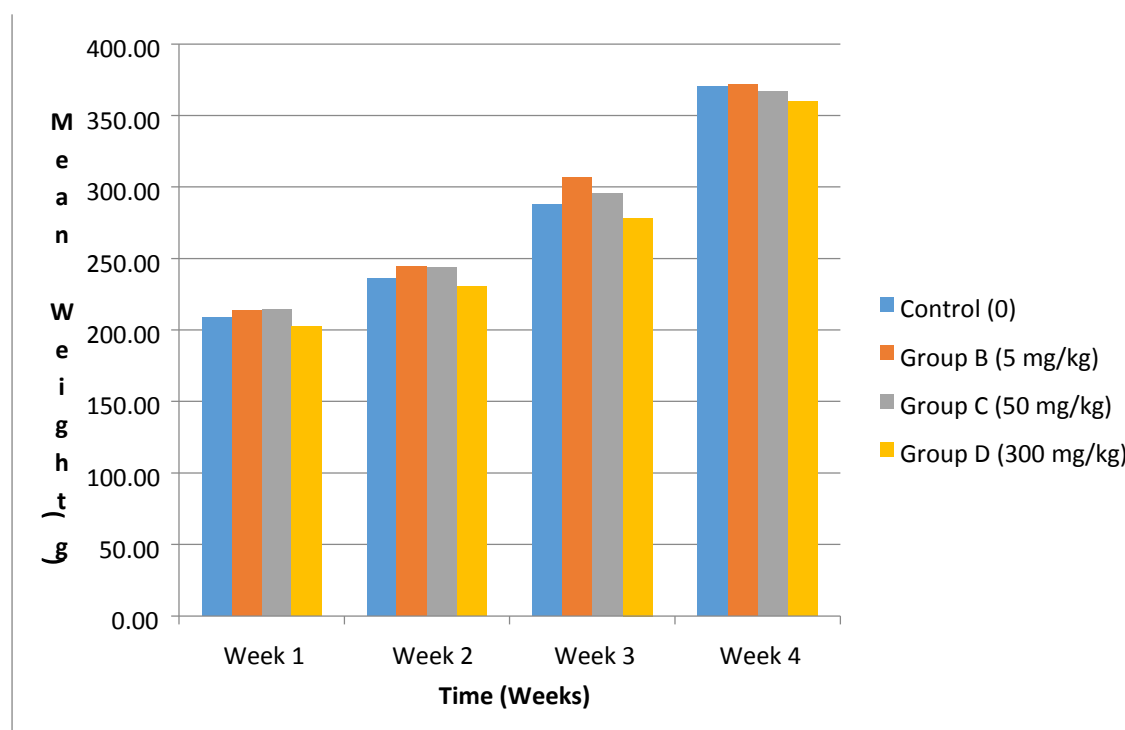


Figure 6.1: An increase in the mean weight of rats per group during the study.

6.4 DISCUSSION

The quantity and quality of plant secondary metabolites can strongly influence the biological activities of medicinal plants (Otang *et al.*, 2012). Gas chromatography mass spectrometry (GCMS) makes identification of bioactive phytochemicals possible. In this study, phenolic compounds were identified as bioactive phytochemicals present in the herbal mixture. Phenols and phenolic acids are considered as some of the bioactive compounds in medicinal plants (Altemimi *et al.*, 2017; Zhao *et al.*, 2015). Phenolic compounds are organic compounds that have hydroxylated aromatic rings with the hydroxyl group linked directly to the phenyl ring (Asong, 2019). Phenolic compounds have several effects on human health ranging from antimicrobial, anticancer, antitumor and antiinflammable, anthelmintic and antidiarrhoeal, and antioxidant (Botelho *et al.*, 2017).

A qualitative and quantitative determination of phytochemicals showed a high phenolic content in some plants with contraceptive potential (Soni *et al.*, 2018). Phenolic profiling and evaluation of contraceptive effect on animals using contraceptive plants revealed the presence of phenols (Shehab and Abu-Ghabieh, 2014). A non-surgical sterilization using phenolmucilage for contraception was found to be extremely acceptable to a group of Chinese women because it was simple, safe and inexpensive (Tang and Kwan, 1988). Aryl 4guanidinobenzoates that possess phenols have shown to be potential vaginal contraceptives whilst gossypol, a phenolic compound has a reputed contraceptive effect (Zatuchni and Osborn, 1981).

The phytochemicals detected from the aqueous extracts of *Teucrium trifidum*, *Helichrysum caespitium* and *Bulbine frutescens* are shown in Appendix J. More phytochemicals, including a bioactive compound (name the bioactive compound) were identified in the *T. trifidum* extract than *Helichrysum caespitium* and *Bulbine frutescens*. This is interesting because *T. trifidum* was the only species that could be used as part of the herbal mixture or on its own. In addition, *T. trifidum* was one species that had the same frequency of mention similar to that of the herbal mixture. Another interesting result about the phytochemical composition of the herbal mixture is that the number of phytochemicals and bioactive compounds identified in each of the species were less than those identified in the herbal mixture. However, the number and type of bioactive phytochemicals identified in the herbal mixture were similar to those identified in *T. trifidum*.

However, from indigenous knowledge systems (IKS) and African traditional medicine (ATM) point of view, the findings from this study and that of Sewani-Rusike (2013) point to the fact that oral herbal contraception does not function on its own but requires the inclusion of other techniques. African traditional medicine (ATM) and indigenous contraception functions in holistic way and no technique of indigenous contraception is more effective than the sum of other techniques. These findings show that no form of contraception or contraceptive, either indigenous or western that can prevent unwanted pregnancies on its own. There will always be a need for integration and synergy at all levels of pregnancy prevention. Therefore, from an ATM perspective, these results are in line with the conceptual and theoretical frameworks of this study.

From a scientific point of view, the findings for the efficacy study showed the difficulty that arises from mimicking indigenous knowledge systems. The ethnobotanical knowledge had to be modified to cater for scientific processes and instruments. For example, the use of a centrifuge and vacuum filter removed all solids from the extract, for which is not the case when prepared by traditional health practitioners for human consumption. The freeze-drying process might have also had an effect on the extract. Furthermore, the dose used in this study was not based on ethnobotanical knowledge of traditional health practitioners. Instead, these doses/concentrations were taken from the options offered by the OECD guidelines and might have been too low. The herbal mixture showed that it was safe at higher concentrations, and doses used in this study should have been in those ranges. The low efficacy of the herbal mixture in this study or that of *P. mixta* in a study by Sewani Rusike (2013) could be due to low dose ranges and less number of dosages. Sewani-Rusike (2013) used the same dose range (300 mg/kg) as we did in this study, with very similar in terms of contraceptive efficacy. The number of times (days) the dosages is administered must therefore be increased. The sample sizes would also need to be increased drastically for data to have any statistical significance. Ethical implications, feasibility of the design, costs and time are some of the considerations that limit the ideal sample size.

6.5 CONCLUSION

In this study, two bioactive compounds, phenol and 2-methoxy-4-vinylphenol were identified from the chemical composition of the herbal mixture. Phenolic compounds have shown contraception activity in different studies. There is a need to isolate these bioactive phytocompounds and test their safety and efficacy. In this study, the contraceptive efficacy

of the herbal mixture was very low. It can be concluded that the herbal mixture was safe but less effective in preventing pregnancy in rats. Nevertheless, indigenous contraception functions effectively with different techniques and taboos when used in combinations and simultaneously. For instance, the use of waistbands, periodic abstinence, withdrawal, avoidance of certain foods etc., usually accompanies herbal mixture in the prevention of pregnancy. In addition, the need to modify the ethnobotanical knowledge to accommodate scientific processes and instruments might have had an impact on the contraceptive efficacy of the herbal mixture. The doses used in this study were not based on the ethnobotanical knowledge of traditional health practitioners but was based on OECD guidelines. A higher range of doses may probably increase the contraceptive efficacy of the herbal mixture. Finally, there is a need to include traditional health practitioners during the experimental part of the study, from plant collection, to sample extraction and administration to rats. Traditional health practitioners might provide advices and suggestions regarding sample preparation and administration to mimic administration of the extract to humans. This is important because the spiritual aspect of indigenous contraception, including performing of certain rituals were neglected. There might be some rituals that are performed on or with the herbal mixture, or on the person herself to increase the effectiveness of the herbal mixture. The next chapter provides a general discussion, conclusions and recommendations to stakeholders.

CHAPTER 7: GENERAL DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

7.1 INTRODUCTION

The aim of this study was to explore indigenous contraception ethnographically and experimentally among the Batswana in the Ngaka Modiri Molema district municipality, with focus on ethnobotanical knowledge, accessibility, affordability, safety and efficacy of indigenous contraception, and medicinal plants used for contraception (herbal contraceptives). This thesis has shown that Batswana traditional health practitioners (THPs) do possess valuable knowledge about practices, taboos and techniques of indigenous contraception, including natural and traditional contraceptives. The study used a combination of ethnography and experimental work as way of integrating two knowledge systems *viz*-indigenous knowledge systems (IKS) and western knowledge system (WKS) as way of adding value to indigenous contraception by the Batswana. This chapter provides a general discussion of the study with the aim of highlighting the implications of the findings to the discipline. The chapter also draws some conclusions, insights and recommendations for different stakeholders. Indigenous contraception such as birthspacing and postponement of first birth (virginity) were important for ensuring mother and infant health.

This study found out that the Batswana THPs in Ngaka Modiri Molema district municipality (NMMDM) possess rich knowledge about indigenous contraception, including ethnobotanical knowledge of medicinal plants used for contraception among the Batswana ethnic group. The study was published in an accredited journal and will contribute immensely to knowledge on indigenous contraception in South Africa. The study showed that THPs knew similar practices of indigenous contraception reported in the literature, whilst some of the techniques known by THP had not been reported before in South Africa or across the continent. The study has shown that Batswana women in Mahikeng local municipalities had a positive attitude towards indigenous contraception. The majority of Batswana women that took part in the survey knew only abstinence. This finding showed that the majority of Batswana women in the Mahikeng local municipality had poor knowledge regarding traditional techniques of indigenous contraception. This poor knowledge about traditional techniques of indigenous contraception among women resulted in negative perceptions towards the safety and effectiveness of traditional techniques, especially among women of reproductive age. Elderly women

perceived the safety and effectiveness of indigenous contraception more positively than the way their younger counterpart did. This is a serious concern and showed lack of inter-age consultations and conversations regarding indigenous contraception between young and old women. This means that older women no longer provide young women with knowledge about indigenous contraception, hence poor knowledge and negative perceptions towards indigenous contraception among young women. The poor knowledge and negative perceptions by women towards indigenous contraception is a contributor towards poor usage of indigenous contraception among women in South Africa.

A few studies have previously focused on indigenous contraception among South Africa's ethnic groups, including the Batswana of the North West province. This study on indigenous contraception is however, the first study on indigenous contraception to be conducted among the Batswana in NMMDM and contributed to knowledge regarding indigenous contraception among South Africa's ethnic groups. This showed that the Batswana ethnic group in NMMDM, North West province possess knowledge and practice indigenous contraception. This study thus set a basis from which other studies on indigenous contraception among different ethnic groups in South Africa could be based on, or can take a leaf from a part of documenting different practices and techniques of indigenous contraception used by the different ethnic groups in South Africa.

Although few studies were conducted on indigenous/traditional contraception in South Africa, almost all these studies focused on humans as participants alone and neglected subjecting the knowledge obtained from humans to the scientific investigations such as the phytochemistry, safety and efficacy of medicinal plants used for contraception. This study thus made a way for other scholars of herbal contraceptives to consider methodologies that include animal experiments as part of documenting and investigating indigenous contraception in South Africa. This study showed that methodologies that investigate indigenous contraception by including human and animals are feasible, affordable and can be based on acceptable ethical consideration and contemporary scientific principles and instruments.

This study also showed the presence of phenolic compounds, which are bioactive phytocompounds that could be responsible for the contraceptive activity of the herbal mixture. The study further showed that the herbal mixture used for contraception was safe on rats, and it can be assumed that the same herbal mixture is also safe on humans as emphasized

by THPs. However, the contraceptive efficacy of the herbal mixture was very low. The herbal mixture was therefore, less effective in preventing pregnancy in rats. This study thus laid a foundation for collaboration between THPs and WHPs in South Africa as envisioned by the Traditional Health Practitioner's act of 2007. This holistic approach to contraception, that is, equal recognition of indigenous and western contraception as valid interventions to prevent pregnancy, will lead to a decolonized and modernized contraceptive system in South Africa.

The results obtained from both ethnography and experiments were in line with the theories applied to this study. Firstly, the willingness by THPs to participate in the study and their willingness to share their knowledge of indigenous contraception made the study Afrocentric because contraception was explored from an African indigenous perspective, with the THPs being central to it. Secondly, the study proved that results were in line with African feminism on contraception. The Batswana women had poor knowledge about traditional techniques of contraception despite the fact that women were the ones mainly task with the responsibility of ensuring contraception among the Batswana. This finding showed not only poor inter-age engagements but also lack of interventions such as workshops to teach and make women aware of indigenous contraception so that they have a broad spectrum of techniques to choose according to their contexts.

In addition, women were not allowed to consult the THPs for indigenous contraception without the presence and consent of their husbands. Indigenous contraception, like western contraception, is therefore, gender biased and there are gender issues that need African feminists to interrogate in order to free women from contraception responsibilities and encourage men to play their part as well. This femistic approach to contraception was to some extent perpetrated by the colonial legacy of male dominance, whereby men were breadwinners and women had to stay home as house-based wives with no ambitions to climb the cooperate ladder. However, some of the practices of indigenous contraception were based on local beliefs and customs among the Batswana that a husband is the head of the house for example, and thus based on the culture of the Batswana.

The results from wet bench experiments regarding the efficacy of herbal contraceptives were also in line with the holism theory selected for this study. The theory explains that indigenous contraception functions in a holistic nature, that the sum of all techniques, taboos and practices of indigenous contraception were more effective than one technique. It is a

wellknown fact that no contraceptive can be 100% effective and reversible at the same time, including western contraceptives. However, by applying a combination of different natural and traditional techniques, such as herbal contraception, avoidance of certain foods, drinking water before and after sex and periodic abstinence (moon checking) increases the effectiveness of indigenous contraception. It is for this reason that herbal contraception on its own was relatively less effective in preventing pregnancy in rats. This theory was extended to contraception, that western or indigenous, is ineffective to preventing unwanted pregnancies in South Africa. A holistic approach that includes both the western and indigenous forms of contraception is required and is referred to as “modern contraception” in this study. This holistic approach to contraception also includes equal participation by both females and males in ensuring effectiveness of contraception, and not only females, as was the case with rats.

7.2 LIMITATIONS OF THE STUDY

Some challenges were encountered when doing this research. One of the challenges noticed when conducting this research was on the transfer of ethnobotanical knowledge to a laboratory setting for experimentation. The laboratory setting requires that the ethnobotanical knowledge documented from THPs be modified to accommodate scientific principles and instruments. For example, a centrifuge and vacuum filter was used to remove all solid particles from the extract so that it could be subjected to GCMS analysis. Otherwise, if not well filtered, the extract will surely damage the GCMS machine, resulting in high costs to fix the instrument. Nonetheless, THPs administered the extract with solids still present in the extract, and these solids could possibly play a key role in the contraceptive activity of the extract.

Furthermore, THPs do not freeze-dry the extract, and by so doing remove the solvent which could somehow also play a role for effective prevention of pregnancy. In addition, the dosages used during the efficacy study were based on results from toxicity studies as required by ethical considerations and not from the ethnobotanical knowledge. It is therefore, clear that the ethnobotanical knowledge of herbal contraceptives among THP's is not tested in its purest form when taken to the science laboratory. Consequently, experimental results from the study might not be in line with the ethnobotanical knowledge. Furthermore, medicinal plants used for contraception were seasonal and accessible mostly after rains in summer.

Another challenge noticed in this study was regarding the interfacing of indigenous knowledge systems (IKS) and western knowledge systems (WKS). It is difficult to mimic

exactly what THPs do. IKS and African traditional medicine in particular, involve spirituality and rituals are performed such as appeasing ancestors when assisting a client, and these are challenges to incorporate when using scientific principles of investigation. Science does not accommodate the traditional rituals that accompany practices, taboos and techniques of indigenous contraception. Before and during administration of these herbal contraceptives, the healer and/or the woman willing to prevent pregnancy performs the rituals that included burning of incense, throwing of bones to determine whether ancestors agree or disagree with contraception and so forth. Although these can be considered and included when experiments are conducted, they will not make sense to majority of the scientific community.

The acceptance of results among both the THPs and WHPs had inherent challenges. The efficacy results are a good example in this case. THPs might have difficulty in accepting that only one rat did not fall pregnant and put the blame on incorrect application of the ethnobotanical knowledge, poor execution of the study or the influence of scientific apparatus and processes on results. On the other hand, WHPs expect results with statistical analysis and that the pregnancy be dose dependent and may see the efficacy results as too simplistic or might believe that something went wrong during the experimental processes that made results inconclusive.

It was apparent therefore, that the WHPs have an embedded bias towards the validity and reliability of indigenous knowledge systems in general, and might view these particular results as a confirmation that indigenous contraception is ineffective without considering the contexts and theories of indigenous contraception. In fact, this challenge occurs not only among scientists but also among the Batswana women as well, and the community at large, whom can see the results as a confirmation regarding their negative perceptions towards the effectiveness of indigenous contraception. There is therefore, a need to change the negative perceptions of women, and the society in general towards the safety and effectiveness of indigenous contraception propagated by the colonial legacy and its policies. Decolonisation of women's view of indigenous contraception in the continent requires cooperation and teamwork among different stakeholders including governments, institutions of higher learning and international agencies through workshops and conferences. The use of social media to teach women about indigenous contraception is also important as we enter the fourth industrial revolution.

Another aspect relevant to this study involves elements of trust of the results. The use of rats as animal models might make some THPs skeptical to trust the results from this study because it is based on tests made on rats. Because THPs use these medicinal plants on humans and not animals, in this case, this might reduce their trust on the study, including results. This lack of trust could lead to poor interpretation of the results and the knowledge developed out of this study. The results from this study could not be generalized to other ethnic groups in South Africa because the sample sizes that were used during the in-depth interviews were too small. Furthermore, the study focused only on Batswana and not participants from the other ethnic groups. For example, among the Batswana, only women take herbal contraceptives, a practice, which is contrast to other ethnic groups. Indigenous contraception among the Batswana is therefore, locally based and follows traditions and customs of the Batswana. Nevertheless, literature review showed that certain practices and techniques of indigenous contraception documented in this study were common not only in South Africa but across Africa.

Despite all challenges discovered when doing this research, the study showed that there was a potential for complementarity between IKS and WKS. This complementarity between the two knowledge systems can lead to commercialization of herbal contraceptives to appease a larger part of the population and not be restricted to indigenous communities. For example, packaging of these medicines in the form of capsules can make them more appealing to a wider audience, and increase the quality and shelf life (longevity) of the medicine. Such modernised packaging of medicine will also result in effective storage and distribution, whilst preventing contamination.

However, there are red tapes that make it difficult to enter the pharmaceutical industry (Child, 2015). These red tapes exist in the form of unrealistic requirements from new entrants such as tax clearances and certificates, including long procedures and processes that discourage poor black people that want to maintain the status quo of marginalising the previously disadvantaged communities from entering the cooperate. In addition, owners of big pharmaceutical companies act as gatekeepers and prevent new entrants from entering the industry to protect their privilege and maintain a monopolised industry. The government must pass laws promoting partnership between local THPs with established pharmaceutical companies.

7.3 STRENGTHS AND WEAKNESSES OF THE STUDY

When making reflections of the research, some weaknesses and strengths arise. The strength of the study lies on its sequential exploratory mixed method design, which started with ethnography (qualitative) and followed by experiments (quantitative). Consequently, this study went through a rigorous ethics application process that required two ethics clearances, one for human study and one for animal studies. The strength of this study is also that the theories applied in it were applicable to both approaches. The results from this study, from both the qualitative and quantitative approaches were explained through each or a combination of different theories selected for this study. The strength of this study also rests the fact that this study employed contemporary experimental procedures including the GCMS instrument and MTT assay. This study followed the OECD guidelines, instead of for example, the the outdated LD₅₀ method (Locke, 1983). This method has no limitations, applies to drugs, agricultural and industrial chemicals and can be used for every route of administration (Locke, 1983). This sequential mixed method design showed that integration of different knowledge systems is possible, and promoted collaboration between THPs and WHPs. This study transcended across different disciplines, including IKS, chemistry, and pharmaceutical sciences. The multi-disciplinary nature of the study is important for collaborative research.

This study was in line with the current trends regarding literature on IKS and ATM on contraception. For example, the Department of Health (2012) contraception policy stated that one of the concerns regarding contraception in South Africa was lack of knowledge regarding the use of herbal contraceptives among indigenous ethnic groups in South Africa. A major part of this study documented and investigated the use of herbal contraceptives among the Batswana; one of the indigenous ethnics groups in South Africa that was concerned on such knowledge. Furthermore, this study focused on the safety and efficacy on indigenous contraception, and integrated IKS with WKS with a goal to foster collaboration between THPs and WHPs. One of the objectives of the establishment of the traditional Health Practitioners Act no 22 of 2007 was to improve the accessibility, safety, efficacy, and quality of traditional medicine in South Africa through collaboration between THPs and WHPs. The declaration adopted by the first World Health Organisation (WHO) Congress on traditional medicine held in China in 2008, emphasised the development of traditional medicine based on research and innovation to ensure its safety and effectiveness. The WHO (2012) Traditional Medicine Strategy for 2014–2023, released in 2012, further emphasised the safe

and effective use of traditional medicine by regulating, researching and integrating traditional medicine products, practitioners and practice into health systems with emphasis on education and training of traditional and western health practitioners.

Similar studies have been conducted in South Africa to document indigenous contraception. For example, the following techniques of indigenous contraception have been reported; safety pin; burial techniques; soil eating; thigh sex; polygamy; drinking ashes, holy water or oil; postpartum abstinence; periodic abstinence; withdrawal, waistband, breastfeeding and drinking of herbs (Mothiba *et al.*, 2012; Wood and Jewkes, 2006). However, few studies have integrated IKS with science to investigate the herbal safety and efficacy. However, a study by Sewani-Rusike (2013) did investigate the safety and contraceptive efficacy of medicinal plants used for contraception in South Africa. Sewani-Rusike (2013) found almost the same results as we did in this study using the same range of concentrations. Firstly, the herbal contraceptive was safe as was the herbal mixture in our case; and secondly, only two rats from a group of eight did not fall pregnant (Sewani-Rusike, 2013). In our case, only one rat from a group of seven did not fall pregnant. The results from this study are thus comparable to that from Sewani-Rusike (2013). The range of the concentrations (0-300 mg/kg) might have had an effect in low efficacy in both our study and that of Sewani-Rusike (2013). A higher range of concentrations (1000 mg/kg -2000 mg/kg) might have resulted in an increased contraceptive efficacy of the herbal contraceptives. The holistic nature of indigenous contraception also requires use of a multiplicity of techniques to ensure complete effectiveness. Similarly, on a global scale, neither indigenous nor western contraception can prevent all unwanted pregnancies on its own; therefore, there is a need to integrate both the indigenous and western forms of contraception. The validity and trustworthiness of the study was discussed in the previous chapters and was not be repeated here. Furthermore, the facilities used in this study to investigate the safety and efficacy of the herbal mixture are world class. Some related studies on pregnancy prevention have been conducted in the North West province. However, their points of departure have been western approaches to research on pregnancy prevention and focus on western contraception alone, neglecting indigenous contraception. For example, Onyensoh (2011) did not consider indigenous contraception when investigating the knowledge, attitudes, and practices of contraception among high school students in Tswaing local district, North West Province. Mhele and Ayiga (2014)

investigated rates and predictors of school pregnancy among black women in the North West province and did not consider indigenous contraception as well.

7.4 CONCLUSIONS

The following conclusions have been drawn from the study:

- The Batswana traditional healers of NMMDM possess rich and diverse ethnobotanical knowledge regarding indigenous contraception.
- Women showed a positive attitude towards indigenous contraception, but their knowledge regarding each technique of indigenous contraception was poor and they showed negative perception towards its safety and efficacy.
- The herbal mixture did not show any signs of toxicity and it is therefore, safe as stated by traditional health practitioners.
- Two phenolic compounds were identified as two bioactive compounds that could be responsible for the herbal mixture because phenolic compounds have shown contraception activity in different studies.
- The contraceptive efficacy of the herbal mixture was very low, illustrating that the herbal mixture was less effective in preventing pregnancy in rats.
- Integration of IKS with WKS is possible and can result in the expansion and development of knowledge and empowerment of both THPs and WHPs.
- Although, intergration of IKS and WKS is possible, there is a challenge for scientific studies to mimic ethnobotanical knowledge without some modifications such as the use of vacuum filter to protect the GCMS instrument.
- THPs need to be included during sample extraction and administration, and during data analysis and interpretation of findings.
- Complete participation of THPs during the experimental stage could contribute to their increased scientific knowledge and laboratory skills.

7.5 CONTRIBUTION OF THE STUDY TO KNOWLEDGE

This study set an example for future research on combining indigenous and western knowledge systems in one study, despite the two knowledge systems being based on different research paradigms. Few studies on indigenous contraception integrate both ethnographic and experimental research, with indigenous knowledge obtained from traditional health

practitioners and combining this with scientifically accepted principles of pre-clinical trials. The ethnographic part of the study documented details on ethnobotanical knowledge, practices, taboos and techniques of indigenous contraception which was never reported before in South Africa. The ethnographic part of the study formed a basis for further experimental work on indigenous contraception. By following traditional practices during sample preparation for scientific investigations, it showed that indigenous preparation practices and techniques were consistent, applicable and complimentary with scientific principles.

The experimental part of the study contributed to knowledge regarding the phytochemical composition, safety and efficacy of the herbal mixture used for contraception among the Batswana in NMMDM. Most THPs do not possess knowledge about bioactive phytocompounds nor are they able to categorise the toxicity of the herbal mixture following contemporary toxicological guidelines. The experimental part of the study empowered THPs by expanding their knowledge regarding phytochemical composition, safety and efficacy of the herbal mixture, allowing them to provide scientific arguments regarding the safety and efficacy of herbal contraceptives. A few articles have been published from the study thereby contributing to the knowledge base to the discipline of indigenous knowledge systems in particular to indigenous contraception. More publications are at advanced stages.

7.6 RECOMMENDATIONS AND SUGGESTIONS FOR FUTURE STUDIES

There are some areas of the study for which future research should focus on such as for example the rest of the medicinal plants documented in this study as being used for contraception. One candidate from the rest of the medicinal plants that need to be investigated for contraception is *Cannabis sativa*. This is the only plant documented in this study as being used for contraception, and reported in literature as herbal contraceptive (Jaravaza, 2012). The experimental part of the study (phytochemistry, toxicity and efficacy) must focus on all phases of the plant, including cannabis powder (solid), cannabis oil (liquid) and smoke (gas). Although indigenous contraception functions in a holistic way, phytocompounds identified as bioactive in the extracts need to be isolated, and tested for efficacy. In addition, although only water was used as a solvent among traditional health practitioners, other solvents such as ethanol should be used for extraction. Both male and female rats should be tested, and both precoital and postcoital contraception must be investigated. Blood samples must be collected

for hormonal analysis and animals be dissected after study and each related organ or tissue examined under microscope.

Of importance is that THPs must be part of the whole study. In our case, THPs were invited to witness extraction processes and be part of extract preparation for animal studies. The presence of these indigenous knowledge holders might contribute beyond just giving indigenous knowledge, but can assist scientists with ideas and suggestions during collection, preparation, extraction and administration of the herbal extract. In the process, traditional health practitioners will be empowered with scientific knowledge and skills. THPs must also be part of analysis and interpretation of results, including conclusions and recommendations made. Future studies on efficacy need to consider larger sample sizes for both ethnography and lab based experiments on animals. In addition, future studies need to isolate bioactive phytocompounds believed to be responsible for contraceptive activity. Acetone for example, could be included as a solvent in addition to water in order to detect both polar and nonpolar phytocompounds. Furthermore, studies in future need to consider experimental designs that test both male and female rats, including postcoital contraception in females. The experiments must include investigation of both single species and herbal mixtures, and not focus solely of the herbal mixture. Future studies also need to analyse the hormonal cycles of both male and female rats to test the effect of the extract on reproductive hormones. Investigations must not focus only on the solid state (powder) of the plants, but must also investigate the liquid phase (essential oils) and gas phase (smoke). The range of concentrations considered for the study need to be broader and towards the estimated lethal concentrations. Therefore, concentrations must be based on the safety of the herbal mixture, as well as be equivalent to those used in humans. In addition to THPs, future studies need to include women who use indigenous contraception in the study to form part of in-depth interviews regarding knowledge, practices and perceptions towards indigenous contraception.

The following recommendations are made based on findings of the study.

- 1) The Department of Arts and Traditional Affairs needs to appreciate the rich and valuable knowledge possessed by THPs in NMMDM and to consult them on interventions and policies aimed at prevention of unwanted pregnancies instead of relying only on WHPs and WKS.

- 2) The Department of Agriculture and Rural Development needs to engage THPs to learn about indigenous plant collection practices that promote conservation of species and provide an oversight to ensure adherence to these indigenous conservation practices.
- 3) The Department of Education needs to introduce indigenous contraception in the school curriculum to form part of the life orientation subject to teach learners about the importance of virginity, birthspacing, abstinence etc., or as part of the arts and culture subject, whereby learners are taught about indigenous contraceptive taboos.
- 4) The Department of Health needs conduct awareness campaigns, whereby women, including men are empowered with knowledge regarding indigenous contraception to change the negative perceptions that the community has towards indigenous contraception and address gender issues related to indigenous contraception.
- 5) The Department of Science and Innovation must encourage and provide funding to support collaborative research between different departments (disciplines) including the IKS Center, Chemistry Department, PharmaCEN and PCDDP to promote research designs that encourage integration of indigenous and western knowledge systems and foster collaboration between traditional and western health practitioners.
- 6) National and international funding agencies such as the National Research Fund (NRF) and World Health Organisation (WHO) need to provide more funding towards research focusing on the phytochemistry, safety, efficacy and quality of traditional medicine.
- 7) Future studies need not be limited by ethnobotanical knowledge but must include scientific procedures such as to include other solvents such as methanol and ethanol so that both polar and non-polar compounds can be extracted. In addition, both male and female rats must be tested, and both the precoital and postcoital contraceptions must be investigated for efficacy studies with a higher range of concentrations.
- 8) Future studies need to be include THPs throughout the experimental stage of the study, including data analysis and interpretation of findings, and not use them only to provide the necessary knowledge at the initial stages.
- 9) The dosage range for efficacy study need to be increased to the safest required starting dose, and the number of days for administration of the herbal mixture need to be increased to approximately seven days before the animals are allowed to mate.

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LIST OF APPENDICES

Appendix A: An interview schedule followed by the researcher as a guide during in-depth interviews with Traditional Health Practitioners (THPs).



Researcher: M.A Moroole

Degree: PhD **Date:**

Duration of interview:

District:

Participant:

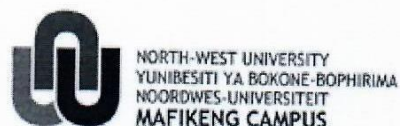
Research Objective:

Document knowledge, practices and techniques of indigenous contraception among the Batswana traditional healers of Ngaka Modiri Molema

Research questions

1. What do you know about indigenous contraception?
1. A o itse thibela pelegi ka setso?
2. Which practices are associated with indigenous contraception?
2. Ke mekgwa tsefe tsa Batswana tse dia amangwang le go thibela pelegi?
3. Which techniques of indigenous contraception are used to prevent pregnancy?
3. Ke ditsela tsefe tse di dirisiwang ke Batswana go thibela pelegi?
4. Which medicinal plants are used as part of indigenous contraception?
4. Ke ditlare tsefe tsa Setswana tse di thebelang pelegi?
5. How safe and efficient is indigenous (techniques) contraception?
5. A mekgwa ya go thibela pelegi ka Setswana e sireletsegile lo gore ya dira?

Appendix B: Certificate of approval of research proposal and registration of the title.



FACULTY OF AGRICULTURE, SCIENCE AND TECHNOLOGY
SCHOOL OF RESEARCH AND POSTGRADUATE STUDIES

Tel: +27 18 3892531
Fax: +27 18 3892052
E-mail: ushotanefe.ush@nwu.ac.za
Internet: <http://www.nwu.ac.za/>

CERTIFICATE OF APPROVAL OF RESEARCH PROPOSAL AND TITLE REGISTRATION

This is to certify that: Moroole MA - 28102509

Whose proposal is titled: An exploration of indigenous contraception among the Batswana of Ngaka Modiri Molema District Municipality, North West Province, South Africa

Was considered by the Faculty Research Committee on the 16 March 2017 and approved.

Proposed Qualification: PhD IKS

Supervisor (s): Prof SA Materechera
Dr W Otang-Mbeng

Signature: Director SRPS

Prof Ushotanefe Useh

Name: Director SRPS

Date



Appendix C: An introductory letter from the Indigenous Knowledge Systems (IKS) Centre allowing the research to do fieldwork.



Private Bag X2046, Mmabatho
South Africa 2735

Tel: +2718 299-389-2111
Fax: +2718 392-5775
Web: <http://www.nwu.ac.za>

INDIGENOUS KNOWLEDGE SYSTEMS CENTER
Tel: +27183892294
Fax: +27183892738
Email: albert.materechera@nwu.ac.za

MEMO

To: **WHOM IT MAY CONCERN**
From: **PROF SA MATERECHERA, DIRECTOR, IKS CENTER**
Date: **04 JULY 2018**
Re: **INTRODUCTION OF STUDENT MA MOROOLE (28102509)**

This is to confirm that student MA Moroole (28102509) is registered for a Doctorate degree in the Faculty of Natural & Agricultural Sciences (FNAS) at the North-West University under the Indigenous Knowledge Systems (IKS) programme. His research proposal titled "An exploration of indigenous contraception among the Batswana of Ngaka Modiri Molema District Municipality, North West Province, South Africa" was approved by the Faculty's Higher Degrees committee and an ethical clearance was given by the University in 2017. The student is ready to commence the study and the IKS centre would like to introduce him to you. Any assistance that you can give to enable him to implement the study will be greatly appreciated.

Feel free to contact me for any further clarification that may be needed.

A handwritten signature in black ink, appearing to read 'SA Materechera', is placed above the printed name.

Professor SA Materechera
0737172911/0183892294

File reference: IKS/MAM/01/18

Appendix D: Prior informed consent form for participants in the study.



Research project: Exploration of indigenous contraception among the Batswana of Ngaka Modiri Molema

Research aim: Exploration of indigenous contraception among the Batswana of Ngaka Modiri Molema

I give consent to participate in the research “An exploration of indigenous contraception among the Batswana of Ngaka Modiri Molema district municipality”

1. I have been given sufficient information about this research project. The purpose of my participation in the study has been explained to me and is clear.
2. My participation in this study is voluntary and is free.
3. It is clear to me that at any point of time I am fully entitled to withdraw from participation.
4. I have the right not to answer any of the questions that might make me feel uncomfortable in any way during the interview session.
5. I have been given the explicit guarantees that, if I wish so, the researcher will not identify me by name. _____

Participant’s Signature

Date

Researcher’s Signature

Date

For further information, please contact the principal investigator:

Prof. S.A Materechera (073 717 2911/018 389 892294)

Appendix E: A non-disclosure agreement reached between the researcher and participants.



Non-disclosure agreement

I, the researcher understand that I may have access to confidential information about participants taking part in this study on knowledge, practices and techniques of indigenous contraception among the Batswana traditional healers in Ngaka Modiri Molema.

By signing this Non-disclosure agreement, I agree that, I am indicating my understanding of my responsibilities to maintain confidentiality and I agree that I will:

1. Keep all information relating to plant collection site provided to me by participants during interviews on knowledge, practices and techniques of indigenous contraception among the Batswana traditional healers in Ngaka Modiri Molema in strict confidence.
2. I agree that I will not publicize the geographical coordinates, images of the plants or plant sites indicated to me by participants during interviews on knowledge, practices and techniques of indigenous contraception among the Batswana traditional healers in Ngaka Modiri Molema.
3. I agree not to divulge, publish, or otherwise make known to unauthorized persons or to the public any other confidential information obtained in the course of the study.

Researcher: M.A Moroole

Date.....

Participant.....

Date.....

Appendix F: A permit from the North-West Provincial Department of Rural Environment and Agriculture allowing the researcher to collect plants for scientific research.

MCPO 00820/2/2019	NW 8076/02/2019	Application ID 8076
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 Issued in terms of the provisions of: The National Environmental Management Biodiversity Act, Act 10 of 2004 as amended	Biodiversity North West Integrated Permit Ordinary Collect, Transport, Research Conduct Research or Scientific Project	 North West Province Issued in terms of the provisions of: (1) Bophuthatswana Nature Conservation Act, Act No.3 of 1973; (2) Transvaal Nature Conservation Ordinance, No.12 of 1983; (3) Cape Nature and Environmental Conservation Ordinance, 19 of 1974
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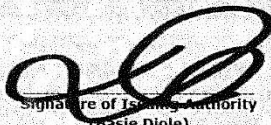
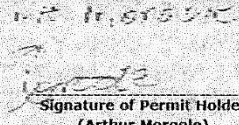
APPROVED SPECIES AND NUMBERS, RESTRICTED ACTIVITIES AND CONDITIONS AS PER ADDENDUM AND PAGES ATTACHED

PERMIT HOLDER			
Details	Physical Address	Postal Address	
Surname: Moroole	Building:	Street Address: 4110 Unit 1 Extension	
Full Name: Arthur	Street: Tiola	Post Office: Selosesha	
Id Number: 7711195526087	Suburb:	Town: Thaba Nchu	
Passport:	Town: Thaba Nchu	Postal Code: 9783	
Cell Home: 0630956860	Area Code: 9783	District/Region: Moehe/ Mangaung	
Tel Home: 0630956860	Division/Region: Moehe/ Mangaung	Province/State: Free State	
Tel Work:	Province/State: Free State	Country: Republic of South Africa	
Fax Home:	Country: Republic of South Africa		
Email: moroolearthur@gmail.com			

REGION	
North West	

LOCATION	
Facility	Property

NATURE CONSERVATION PERMIT OFFICE NORTH WEST PROVINCE 28 Feb 2019, 10:19 AM Private Bag X2038 Mmabatho 2735 Tel: +27 (0)18 389 5130 Fax: +27 (0)18 389 5130 <i>Stamp of Issuing authority</i>	VALIDITY PERIOD FROM 26/02/2019 TO 25/02/2020	<i>Stamp if applicable</i>
---	--	--

 Signature of Issuing Authority (Basie Diolo) 28 Feb 2019, 10:19 AM	Page 1 of 3	 Signature of Permit Holder (Arthur Moroole) 28 Feb 2019, 10:19 AM
---	-------------	--

North West Department of Rural, Environment and Agricultural Development. (READ), Cnr. Dr. James Moroka Drive & Stadium Road, Mmabatho
 Contact Information: Tel: +27 (0)18 389 5130, Fax: +27 (0)18 389 5130, E-mail: jdenga@nwpg.gov.za
 Postal Address: Private Bag X 15, Mmabatho, 2735

APPENDIX

SPECIES INFORMATION

Scientific Name	Common Name	Number	Gender	Description/Markings
Helichrysum spp	All species of everlastings		Unknown	None

OTHER PARTIES INVOLVED

Full Name	ID Number	Contact	Involvement	Physical Address
SANBI South African National Biodiversity Institute	SANBI	Tel:0128043211	Identification and authentication	2 Cussonia Ave 2 Cussonia Ave, Brummeria, Pretoria, 0184, Gauteng, Republic of South Africa

ACTIVITIES

Activity Name

Collect
Transport
Research

STANDARD CONDITIONS

GENERAL CONDITIONS - ALL PERMITS

1) The Issuing Authority for this licence is : The Northwest Department of Rural, Environment and Agricultural Development (READ), Chief Directorate Environmental Services, Private Bag X 2039, Mmabatho, 2735, hereafter named "the Issuing Authority". 2) This permit, unless otherwise stated, is only valid within the boundaries of the North West Province (hereafter named "the Province") and then specifically as specified on the permit. 3) This permit is valid only : - a) for the specific species, sex and numbers as specified on this permit. b) for the specific activity / activities authorised, c) for the specified methods or instruments authorised. d) for the specific property / locality as specified. e) for the specific day, time or period stipulated. 4) This permit is only deemed valid : - a) in the original format and with the content as issued by the Issuing Authority. b) once it has been printed and the signature of the permit holder has been endorsed thereon in ink. 5) the Issuing Authority reserves the right to amend, withhold, withdraw or cancel any permit at any time. 6) This permit is not transferable to any individual, natural person, juristic person or any other legal identity. 7) Any alterations or attempt thereto, whether electronically or in any other way, shall immediately render it invalid. 8) This permit shall lapse and be deemed invalid when it is altered, lost or destroyed and no copy thereof shall be issued. 9) This permit shall also become invalid as soon as the permit holder loses possession of any animal, plant or derivative as the case may be, as specified on the permit. 10) This permit does not grant the permit holder automatic access to any Protected Area, National Park, Provincial Nature Reserve or privately owned land and : - a) the permit holder must beforehand obtain all other relevant written permissions, documents, rights and licences. b) the permit holder must comply with any other / further conditions or restrictions that the manager / landowner may stipulate at his / her discretion. 11) The permit holder must at all times while performing any restricted activity authorised by this permit, have the permit and all other relevant documentation in his / her possession and without delay make it available upon request by any authorized person. 12) An authorized person must also be allowed access onto the property at any reasonable time for any inspection needed and can remain on such property as long as it is needed to do the inspection. 13) The permit holder must immediately after completion of any activity authorised by this permit, record the required particulars in the space provided therefore or on the annexure or document attached hereto or in the prescribed register related to the permit. 14) The permit holder must return the original signed permit to the Issuing Authority within (14) fourteen days : - a) after performing or completing the authorised restricted activity, or b) after the date of expiry thereof whichever happens first, and c) if applicable furnish the Issuing Authority with a prescribed written feedback report on the results of every activity conducted. 15) The permit holder must retain a copy of the permit together with all other relevant written permissions, documents, rights and licenses for a period of at least (2) two years from date of issue or for as long as the permit holder is in possession of the animal, plant or derivative, whichever period is the longer. 16) If applicable, the permit holder shall apply for the renewal of the permit to the Issuing Authority, on the appropriate application form, at least (3) three months prior to the expiry date thereof. 17) Applications for renewal of this permit will only be processed after the original signed permit together with the prescribed written feedback report has been returned to the Issuing Authority. 18) This permit, during the period of validity thereof, is also subject to : - a) all applicable norms and standards in existence at the time of issuance. b) the provisions of any law in force, in respect of the specific species, activity, method or instrument to which this permit applies. 19) It is the permit holder's responsibility to obtain the correct information on any other legislation, specification, requirement or changes thereto that may be applicable or are required by any other Issuing Authority / Organization / Institute, relating to this permit. 20) By signing this permit, the permit holder declares that he / she is aware of the fact that : - a) any transgression or failure to return the original permit or failure to render the required reports can lead to criminal prosecution and also jeopardize any future applications by or in the name of the permit holder. b) if the permit holder contravenes or fails to comply with any permit condition or requirement, he / she shall be guilty of an offence. 21) The prescribed fees paid to the Issuing Authority for the issue of this permit shall not be refunded.

HARVESTING - COLLECT FOR SCIENTIFIC RESEARCH

1) The permit holder must ensure that : - a) specimens collected in terms of this permit is utilised for scientific purposes and only by the applicable institution or Issuing Authority as specified on this permit. b) specimens collected in term of this permit is not sold, bartered or given away. c) the written permission of the owner or occupier of land is obtained before any plant is harvested / picked. d) quantities of soil, rock or specimens is limited to the absolute minimum necessary for the research project. e) no endangered or specially protected specimens is collected. f) detailed record is kept on the specimens, quantities and localities where specimens are collected.

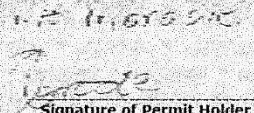
OCCUPATION - RESEARCH - (Non-Bioprospecting)

1) Should the research be conducted by a group, numbers specified are for the group as a whole and not per individual. 2) Written permission of the landowner or relevant authority must be obtained and must always be carried on such person with the valid permit. 3) Care should be taken not to harm non-target species. 4) An update report must be forwarded to the Issuing Authority which includes the permit holders name and contact details, species scientific and common name, numbers, date and locality (grid reference and description), Latitude and longitude as well as a copy of the written permission of the landowner where the activity had been conducted. 5) If applicable, at least one specimen per species should be lodged / housed at a South African Institute / Herbarium / Museum. 6) A copy of all completed reports, publications, or articles resulting from the project must be submitted free of charge to the Issuing Authority. 7) Should a report, publication, article or thesis arise from this project, an acknowledgement to the Issuing Authority. 8) Unless otherwise specifically indicated in writing, no material or specimens collected with this permit or material or specimens bred or propagated, from material or specimens collected with this permit, may be donated, sold or used for any commercial purpose by any party. 9) Type-specimens of any newly described / discovered species or other taxon collected must be lodged with a recognized South African institution /

Page 2 of 3


Signature of Issuing Authority
(Basie Diale)

28 Feb 2019, 10:19 AM


Signature of Permit Holder
(Arthur Moroole)

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Appendix G: A sample of an interview transcript from the study.

Date: 13 November 2019 Participant: Male traditional health practitioner

PARTICIPANT: S

DISTRICT: MAHIKENG

GENDER: MALE

Researcher: *Re ka simolola gee, re batla hela go itse gore Batswana ka setso ba thibela pelegi yang/* Okay, we can begin then, we simply want to know how Batswana, traditionally used different methods to prevent pregnancy.

Participant: *Eya/*Yes

Researcher: *Ka gone go nale mathata ka dithibela pelegi tsa sekgowa/* Because there are problems associated with western contraceptives

Participant: *Eya/*Yes

Researcher: *Ya ka ditlamorago/*Things like side effects

Participant: *Eya/*Yes

Researcher: *Le ko skolong ban aba ima go ntse go na le dicondom/*Teenage pregnancy at schools even though condoms are provided

Participant: *Ke nnete/* It is true

Researcher: *So ga di thuse ka sepe/* So they are not helpful

Participant: *Eya/*Yes

Researcher: *Ka jalo re leka to kwala ka kisto eno gore re bone re ka se thuse sechaba/* So we try to document this indigenous knowledge of ours and see if we cannot help somehow.

Participant: *Yes*

Researcher: Because our grandparents leave us (die), and leave with it.

Participant: *Eya/*Yes

Researcher: *Le go re re sobokanye go direla nako e tlang ha dipisisi or dokhondomo di seyo, re be rentse re nale kitso/* So we want to also preserve it so that in future, when these pills or condoms are no longer useful to us, at least we still have an alternative knowledge.

Eya/Yes

Researcher: *Ka gone sekgowa ke sone se se ikangwang/* Because western knowledge has overpowered our traditions.

Participant: Eya/Yes

Researcher: *Ka jalo ke ithuta ka kitso ka setso, thata re lebeletse kgang ya thibela pelegi ka setso/* So my research focus is on indigenous knowledge systems, with special attention to indigenous contraception.

Participant: Eya/Yes

Researcher: *Ka gone nako e ntsi go lebelelwa kgang ya thobalano le go tsala, ka jalo kare ke lebelele kgang ya go thibela/* Because too much focus is sometimes placed on conception, so I said, let me focus on this other side of prevention.

Participant: Eya/Yes

Researcher: *Ka jalo retla simolola ka basetsana gore mo malatsing a hetileng go ne go dirwang ka bone go thibela pelegi. Morago ga bone re tla bua ka bagolo, re be retsenya basimane le bontate/* So we will first begin the discussion on young girls, regarding what was done in the past to ensure that they don't fall pregnant. We thereafter discuss more matured women, if they don't want to have shorter birth spacing's, and then also include young boys' contraceptives and those for men.

Participant: Eya/Yes

Researcher: *Morago ga kgang eo re tla tla mo go ya go bolokega le go dira ga thibela pelegi morago ga thobalano/* And then from there it will be a matter of the safety and efficacy when a woman has slept with a male person without protection in the previous day,

Participant: Eya/Yes

Researcher: *Go tloga fao e tla nna kgang ya gore wena o tla tlhalosa tseo di tlhokagalang/* And from there it will be according to you, what is indigenous contraception

Participant: Eya/Yes.

Researcher: *ke tsone dikgang kgolo tseo retla simololang ka tsone/* Yes, those are the highlights that we can start on discuss.

Participant: *Eya, ka go utlwa rra/* I have heard you sir.

Researcher: *Eya/*Yes

Participant: *Nna maina a me ke Andrian Moruti Seleke/* My names are.....

Researcher: *Ka leboga/* Thank you.

Participant: *Go ya ka setso sa rona, re nale yone mekgwa ya go thibela pelegi, Ka setso sa Setswana. Mo nakong e ntsi re dirisa meila (go ikelela), jaanong re dirisa le ditlhare tsa setso, ra ditlhakanya re fe ngwana a nwe/*According to our tradition, we do have prevention of pregnancy, according to our Setswana culture. And more time we were people who used abstinence/taboo, so now these medicinal plants are present and we mix them, when we have mixed them like this, we give them to the child to drink.

Researcher: *Eya/*Yes,

Participant: *Eya, gaa kitla a nna mo mmeleng/* Yes, she won't fall pregnant.

Researcher: *Eya/*Yes

Participant: *Ngwana wa mosetsana/*A girl child

Researcher: *Eya/*Yes

Participant: *Gape rebereka ka kgole, ra mobofa/*And secondly, we can work on rope and tie her.

Researcher: *Eya/*Okay

Participant: *Re mo bofa mo thekeng, ga a kitla a nna mo mmeleng/*We tie her on the waist, she won't fall pregnant.

Researcher: *Eya/*Yes,

Participant: *Re kgona le go dirisa dijo, re tlhopa dijo tse a tshwanelang ke go dija. Ga a tshwanela go ja dijo tse di tshwanang le mahe, cheese, matokoma jalo jalo, thata dijo tse di nang le divithamins le diproteini.* We are also able to use food, we select food for to consume. She is not supposed to eat eggs, cheese and peanuts and other foods with too much vitamins and proteins. Researcher: *Eya/*Okay

*Gore mosetsana seke a nna mo mmeleng ga botlhofo/*So that, that child does not easily catch (fall pregnant).

Researcher: *Eya/Okay*

Participant: *Ke emeng ya ditsela tse re neng re di dirisa yaka Batswana/ Those are methods that we normally use as Batswana*

Researcher: *Eya/Okay*

Participant: *Le go dula o buwa le yena o mo tsenya mo tseleng go mo itsesi ka dilo tse ka diragalang, yaalo/Even to sit with her and talk to her to discipline her so that she is made aware that things like this happens like that,*

Researcher: *Eya/Okay.*

Participant: *Eya. Le ka mo letlhakoreng le leng la bontate re na le dithibela pelegi. Yes. Now even on the other side of men we have contraceptives. We used to use a certain part of the animal.*

Researcher: *Eya/Yes*

Participant: *Jaanong karolo e no ya phologolo, malana, notho wa monna o kgona go e tsenya mo botoneng ba gage a robale le mosadi ka go so mo imise. So this part of the animal, intestines, a male person is able to put it on his penis and sleep with a woman without impregnating her.*

Researcher: *Eya/Okay*

Participant: *Mosadi gaa kitla a nna mo mmeleng/ Woman can never fall pregnant.*

Researcher: *Eya/Yes*

Participant: *Le ena monna re kgona go mo bereka mo letheke. Ke kgona go mo phatsa mo theke gore a sekgone go nna le bana. /Even the man we can work on her waste, I can operate him so that he is not able to make a woman fall pregnant.*

Researcher: *Mang? Monna kgotsa mosadi/ Which one, a woman, man?*

Participant: *Motho wa ntate/ a ka se kgone go dira motho wa mme a ime/ Nako ele ha a batla go nna le bana re kgona go mo baakanya, re mo busetse gape thari ka go dirisa ditlhare/ Male person. He cannot make a woman fall pregnant. And then when we want him to make a woman pregnant, we reverse the process, using other medicinal plants.*

Researcher: *Eya/Yes*

Participant: *Go mo fetola/* To change him

Researcher: *Eya/*Okay

Participant: *A ba a kgona go nna le bana/*And he can then have children.

Researcher: *Eya/*Okay

Participant: *Ka mantswe a mang o nale ditshwetso tse pedi, ge a sa battle ke mo phatsa mo thekeng, a ka dirisa karolo ele ya phologolo eo a tsenyang mo bonneng ba gage/* So he has two choices, if he does not want to be operated on the waist, we do use that animal part that he puts on his penis.

Researcher: *Eya/*Yes

Participant: *A ka robala le mosadi fela mosadi eo ga kitla a nna mo mmeleng/*He can sleep with a woman, that woman won't fall pregnant.

Researcher: *Eya/*Yes,

Participant: *Ditsela di dintsi gore motho a sa nna mo mmeleng/* And there are many ways for a woman not to fall pregnant.

Researcher: *Eya/*Yes,

Participant: *Lenna ke kgona go tsaya mosetsana, ha ke sa battle go dirisa ditlhare, re tsaya jeke ya metsi, mosadi eo wa a nwa le nna ka nwa, ha re fetsa re dira thobalano. Ha a kitla a nna mo mmeleng. /*Myself I can also have a young girl, and if we don't want to use medicines, we take a huge Jug of water, that woman drink it and I also drink it, and we then engage in a sexual intercourse after drinking that water. She won't fall pregnant.

Researcher: *Eya/*Okay

Participant: *Dispeme tseo di tla nna metsi jaanong ga a kitla a nna mo mmeleng/*Those sperms will be watery and won't make her pregnant.

Researcher: *Eya/*Okay

*So ditsela di dintsi tsa go thibela pelegi ka setso/*So there are many ways that we can use to prevent pregnancy.

Researcher: *Eya, go a bonagala/*Yes indeed, they are a handful indeed.

Participant: *So ke gone ke go neelang*/Yes, so that is what I can offer you.

Researcher: *Eya*/ Okay,

Participant: *Eya*/Yes

Researcher: *A o ka mpha maina a ditlhare tse o didirisang go thibela palegi*/ Can you give me the names of those medicinal plants, especially those that are drunk. Even if it is just two.

Participant: *Ditlhare tseno dianowa, ke ditlahre tse pedi, eleng mojakabomo le tloenya*. These plants that are drunk are, it is only two plants, the first plant is called *mojakabomo* and the other one is called *tlhonya*.

Researcher: *Eya*/Yes.

Participant: *Wa di tlhakanya o be o tshela metsi o nwesa ngana jaaka molemo*. /You simply grind them and mix it with water, and give this child this *pitsa*.

Researcher: *Ke kopa o di boeletse gape*/ Do you use.... Please remind me, you say it's what?

Participant: *Mojakabomo le tlhonya, wa di bidis aka metsi o be di nwesa ngwana*/ *Mojakabomo le tlhonya*, you boil a bit in water and let the child drink the *pitsa*.

Researcher: *O dirisa karolo e feng ya setlhare?*/ *metang kgotsa matlhare kgotsa jang*/ Which part of the plant do you use? Roots or leaves

Participant: *Eya, metang*/Yes the roots.

Researcher: *Eya, metang. Jannong onwa jang, ka letsatsi kgotsa yang?*/ Okay the roots. And then she is supposed to drink it every day or how?

Participant: *Le fa a ka tsaya litara ya mole a e nwa go fitlha e fela ga a kitla a nna mo mmeleng*/ Even if she takes a liter and drink it, she won't fall pregnant

Researcher: *Eya*/Yes

Ka jalo nako ele fa a batla go nna mo mmelemg ke nna a tla mothusa gore a bowe a bone bana/ So that time when she want to fall pregnant, I am the one who will reverse the process, and then she can conceive.

Researcher: *A go ya ka gore o dingwaga dikae kgotsa ha go na sepe?* /Is there no age restrictions that she must be a certain age for her to take such medicine?

Participant: *Nyaya, ga go na kgang ya dingwaga/* No, there is no age restrictions.

Researcher: *Eya, ke fo mosadi mongwe le mongwe o kgonang go nna mo mmeleng/* Okay, as long as she is older enough to can fall pregnant.

Participant: *Eya/*Yes

Participant: *Eya/*Yes

Researcher: *A ditsela tse di bolokegegile? /*Are all these methods safe?

Participant: *Eya/*Yes.

Researcher: *E ne di a dira?/* And they are effective?

Participant: *Eya, fela atle le ntate kgotsa motsadi/* Yes, but she must come with parents or husband.

Researcher: *Ka kgang ya go thileba pelegi morago ga thobalano/* What about after prevention of pregnancy after sex.

Participant: *A ka tseya ditlhare tsele tse ke di umakileng/* She can take the plants that I have already mentioned.

Researcher: *Eya, eseng a le nosi/* Okay. Not that she come alone

Participant: *fa re batla gore a nne le bana gape re mo tsenya bo dibateng/* It is only that when we want her to conceive, we must then wash them out.

Researcher: *Eya, arere o tseile dingwaga tse tharo a thibela pelegi, go hetola gore a nne mo mmeleng ga go kitla go tsaya nako e telele kgotsa go nna thata? /*Okay, let us say she took three years to four years using them, to reverse the process, is it not going to be difficult.

*Nyaya ga gona mathata sepe se se thata/*No, there is no infection there is nothing problematic

Researcher: *Eya/ jaanong ka lebanta la letheke?/* okay. Alright. Now, the waste rope,

Participant: *Eya lebanta leo la bereka re tsenya le ditlhare tse rileng le mafura nyana/* Yes the waste rope is worked on using some medicines and some fats that we put on.

Researcher: *Eya/*Yes.

Participant: *Re tsaya mafura a phologolo re a tshasa bo lebanteng re be re mobopa mo thekeng gore a se tshole bana./* We take animal fat and we smear it on that rope, and then tie it on her waist to prevent her from falling pregnant

Researcher: *A o dula a le tsentse?* / Does she keep it all the time or what?

Participant: *Eya, o dula a le tsentse le ha a robala le monna o dula a le tsentse/* Yes, she keep it all the time, when she meets and sleep with a man she does not take off that rope. So with it as well there are no age restrictions?

Researcher: *Jaanong ha a dira thobalano ga le mosukudise?*/So when she engages in sexual acts, does it not disturb that rope?

Participant: *Nyaya le goka, it is tight so that the sperm does not enter the womb/*No, it does not disturb her in any way. It has just been tied so that the sperm cannot enter the womb

Researcher: *So le bofa ka gare ga popelo?*/Okay, it is also tied inside the womb?

Participant: *Eya, re fasa gore e kgone go tlhanoela popelo/* Yes, we tie in such a way that it turns the womb.

Researcher: *Jaanong gone go babalesegile/*But what about its safety?

Participant: *Nyaya, ga e na kotsi epe. Fa abowela mo go rona ra entsha, ha re fetsa ra motlhatswa/* No, it has no negative effects. It is only then that when she returns to us, we then take off that rope and cleanse her with medicinal plants.

Researcher: Eya/Yes.

Participant: Eya/Yes.

Researcher: *A batsadi ba gage ba bolellwa kgotsa ke sephiri/*So parents must also be aware or is it her secret alone?

Eya, ga a nale maikarabelo re kgona go mothusa, fela fa a le monnye o tshwanela ke go tla le batsadi/ Yes, when she is responsible, we can help her, but if she is still under age, her parents must accompany her.

Researcher: *A banna teng ha ofasa lebanta?/* They must also be present during the tying of the rope?

Participant: *Eya/ so that ba kgone go paka seo ba se boning/* Yes so that they can be witnesses on what happened.

Researcher: *A batla mo wena go batla thuso eno?/* Do they come for such help by the way?

Participant: *Eya, bale bantsi batla/ ke lgale ke thus aba le bantsi/* Yes, many of them, they come; I have helped many people in this regard.

Researcher: *Eya/Yes*

Participant: *Thatathata basetsana ba bannye ba ko Unibesithi, ke bathusa ka bonako/* Especially these young women who attend universities, we help them quickly.

Researcher: *Eya, kabona ditoro tse bonstsi ke diphiri?* Okay, I now see this matter, is sometimes kept secret.

Participant: *Eya/Yes*

Researcher: *Yone ha e bewe mo pepeneneng ya ka thobalano/*It is not always put in public like it is the case with conception.

Participant: *Eya, e berekiwa ya ka sephiri/*Yes, it is treated secretly.

Researcher: *Eya/Yes,*

Participant: *Ke tsela e re dirang dilo ka yone ka setso sa Setswana/* It is our way of doing things based on the Setswana traditions.

Researcher: *Ha se kitso ya sechaba ka kakaretso/* It is not public knowledge

Participant: *Eya, go tsentse le go ila, re bollella bana gore dira se, se dire sele/* Yes, including *maila*, when we tell the child do this don't do this, if you do this, this will happen.

Researcher: *Eya/Yes.*

Participant: *Eya, a lebanta lele le bereka le mo basimaneng kgotsa ke la basetsana fela? /* Yes. So this rope, does it also work in boys, or is it only used among girls?

Participant: *Nyaya ke la basetsana fela/*No we only use it among girls only.

Researcher: *Eya ka gone ke bone b aba nnang mo mmeleng/*Okay, because they are the ones that fall pregnant.

Participant: *Bann aba na le tse pedi, go diri sa malana kgotsa re ba sebetsa letheke/* men have two option, to be operated, or to use the animal part, we put on his penis.

Researcher: *Eya/* Yes

Participant: *karolo e ya phologologo ke malana fela/*This part of the animal, is simply just an animal intestine

Researcher: *Eya/*Okay

Participant: *E bonolo/*It is soft,

Researcher: *ke nnete/*True

Participant: *Ha go se seng gape/*There is nothing more to it.

Researcher: *ka ipotsa go reng di thibela pelegi tseno di sa letlelelwa lo go rutiwa batho/* I just wonder why it that these methods are not being used or recognized by for example department of health, but we will come back to that point, or is that they don't have such knowledge.

Participant: *Eya, gaba na kitso ka tsone/*Yes, they don't have our knowledge.

Researcher: *Eya/*Yes.

Participant: *Se se re thswenyang bontsi ba rona ke gore ba tseyo kitso ya rona ba be dira melao e regatelelang, Jaaka disprin, ra itse e dirwe k aka setlhare, setlhare seo ke tlhoka la tsela b aba tsenya dichemical tse dingwe/* Now what bothers us most is that, they want to suck us our knowledge, and on top of that they want to control us and put laws for us. But we don't put laws for them. For example, this disprin, we know it is made up of our plant, but when they come they say no, it can help you with your headache, but then what is this desprin? While I know that this desprin was made using *tlhoko la tsie*, and they put some chemicals.

Researcher: *Eya/*Yes.

Participant: *Mare bagana go re fa kitso ya bone bare o ye for dingwaga tse supa/*Yes, they refuse to give us their knowledge, they will tell you to go for seven years to study medicine.

Researcher: *Eya/*Yes,

Participant: *Ke tsone tseo gee tsa thibela pelegi ka setso sa rona Batswana/* That is all about what I know regarding indigenous contraception among the Batswana

Researcher: *Eya go lebogile nna/*Yes I am gratefulme too

Participant: *Eya lenna*/Yes me too

Researcher: *Go siame rra*/ Okay Elder,

Participant: *Eya go siame*/ Yes alright

Appendix H: A structured research questionnaire used as a tool during the survey.

Research questionnaire on the Batswana women's knowledge, attitudes and perceptions towards indigenous contraception

I, respondent, give consent to participate in the study and I know I can withdraw at any time

YES

SECTION A: Knowledge regarding indigenous contraception among the Batswana women

Mark "X" on the correct answer. You can choose more than one answer from 1-8.

1. Which practice (s) of indigenous contraception do you know?

- A. Birth Spacing B. Virginity C. Taboos D. None

2. What is the time required between two consecutive pregnancies?

- A. 3 to 6 months B. 1 to 2 years C. 3-5 years D. I do not know

3. Which taboos of indigenous contraception do you know?

- A. No sex after death B. No sex after miscarriage C. No sex during menstruation D. None

4. Which other taboos of indigenous contraception do you know?

- A. No sex after divorce B. No sex after abortion C. No sex after birth D. None

5. Which natural technique(s) of indigenous contraception do you know?

- A. Withdrawal B. Abstinence C. Avoiding certain foods D. None

6. Which traditional technique(s) of indigenous contraception do you know?

- A. Use of animal intestines B. Waist rope C. Burying menstruation D. None

7. Which other technique(s) of indigenous contraception do you know?

- A. Male waist technique B. Vaginal stitch C. Drinking a lot of water D. None

8. Which traditional techniques of indigenous contraception do you know?

- A. Use of medicinal plants B. Child burial technique C. Soil eating D. None

9. Which part of the plant is used for contraception?

- A. Roots B. Leaves C. Seeds D. Do not know

10. Do you know any medicinal plant used for contraception?

- A. Yes B. No

SECTION B. Attitudes of the Batswana women toward indigenous contraception.

Please choose only one answer from the five options provided.

No	Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
11	The community must use indigenous contraception					
12	Indigenous contraception must be documented					
13	Indigenous contraception must be provided at clinics					
14	Indigenous contraception must be taught at school					

SECTION C. Perceptions of the Batswana women towards indigenous contraception.

Please choose only one answer from the five options provided by marking with "X"

No	Statement	Very bad	Bad	Fair	Good	Very good
15	Safety of indigenous contraception					
16	Effectiveness of indigenous contraception					
17	Affordability of medicinal plants used for contraception					
18	Accessibility of medicinal plants used for contraception					

SECTION D: Demographic data of the respondent

Please select an appropriate option by marking with an X"

Age	20-29	30-39	40-49	50-59	60+
Marital status	Single	Married		Divorcee	Widow
Number of children	0	1-3		4-6	>6
Highest education	No schooling	Primary		Secondary	Higher education
Employment	Employed	Unemployed		Self-employed	

**Patlisiso ka kitso, maikutlo le kakanyo ya bomme ba Batswana mabapi le
thibela pelegi ka setso**

Ke dumela go tsaya karolo mo thutong eno, mme ka itse gore ke ka tlogela nako engwe le engwe

YES

Karolo A: Kitso ka thibela pelegi ka setso mo go bomme ba Batswana

Dira "X" mo karabong e matshwanedi. O ka tlhopa go feta gangwe mo go 1-8.

1. Ke tirafatso efeng ya thibela pelegi ka setso e o itseng?

A. Go tsaya nako go tthatlhamisa B. Go se tsene mo thobalong C. Go ila) D. Sepe

2. Go tsewa nako e kae pele ga go tthatlhamisa?

A. 3 to 6 months B. 1 to 2 years C. 3-5 years D. Ga ke itse

3. Ke meila efeng e o itseng ya go se tsene mo thobalanong?

A. Morago ga losho B. Morago ga mishareije C. Ha mme a le mo kgwedding D. Sepe

4. Ke meila efeng ya thibela pelegi ya setso eo itseng?

A. Morago ga kgaogano B. Morago ga aboshene C. Morago ga go tsala D. Sepe

6. Ke ditsela tse feng tsa thibela pelegi ka setso e o itseng?

A. Rre o ikgogela morago B. Absteina C. Go tlhopa dijo D. Sepe

6. Ke ditsela tse feng tsa thibela pelegi ka setso tse o diitseng?

A. Malana a phologolo B. Thapo ya letheka C. Go fitlha madi a mme a kgwedi D. Sepe

7. Ke ditsela tse feng tsa thibela pelegi ka setso tse o diitseng?

A. Go phatsa theka la rre B. Go fasa bokapele ba le kgarebe C. Go nwa metsi D. Sepe

8. Ke karolo efeng ya setlhare e dirisiwang go thibela pelegi?

A. Metso B. Matlhare C. Peo D. Ga ke itse

9. Ke ditsela tse feng tsa thibela pelegi tse o di itseng?

A. Go dirisa ditlhare B. Tsela ya go boloka ngwana C. Go ja mmu D. Sepe

10. Do you know any medicinal plant used for contraception?

A. Eya B. Le eseng

Appendix I: Cross tabulations that formed part of the results from the survey.

Age

Total								
		20--29	30--39	40--49	50--59	60+		
Usage	Strongly disagree	Count	18	3	0	0	1	22
		% within Usage	81,8%	13,6%	0,0%	0,0%	4,5%	100,0%
		% within Age	13,4%	3,3%	0,0%	0,0%	2,0%	5,7%
	Disagree	Count	20	6	7	8	5	46
		% within Usage	43,5%	13,0%	15,2%	17,4%	10,9%	100,0%
		% within Age	14,9%	6,5%	10,6%	19,5%	10,0%	12,0%
	Neutral	Count	19	11	9	0	0	39
		% within Usage	48,7%	28,2%	23,1%	0,0%	0,0%	100,0%
		% within Age	14,2%	12,0%	13,6%	0,0%	0,0%	10,2%
	Agree	Count	56	57	34	14	21	182
		% within Usage	30,8%	31,3%	18,7%	7,7%	11,5%	100,0%
		% within Age	41,8%	62,0%	51,5%	34,1%	42,0%	47,5%
	Strongly agree	Count	21	15	16	19	23	94
		% within Usage	22,3%	16,0%	17,0%	20,2%	24,5%	100,0%
		% within Age	15,7%	16,3%	24,2%	46,3%	46,0%	24,5%
Total	Count	134	92	66	41	50	383	
	% within Usage	35,0%	24,0%	17,2%	10,7%	13,1%	100,0%	
	% within Age	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	

			Age					
			20--29	30--39	40--49	50--59	60+	Total
Documentation	Strongly disagree	Count	9	0	0	0	1	10
		% within Document	90,0%	0,0%	0,0%	0,0%	10,0%	100,0%
		% within Age	6,7%	0,0%	0,0%	0,0%	2,0%	2,6%
	Disagree	Count	8	6	6	6	4	30
		% within Document	26,7%	20,0%	20,0%	20,0%	13,3%	100,0%
		% within Age	6,0%	6,5%	9,1%	14,6%	8,0%	7,8%
	Neutral	Count	30	11	6	0	0	47
		% within Document	63,8%	23,4%	12,8%	0,0%	0,0%	100,0%
		% within Age	22,4%	12,0%	9,1%	0,0%	0,0%	12,3%
	Agree	Count	47	60	38	17	26	188
		% within Document	25,0%	31,9%	20,2%	9,0%	13,8%	100,0%
		% within Age	35,1%	65,2%	57,6%	41,5%	52,0%	49,1%
	Strongly agree	Count	40	15	16	18	19	108
		% within Document	37,0%	13,9%	14,8%	16,7%	17,6%	100,0%
		% within Age	29,9%	16,3%	24,2%	43,9%	38,0%	28,2%
Total		Count	134	92	66	41	50	383
		% within Document	35,0%	24,0%	17,2%	10,7%	13,1%	100,0%
		% within Age	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%

			Age					Total
			20--29	30--39	40--49	50--59	60+	
Clinics	1	Count	6	1	0	0	2	9
		% within Clinics	66,7%	11,1%	0,0%	0,0%	22,2%	100,0%
		% within Age	4,5%	1,1%	0,0%	0,0%	4,0%	2,3%
	2	Count	19	6	8	8	3	44
		% within Clinics	43,2%	13,6%	18,2%	18,2%	6,8%	100,0%
		% within Age	14,2%	6,5%	12,1%	19,5%	6,0%	11,5%
	3	Count	32	14	5	2	0	53
		% within Clinics	60,4%	26,4%	9,4%	3,8%	0,0%	100,0%
		% within Age	23,9%	15,2%	7,6%	4,9%	0,0%	13,8%
	4	Count	53	46	25	17	21	162
		% within Clinics	32,7%	28,4%	15,4%	10,5%	13,0%	100,0%
		% within Age	39,6%	50,0%	37,9%	41,5%	42,0%	42,3%
	5	Count	24	25	28	14	24	115
		% within Clinics	20,9%	21,7%	24,3%	12,2%	20,9%	100,0%
		% within Age	17,9%	27,2%	42,4%	34,1%	48,0%	30,0%
Total	Count		134	92	66	41	50	383
	% within Clinics		35,0%	24,0%	17,2%	10,7%	13,1%	100,0%
	% within Age		100,0%	#####	100,0%	100,0%	100,0%	100,0%

		20--29	30--39	Age 40--49	50--59	60+	Total
School 1	Count	2	5	9	0	3	19
	% within School	10,5%	26,3%	47,4%	0,0%	15,8%	100,0%
	% within Age	1,5%	5,4%	13,6%	0,0%	6,0%	5,0%
2	Count	6	1	1	8	2	18
	% within School	33,3%	5,6%	5,6%	44,4%	11,1%	100,0%
	% within Age	4,5%	1,1%	1,5%	19,5%	4,0%	4,7%
3	Count	14	13	7	5	3	42
	% within School	33,3%	31,0%	16,7%	11,9%	7,1%	100,0%
	% within Age	10,4%	14,1%	10,6%	12,2%	6,0%	11,0%
4	Count	77	49	22	12	18	178
	% within School	43,3%	27,5%	12,4%	6,7%	10,1%	100,0%
	% within Age	57,5%	53,3%	33,3%	29,3%	36,0%	46,5%
5	Count	35	24	27	16	24	126
	% within School	27,8%	19,0%	21,4%	12,7%	19,0%	100,0%
	% within Age	26,1%	26,1%	40,9%	39,0%	48,0%	32,9%
Total	Count	134	92	66	41	50	383
	% within School	35,0%	24,0%	17,2%	10,7%	13,1%	100,0%
	% within Age	100,0%	#####	100,0%	100,0%	100,0%	100,0%

Crosstab							
		education					
		H	N	P	S	Total	
School	1	Count	6	0	8	5	19
		% within School	31,6%	0,0%	42,1%	26,3%	100,0%
		% within education	4,2%	0,0%	15,1%	2,9%	5,0%
	2	Count	8	1	2	7	18
		% within School	44,4%	5,6%	11,1%	38,9%	100,0%
		% within education	5,6%	6,7%	3,8%	4,1%	4,7%
	3	Count	19	0	7	16	42
		% within School	45,2%	0,0%	16,7%	38,1%	100,0%
		% within education	13,3%	0,0%	13,2%	9,3%	11,0%
	4	Count	72	10	20	76	178
		% within School	40,4%	5,6%	11,2%	42,7%	100,0%
		% within education	50,3%	66,7%	37,7%	44,2%	46,5%
	5	Count	38	4	16	68	126
		% within School	30,2%	3,2%	12,7%	54,0%	100,0%
		% within education	26,6%	26,7%	30,2%	39,5%	32,9%
Total	Count	143	15	53	172	383	
	% within School	37,3%	3,9%	13,8%	44,9%	100,0%	
	% within education	100,0%	#####	100,0%	100,0%	100,0%	

		Age				60+	Total	
		20--29	30--39	40--49	50--59			
Safety	1	Count	14	3	3	6	5	31
		% within Safety	45,2%	9,7%	9,7%	19,4%	16,1%	100,0%
		% within Age	10,4%	3,3%	4,5%	14,6%	10,0%	8,1%
	2	Count	39	10	9	4	1	63
		% within Safety	61,9%	15,9%	14,3%	6,3%	1,6%	100,0%
		% within Age	29,1%	10,9%	13,6%	9,8%	2,0%	16,4%
	3	Count	44	49	18	12	16	139
		% within Safety	31,7%	35,3%	12,9%	8,6%	11,5%	100,0%
		% within Age	32,8%	53,3%	27,3%	29,3%	32,0%	36,3%
	4	Count	29	26	20	11	17	103
		% within Safety	28,2%	25,2%	19,4%	10,7%	16,5%	100,0%
		% within Age	21,6%	28,3%	30,3%	26,8%	34,0%	26,9%
	5	Count	8	4	16	8	11	47
		% within Safety	17,0%	8,5%	34,0%	17,0%	23,4%	100,0%
		% within Age	6,0%	4,3%	24,2%	19,5%	22,0%	12,3%
Total		Count	134	92	66	41	50	383
		% within Safety	35,0%	24,0%	17,2%	10,7%	13,1%	100,0%
		% within Age	100,0%	#####	100,0%	100,0%	100,0%	100,0%

Age

		20--29	30--39	40--49	50--59	60+	Total	
Age							Total	
Affordability	1	Count	8	15	7	11	9	50
		% within Affordability	16,0%	30,0%	14,0%	22,0%	18,0%	100,0%
		% within Age	6,0%	16,3%	10,6%	26,8%	18,0%	13,1%
	2	Count	28	13	6	7	5	59
		% within Affordability	47,5%	22,0%	10,2%	11,9%	8,5%	100,0%
		% within Age	20,9%	14,1%	9,1%	17,1%	10,0%	15,4%
	3	Count	44	32	38	9	22	145
		% within Affordability	30,3%	22,1%	26,2%	6,2%	15,2%	100,0%
		% within Age	32,8%	34,8%	57,6%	22,0%	44,0%	37,9%
	4	Count	19	11	12	12	9	63
		% within Affordability	30,2%	17,5%	19,0%	19,0%	14,3%	100,0%
		% within Age	14,2%	12,0%	18,2%	29,3%	18,0%	16,4%
	5	Count	35	21	3	2	5	66
		% within Affordability	53,0%	31,8%	4,5%	3,0%	7,6%	100,0%
		% within Age	26,1%	22,8%	4,5%	4,9%	10,0%	17,2%
Total		Count	134	92	66	41	50	383
		% within Affordability	35,0%	24,0%	17,2%	10,7%	13,1%	100,0%
		% within Age	100,0%	#####	100,0%	100,0%	100,0%	100,0%

			20--29	30--39	40--49	50--59	60+	
Accessibility	1	Count	25	20	14	10	13	82
		% within Accessibility	30,5%	24,4%	17,1%	12,2%	15,9%	100,0%
		% within Age	18,7%	21,7%	21,2%	24,4%	26,0%	21,4%
	2	Count	41	18	11	17	18	105
		% within Accessibility	39,0%	17,1%	10,5%	16,2%	17,1%	100,0%
		% within Age	30,6%	19,6%	16,7%	41,5%	36,0%	27,4%
	3	Count	38	34	26	11	12	121
		% within Accessibility	31,4%	28,1%	21,5%	9,1%	9,9%	100,0%
		% within Age	28,4%	37,0%	39,4%	26,8%	24,0%	31,6%
	4	Count	18	11	5	2	7	43
		% within Accessibility	41,9%	25,6%	11,6%	4,7%	16,3%	100,0%
		% within Age	13,4%	12,0%	7,6%	4,9%	14,0%	11,2%
	5	Count	12	9	10	1	0	32
		% within Accessibility	37,5%	28,1%	31,3%	3,1%	0,0%	100,0%
		% within Age	9,0%	9,8%	15,2%	2,4%	0,0%	8,4%
Total	Count		134	92	66	41	50	383
	% within Accessibility		35,0%	24,0%	17,2%	10,7%	13,1%	100,0%
	% within Age		100,0%	#####	100,0%	100,0%	100,0%	100,0%

Appendix J: A certificate of compliance with Organisation for Economic Corporation and Development (OECD) guidelines by the facility responsible for animal experiments.



CERTIFICATE OF COMPLIANCE

In terms of section 22(2) (b) of the Accreditation for Conformity Assessment, Calibration and Good Laboratory Practice Act, 2006 (Act 19 of 2006), read with sections 23(1), (2) and (3) of the said Act, I hereby certify that:

NORTH WEST UNIVERSITY (NWU)

Co. Reg. No: N/A

DST/NWU PRECLINICAL DRUG DEVELOPMENT PLATFORM (PCDDP)

Facility Compliance Number: G0019

is a south African National Accreditation System compliant facility provided that all conditions and requirements are complied with

This certificate is valid as per the scope as stated in the accompanying schedule of compliance. Annexure 'A', bearing the above number for

TOXICITY TESTING

Conducted on : **Industrial, Pharmaceutical & Veterinary Drugs**

Date of inspection : **09 December 2015**

The facility is in compliance with the OECD Principles of Good Laboratory Practice (1997) in the conduct of non-clinical and environmental safety studies of test items contained in Industrial, pharmaceutical products and veterinary drugs

While this certificate remains valid, the compliant facility named above is authorised to use the relevant accreditation symbol to issue reports and/or certificates



Dr E.J. Steyn

Acting Chief Executive Officer

Effective Date: 07 March 2016
Certificate Expires: 06 March 2018



Appendix K: A report summarising methods and results for the cytotoxicity study.

1. Background

Cytotoxicity potential of a natural product was determined using the MTT assay as a colorimetric assay. A yellow water-soluble tetrazolium (3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) is reduced by metabolically active mitochondrial dehydrogenase enzymes to purple, water insoluble formazan crystals within the cell (Mosmann, 1983). The water insoluble formazan crystals can be dissolved to provide a colour change, which can be spectrophotometrically measured and provides an estimate of the number of metabolically active (viable) cells.

The relative percentage viable cells were calculated and were expressed as percentage cell viability relative to the untreated control (assumed to be 100% viable).

All MTT experiments were performed in six-fold (two biological repeats of three technical repeats each). SPSS statistical analysis software (IBM Analytics, Version 25), in conjunction with the Probit Analysis Method, were then used to calculate IC₅₀ (50% viability inhibition) values and 95% confidence limit ranges from the MTT analyses.

2. Aim of services

The assessment of product toxicity *in vitro* in a cell culture model, using the standard cell viability assay; the 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyl tetrazolium bromide (MTT).

3. Agreed to service levels and fees

Nature of products:

Natural product – Provided as plant extract, subsequently freeze-dried by PCCS.

Number of samples:

One

Expected time of exposure:

72 hours – every 24 hours treatment.

Expected concentrations for each sample:

5 µg/ml; 20 µg/ml; 50 µg/ml; 100 µg/ml; 300 µg/ml; 700 µg/ml; 1000 µg/ml; 2000 µg/ml – starting series. To be discussed following first experiments if necessary to adjust.

Solvent:

Water-soluble

Payment Terms:

Invoices will be prepared monthly with reports of the month's results, to be paid as stipulated by the service contract.

4. Materials and methodology

The Vero cell line (African green monkey; kidney; normal; epithelial) frequently used to screen natural products were hosted by NWU, Potchefstroom. Briefly, cells at passages 11-12 were seeded at 3 000 cells per well of a 96-well plate and incubated for 24 h in 5% CO₂ at 37°C, to adhere to the surface area. After which they were treated every 24 hours at serial dilutions of concentration ranging between 5 and 2 000 µg/ml for a duration of 72 h before the cytotoxicity assay was initiated. The tested compound was dissolved in complete culture media at 2 000 µg/ml, filtered through a 0.22 µm

Appendix

Appendix L: A report summarising extract preparation and administration for acute oral toxicity study.

  	
Study Title	An exploration of indigenous contraception among the Botswana of Ngaka Modiri Molema District Municipality, North West Province, South Africa
Addendum title	Log Sheet: Administration of Plant Extract to female Sprague Dawley Rats
NWU Study Reference	NWU-00598-19-A5
Study initiation date	10/08/2020
Page no	Page 1 of 2

DATE: 10/08/2020

Compound and Animal Description for Acute Oral Toxicity Study	
Compound Description	2000 mg of Crude Plant Extract (dry powder) in white container labelled: Prot Serwis Madikane Plant Extract
Date Received	05/08/2020
Date Manufactured	Not indicated
Expiry Date	Not indicated
Dosage	2000 mg of crude plant extract per kg body mass
Solvent	Deionized Water
Volume of Dose	0.2 ml per 100g body mass
Route of Administration	Oral
Animal Species and Strain	Rat; Sprague Dawley
Genetic Status	Outbred
Microbiological Status	Bred under Specific Pathogen Free Conditions
Gender	♀
D.O.B	12/06/2020

ID	Ear Map	Body Mass (g)	Time	Amount Compound required per BM (mg)	Maximum Volume per rat (2ml per 100g BM)
1.		198.89	10H07	397.78 mg	3.98 ml
2.		201.35	10H08	402.7 mg	4.03 ml
3.		192.20	10H10	384.4 mg	3.84 ml

NOTES: Mean amount of crude compound required per BM = 394.6 mg x 4 doses (to provide for spills) = 1579.84 mg that is required in total. A mean dose volume of 395 x 4 ml may be administered by oral gavage. Thus, weigh out 1579.84g of crude extract and add gradually deionized water until fully dissolved (maximum volume of solution: 16 ml)

PTO

Appendix

M: A report summarising results for the acute oral toxicity study.

NWU®		PCDDP US/NWU Preclinical Drug Development Platform		science & innovation Department Science and Innovation REPUBLIC OF SOUTH AFRICA	
Study Title	An exploration of indigenous contraception among the Botswana of Ngaka Modiri Molema District Municipality, North West Province, South Africa				
Addendum title	Log Sheet: Clinical Signs of Acute Oral Toxicity in female Sprague Dawley Rats				
NWU Study Reference	NWU-00596-19-A5				
Study initiation date	10/08/2020	Page no	Page 3 of 3		

		Degree of Severity (Clinical Signs)											
		DATE: 10/08/2020											
		12H05		12H07		12H08		12H09		12H10		12H13	
		Rat ID 1		Rat ID 2		Rat ID 3		Rat ID 4		Rat ID 5		Rat ID 6	
		Ear Map		Ear Map		Ear Map		Ear Map		Ear Map		Ear Map	
#	Health Indicator	1		2		3		4		5		6	
1.	Body Mass (g)	200.23		210.93		193.10							
2.	% Loss in Body Mass	0	1	2	3	0	1	2	3	0	1	2	3
3.	Respiration	0	1	2	3	0	1	2	3	0	1	2	3
4.	Gait	0	1	2	3	0	1	2	3	0	1	2	3
5.	Piloerection	0	1	2	3	0	1	2	3	0	1	2	3
6.	Neurological Signs	0	1	2	3	0	1	2	3	0	1	2	3
7.	Vocalisation	0	1	2	3	0	1	2	3	0	1	2	3
8.	Eyes	0	1	2	3	0	1	2	3	0	1	2	3
9.	Malocclusion	0	1	2	3	0	1	2	3	0	1	2	3
10.	Salivation	0	1	2	3	0	1	2	3	0	1	2	3
11.	Dehydration	0	1	2	3	0	1	2	3	0	1	2	3
12.	Chromodachryorrhea	0	1	2	3	0	1	2	3	0	1	2	3
13.	Appearance of Fur	0	1	2	3	0	1	2	3	0	1	2	3
14.	Abdomen	0	1	2	3	0	1	2	3	0	1	2	3
15.	Prolapse (Rectal, Penile, Vaginal)	0	1	2	3	0	1	2	3	0	1	2	3
16.	Consistency of Faeces	0	1	2	3	0	1	2	3	0	1	2	3
17.	Bladder Control (Incontinence or Retention)	0	1	2	3	0	1	2	3	0	1	2	3
18.	Blood in Stool	0	1	2	3	0	1	2	3	0	1	2	3
19.	Blood in Urine	0	1	2	3	0	1	2	3	0	1	2	3
20.	Abnormal Bleeding, Discharge from any Orifice	0	1	2	3	0	1	2	3	0	1	2	3
21.	Behaviour	0	1	2	3	0	1	2	3	0	1	2	3
TOTAL SCORE		1		0		1							
NOTES: 30 minutes after administration of plant extract/vocalization during handling													
LAT	K Venter	J Venter		Veterinarian (if applicable)		N/A		N/A					

PTO

Appendix

N: Results showing phytochemicals detected from aqueous extracts of *Teucrium trifidum*, *Helichrysum caespitium*, and *Bulbine frutescens* respectively.

RDM Potchefstroom Results Chromatogram

Sample name A:1

Sample injection

volume (uL): 1

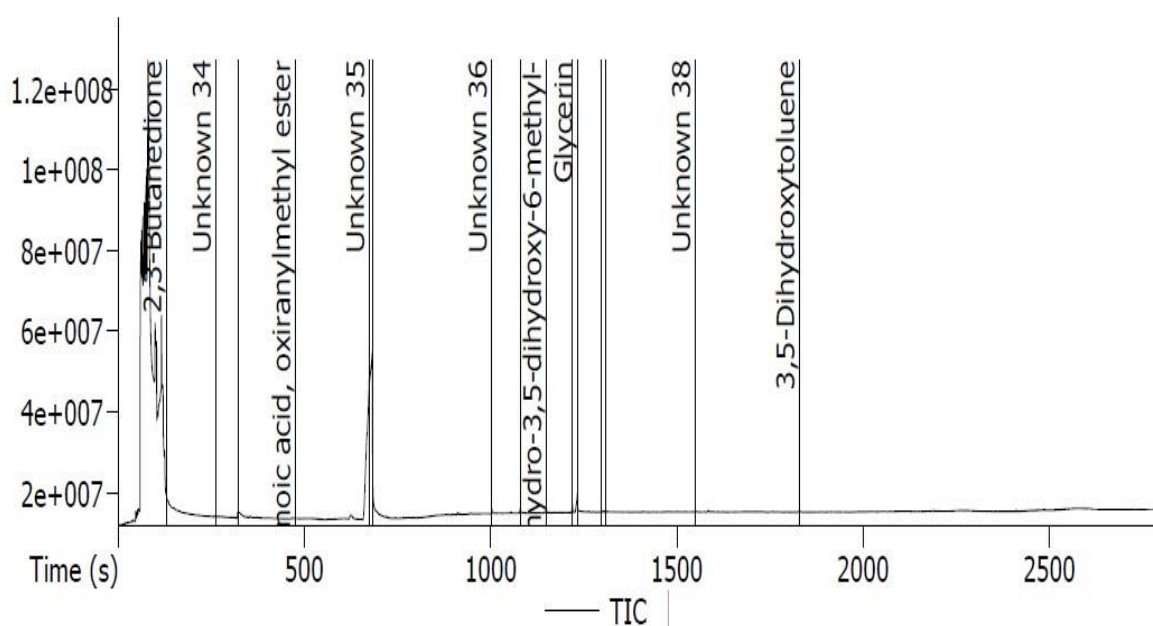
GC method used: jhlj-Mahikeng_2019_des

MS

method Used: jhlj-Mahikeng-2019

Comments:

Operator: Dr JHL Jordaan 12/4/2019



Peak #	Name	R.T. (s)	UniqueMass	Analyte Type	Calibration	Conc. Units	Area	Area %	S/N	Similarity	Sample Concentration
1	2,3-Butanedione	129.6	42		Uncalibrated		118372	0.014718	131.65	964	
2	Unknown 34	261.6	91		Uncalibrated		745052	0.092640	1395.7	708	
3	Acetic acid	321.6	42		Uncalibrated		13319296	1.6561	520.01	917	
4	2-Propenoic acid, oxiranylmethyl ester	475	55		Uncalibrated		587366	0.073033	1133.6	879	
5	Unknown 35	673.6	40		Uncalibrated		48435197	6.0224	14.715	719	
6	2,3-Butanediol	682.4	27		Uncalibrated		447193088	55.604	13503	921	
7	Unknown 36	1003.3	57		Uncalibrated		20978612	2.6085	1386.0	716	
8	1,3-Dihydroxyacetone dimer	1079.5	31		Uncalibrated		27391035	3.4058	2198.7	870	
9	4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl-	1149.3	101		Uncalibrated		27813085	3.4583	1691.5	883	
10	2-Methoxy-4-vinylphenol	1219	135		Uncalibrated		38919238	4.8392	6404.0	954	
11	Glycerin	1232.9	61		Uncalibrated		157295530	19.558	19469	955	
12	Unknown 37	1298	84		Uncalibrated		7641478	0.95014	1096.0	746	
13	Benzaldehyde, 3-methyl-	1307.8	120		Uncalibrated		5281796	0.65674	2133.1	846	
14	Unknown 38	1549.9	59		Uncalibrated		8355385	1.0389	2283.6	751	
15	3,5-Dihydroxytoluene	1828.6	62		Uncalibrated		170803	0.021238	78.330	903	

RDM Potchefstroom Results Chromatogram

Sample name B:1

Sample injection

volume (uL): 1

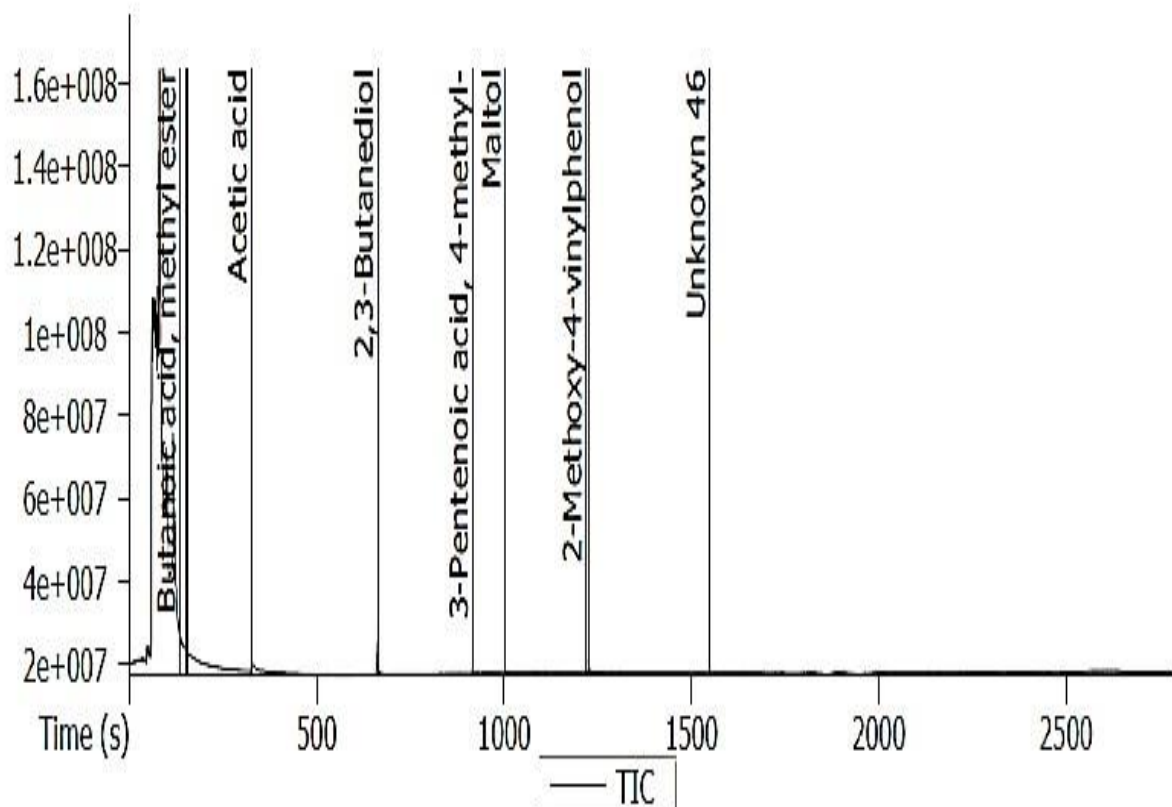
GC method used: jhlj-Mahikeng_2019_des

MS

method Used: jhlj-Mahikeng-2019

Comments:

Operator: Dr JHL Jordaan 12/4/2019



Peak #	Name	R.T. (s)	UniqueMass	Analyte Type	Calibration	Conc. Units	Area	Area %	S/N	Similarity	Sample Concentration
1	Butanoic acid, methyl ester	135.9	74		Uncalibrated		1330134	0.26303	1878.3	930	
2	Unknown 45	152.4	43		Uncalibrated		884736	0.17437	1314.8		
3	3-Pentanone	153.9	57		Uncalibrated		156526	0.030849	1334.6	913	
4	Acetic acid	328.1	42		Uncalibrated		25435290	5.0130	751.63	930	
5	2,3-Butanediol	663.7	45		Uncalibrated		335747528	66.172	32385	979	
6	3-Pentenoic acid, 4-methyl-	918.9	99		Uncalibrated		13763746	2.7127	1572.9	889	
7	Maltol	1003.8	71		Uncalibrated		11182296	2.2039	1145.2	862	
8	2-Methoxy-4-vinylphenol	1219.1	135		Uncalibrated		94028333	18.561	14383	952	
9	Glycerin	1228	81		Uncalibrated		25605426	5.0465	4455.3	877	
10	Unknown 46	1549.8	59		Uncalibrated		9243504	1.8218	3165.5	739	

RDM Potchefstroom Results Chromatogram

Sample name C:1

Sample injection

volume (uL): 1

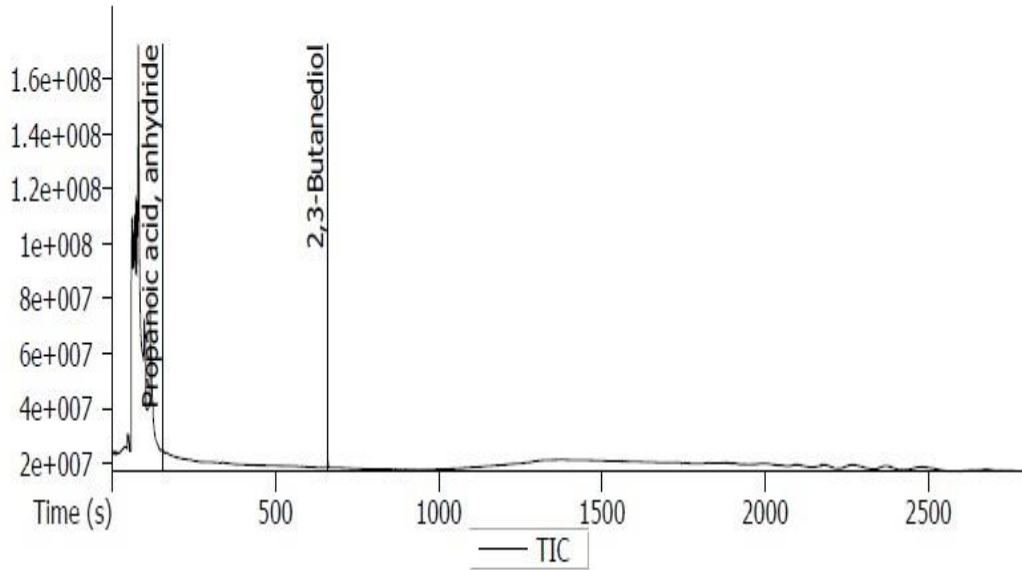
GC method used: jhlj-Mahikeng_2019_des

MS

method Used: jhlj-Mahikeng-2019

Comments:

Operator: Dr JHL Jordaan 12/4/2019



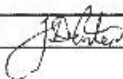
Peak #	Name	R.T. (s)	UniqueMass	Analyte Type	Calibration	Conc. Units	Area	Area %	S/N	Similarity	Sample Concentration
1	Propanoic acid, anhydride	153.8	57		Uncalibrated		282272	0.48918	1858.4	981	
2	2,3-Butanediol	660.8	75		Uncalibrated		57422873	99.511	562.80	937	

Appendix O: A report showing the number of pregnant rats from the efficacy study.

  	
Study Title An exploration of indigenous contraception among the Botswana of Ngaka Modiri Molema District Municipality, North West Province, South Africa	
Addendum title Log Sheet: Clinical Signs in female Sprague Dawley Rats	
NWU Study Reference NWU-00596-19-A5	Page no Page 2 of 2
Study initiation date 12/10/2020	

TABLE 1: SEVERITY INDEX FOR CLINICAL SIGNS IN SD FEMALE RATS

ID	Ear Map	Body Mass (g)	% Loss in BM	Other Clinical Signs	TOTAL INDEX	Time
1.1		394.2	+ 2.0	0 (P)	0	07:36
1.2		414.3	+ 2.1	0 (P)	0	07:36
1.3		401.2	+ 1.9	0 (P)	0	07:38
1.4		352.9	+ 2.1	0 (P)	0	07:54
1.5		273.5	+ 1.5	0 (P)	0	07:55
1.6		407.0	+ 1.9	0 (P)	0	07:40
1.7		350.1	+ 2.0	0 (P)	0	08:12
2.1		442.2	+ 2.0	0 (P)	0	07:34
2.2		424.6	+ 1.9	0 (P)	0	07:39
2.3		312.7	+ 1.8	0 (P)	0	08:05
2.4		496.2	+ 2.0	0 (P)	0	08:07
2.5		287.4	+ 1.6	0 (P)	0	08:12
2.6		355.7	+ 1.9	0 (P)	0	08:13
2.7		394.6	+ 2.1	0 (P)	0	08:15
3.1		332.7	+ 2.0	0 (P)	0	07:36
3.2		403.6	+ 1.9	0 (P)	0	07:42
3.3		330.5	+ 1.7	0 (P)	0	08:04
3.4		245.8	+ 1.3	0	0	08:05
3.5		437.4	+ 2.0	0 (P)	0	08:06
3.6		399.9	+ 1.89	0 (P)	0	08:09
3.7		418.4	+ 1.86	0 (P)	0	08:13
4.1		323.5	+ 1.84	0 (P)	0	07:39
4.2		385.4	+ 2.06	0 (P)	0	07:41
4.3		395.0	+ 2.0	0 (P)	0	07:43
4.4		341.8	+ 1.6	0 (P)	0	08:08
4.5		383.1	+ 1.9	0 (P)	0	08:08
4.6		336.6	+ 1.7	0 (P)	0	08:16
4.7		353.8	+ 1.8	0 (P)	0	08:17

NAME:	K Venter	SIGNATURE:	
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P ⇒ Pregnant

Euthanized all female rats (12/10/2020)