

**HUMAN IMMUNODEFICIENCY VIRUS (HIV) PREVALENCE  
AMONG *CATHA EDULIS* FORSK (MIRAA) USERS IN MERU  
REGION, KENYA**

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**DECLARATION**

This thesis is my original work and has not been presented for a degree or other awards in any other University.

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**DEDICATION**

To my daughter Debbie, my wife Gatwiri, mum and dad.

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**TABLE OF CONTENTS**

	Page
DECLARATION	i
DEDICATION	ii
ACKNOWLEDGEMENT	iii
TABLE OF CONTENTS	iv
LIST OF FIGURES	viii
LIST OF TABLES	ix
LIST OF ABBREVIATIONS AND ACRONYMS	x
ABSTRACT	xi

**CHAPTER ONE**

<b>INTRODUCTION</b>	1
1.1 Background of the study	1
1.2 Statement of the problem	4
1.3 Significance of the study	4
1.4 Research questions	5
1.5 Null hypotheses.	5
1.6 General objectives	5
1.6.1 Specific objectives.	5
1.7 Limitation of the Study.	6

**CHAPTER TWO**

<b>LITERATURE REVIEW</b>	7
2.1 HIV and AIDS situation in Kenya by 2011	7
2.1.1 Knowledge and disclosure of HIV and AIDS status	7
2.1.2 Role of counseling	9
2.1.3 Modes of HIV transmission	9
2.2 <i>Catha edulis</i> - The plant and its economics	10
2.3 Drug and substance abuse situation in Kenya	13
2.4 Pharmacology of <i>C. edulis</i>	14
2.5 Effects of <i>C. edulis</i> use in relation HIV transmission	16
2.6 Effects of <i>C. edulis</i> to fertility	18

<b>CHAPTER THREE</b>	
<b>METHODOLOGY</b>	19
3.1 Location of the study	19
3.2 Study design	19
3.3 Study variables	19
3.4 Target population	19
3.5 Inclusion criteria	20
3.5.2 Exclusion criteria	20
3.6 Sample size	20
3.7 Questionnaire	22
3.8 Sample collection and analysis	22
3.8.1 HIV Test	23
3.8.2 CD4 cell count and viral load.	23
3.8.3 Destruction of specimen	23
3.9 Validity of HIV, CD4 count and viral load test results	24
3.10 Return test results to the participants	24
3.11 Comprehensive referrals	24
3.12 Statistical treatment of data	25
3.13 Prevalence rate data analysis	25
3.14 Ethical consideration	26
<b>CHAPTER FOUR</b>	28
<b>RESULTS</b>	28
4.1 HIV prevalence among users of <i>C. edulis</i> (15 years and above) in Nyambene region	28
4.1.1 HIV prevalence across gender	28
4.1.2 HIV prevalence by age group	28
4.1.3 HIV prevalence by marital status	29
4.1.4 HIV prevalence by occupation	29
4.1.5 HIV prevalence by education level	30
4.1.6 HIV prevalence by residence and gender	30
4.1.7 HIV prevalence by business type and gender	30
4.1.8 HIV prevalence by sexual orientation, couples and pregnancy	31

4.2 Results of social-demographic, knowledge on HIV and behavioral risk factors	32
4.2.1 HIV prevention methods - Abstinence, Condom use and Being faithful (ABC)	34
4.2.2 Relationship between knowledge on HIV/AIDS ABC and HIV status	35
4.2.3 <i>C. edulis</i> use, prevention and knowledge in relation to HIV rate of infection	35
4.2.4 Participants source of information in relation to HIV prevalence	37
4.2.5 Participants source of information in relation to education level	37
4.2.6 Knowledge on HIV transmission from mother to baby during breast feeding, pregnancy and in delivery	38
4.2.7 Education level in relation to HIV acquisition and transmission routes	39
4.3 Effects of <i>C. edulis</i> use to the CD4 and viral load of PLWA	41
4.3.1 CD4 counts among HIV positive participants	41
4.3.2 Participants HIV status, frequency of <i>C. edulis</i> use and CD4 counts	41
4.3.3 Mean distribution of CD4 counts across gender	42
4.3.4 Participants HIV status and viral load count	43
4.3.5 HIV status, <i>C. edulis</i> use and viral load counts	44
4.3.6 Mean distribution of viral load counts across gender	45
4.3.7 Correlation for the viral load and the CD4 counts	45
4.4 Comprehensive referrals	46
4.5 Overall response by the participants	46
4.6 HIV prevalence data in Nyambene region (January – May, 2012)	47
<b>CHAPTER FIVE</b>	48
<b>DISCUSSION</b>	48
5.1 HIV prevalence	48
5.1.2 Social demographic, knowledge and behavioral risk factors on HIV	50
5.1.3 CD4 cells and viral load counts in relation to <i>C. edulis</i> use	54
5.2 Conclusion	56
5.3 Recommendation	57
<b>REFERENCES</b>	58

<b>APPENDICES</b>	63
Appendix 1: Checklist of materials	63
Appendix 2: Questionnaire	65
Appendix 3: HIV consent form	69
Appendix 4: Results collection card	70
Appendix 5: KUERC Ethical clearance letter	71
Appendix 6: NCSTI Research authorization letter	73
Appendix 7: NCSTI Research permit	74
Appendix 8: MoPHS Letter of support	75
Appendix 9: KU Graduate School research authorization letter	76
Appendix 10: KU Dean Graduate School letter of introduction	77
Appendix 11: KU Graduate School research approval letter	78
Appendix 12: CD4 and viral load raw data	79
Appendix 13: Social demographic, knowledge on HIV and behavioral factors as related to HIV infection	80
Appendix 14: <i>C. edulis</i> use, HIV prevention in relation to rate of infection	81
Appendix 15: Map of Nyambene region of Meru County	82

**LIST OF FIGURES**

Figure 2.1 <i>Catha edulis</i> bundles ready for sale	11
Figure 2.2 Bundles of <i>C. edulis</i> being transported to airport for international market	12
Figure 2.3 <i>C. edulis</i> bundle on display in local market	12
Figure 2.4 Mature <i>C. edulis</i> plant twigs	13
Figure 4.1: HIV prevention by abstinence.	34
Figure 4.2: HIV prevention by being faithful to one partner	34
Figure 4.3: HIV prevention by condom use	34
Figure 4.4: Participants source of information in relation to HIV prevalence	37
Figure 4.5: Participants source of information in relation to education level	38
Figure 4.6: Knowledge on HIV transmission from mother-baby	38
Figure 4.7: Comprehensive referral for HIV positive participants	46

**LIST OF TABLES**

Table 4.1	HIV prevalence across gender	28
Table 4.2	HIV prevalence by age group	28
Table 4.3	HIV prevalence by marital status	29
Table 4.4	HIV prevalence by occupation	29
Table 4.5	HIV prevalence by education level	30
Table 4.6	HIV prevalence by residence and gender	30
Table 4.7	HIV prevalence by business type and gender	31
Table 4.8	HIV prevalence by sexual orientation, couple participation and pregnancy	33
Table 4.9	Social-demographic, knowledge on HIV and behavioral risk factors	35
Table 4.10	Relationship between knowledge on HIV/AIDS ABC and HIV status	36
Table 4.11	<i>C. edulis</i> use, HIV prevention and knowledge in relation to rate of infection	36
Table 4.12	Education level in relation to HIV acquisition and transmission	40
Table 4.13	CD4 counts of HIV positive participants	41
Table 4.14	Participants HIV status, frequency of <i>C. edulis</i> use and CD4 counts	42
Table 4.15	Mean distribution of CD4 counts across gender	43
Table 4.16	Participants HIV status and viral load counts	43
Table 4.17	HIV status, frequency of <i>C. edulis</i> use and viral load counts	44
Table 4.18	Mean distribution of viral load counts across gender	45
Table 4.19	Correlation for the viral load and the CD4 counts	46
Table 4.21	Overall participant's response by the participants	47
Table 4.21	HIV prevalence data in Nyambene County	47

## LIST OF ABBREVIATIONS AND ACROMNYMS

<b>Ag</b>	Antigen.
<b>Ab</b>	Antibody
<b>AIDS</b>	Acquired Immune Deficiency Syndrome.
<b>ART</b>	Anti-retro viral drugs.
<b>CBS</b>	Central Bureau of Statistics
<b>CD4</b>	Cluster of Differentiation 4
<b>DMO</b>	District Medical Officer.
<b>EIA</b>	Enzyme immunoassay.
<b>ELIZA</b>	Enzyme-linked immunosorbent Assay.
<b>FCSWs</b>	Female Commercial Sex Workers
<b>HIV</b>	Human Immunodeficiency Virus.
<b>KAIS</b>	Kenya AIDS Indicator Survey
<b>KEMRI</b>	Kenya Medical Research Institute.
<b>KBS</b>	Kenya Bureau of Statistics.
<b>KDHS</b>	Kenya Demographic Health Survey
<b>KUERC</b>	Kenyatta University Ethics Review Committee
<b>MoPHS</b>	Ministry of Public Health and Sanitation.
<b>MoMS</b>	Ministry of Medical Services.
<b>NACADA</b>	National Agency for the Campaign Against Drugs.
<b>NASCOP</b>	National AIDS and STI Control Program.
<b>NGO</b>	Non Governmental Organization
<b>NACOSTI</b>	National Commission for Science, Technology
<b>PLWA</b>	People Living with HIV and AIDS.
<b>PMTCT</b>	Prevention of Mother to Child Transmission
<b>TB</b>	Tuberculosis.
<b>TMB</b>	Tetramethylbenzidine.
<b>VCT</b>	Voluntary, Cancelling and Testing.
<b>WHO</b>	World Health Organization.

**ABSTRACT**

Khat or miraa (*Catha edulis* Forsk (Celastraceae) chewing is known to be a widespread habit in among selected communities in Kenya. Since HIV/AIDS was declared a national disaster in Kenya in 1999, the disease has become an obstacle to both health and development of the people. Nevertheless, the use of substance including *C. edulis* has dramatically increased despite the serious concern on control of HIV infection. This study was aimed at determining the HIV prevalence and impact of *C. edulis* chewing and social-demographic, knowledge, behavioral as risk factors to HIV infections and possible effects to CD4 and viral load counts among residents of Nyambene region of Meru County. A cross-sectional study was conducted among 267 individuals aged above 15 years in the region during the period of May-December 2012. Data was collected using structured questionnaire and blood drawn from consenting participants. HIV status was determined by use of rapid tests; Determine and confirmed by ELISA test. CD4 and viral load counts were monitored (3months) for all HIV positive participants. The study established that the general HIV prevalence was 7.9% with women (8.1%) being affected more than men (7.6%) though not significant ( $p=0.019$ ). Risk behaviours for HIV infection like *C. edulis* use were more observed among women engaged in *Catha edulis* business than men though not significant ( $p=1.468$ ). Lack of knowledge on HIV transmission and prevention methods were associated with HIV status despite the high awareness of the disease. However there was significant difference on education level and breast feeding ( $p = 0.001$ ), pregnancy ( $p=0.017$ ) and HIV transmission during delivery ( $p=0.039$ ). Most participants relied on radio as a source of information on HIV/AIDS which varied significantly with their education level ( $p = 0.001$ ) and in HIV-TB co infection ( $p=0.005$ ). There was significant difference on first CD4 count and the second, three months after ( $p = 0.001$ ) unlike in viral load counts ( $p = 0.396$ ). *C. edulis* use is risk behaviour for the spread of HIV infection. Ignorance, lack of knowledge and engagement into multiple sex partners predisposes people to risk of contracting HIV infection.

## CHAPTER ONE

### INTRODUCTION

#### 1.1 Background of the study

Khat or miraa (*Catha edulis* Forsk (Celastraceae) is an evergreen plant that is extensively cultivated in the highlands of Ethiopia, Kenya, Yemen (Alem *et al.*, 1999) and the Arabian Peninsula where its use has a long history as a social custom, dating back thousands of years (Arimi *et al.*, 2003). It is a bushy plant whose leaves are the source of a naturally occurring amphetamine-like substance (Al Habori *et al.*, 2004). It is estimated that 10 million people globally use *C. edulis* on a daily basis (NACADA, 2007). The prevalence of *C. edulis* abuse in Kenya currently stands at 7.7% in urban, 4.7% in rural setting and 6.1% among persons aged 18 years and above (NACADA, 2011). North Eastern region leads with 18.7% prevalence rate followed by Eastern at 13.8% (NACADA, 2011). The most abused substances in Kenya are *C. edulis*, alcohol, cigarettes and cannabis (NACADA, 2007; Ndetei *et al.*, 2009). *C. edulis* and other drugs are readily, cheaply available, highly addictive and consumers often lack the will to resist them (Fekaduk, 2009). In Ethiopia and Kenya, *C. edulis* is commonly used for stimulation and social recreation. A significant number of students consume *C. edulis* to be alert and wakeful at night especially during examination periods (Cox and Rampes, 2003). In a similar manner other sections of the community like teachers and farmers chew *C. edulis* in order to reduce fatigue and increase performance (Kabede, 2002). The prevalence of Human Immunodeficiency Virus (HIV) in Eastern province show regional variation across urban *C. edulis*-growing parches where the highest HIV prevalence is reported as compared to surrounding rural areas.

There are several issues that have for a long time been put forward in support or against *C. edulis* among the Meru community of Kenya. Matters against *C. edulis* use are regarded as

taboo and goes against social-economic development, cultural values and heritage among the stakeholders. These include the farmers, *C. edulis* business community and its users. Politicians, educationist, visitors and the clergy preserve the community values of *C. edulis* in the region to avoid conflict. These values go beyond economical gain to dowry, penalties in disputes and sorcery. Cultural interactions especially among the Somali and Rendile communities are common leading to marriages and business partnerships building all the way to Arab world and UK where *C. edulis* is exported (Suhail *et al.*, 2010). This has led to multi-million business projects generating a lot of income to the area. Despite benefit generated, low levels of education, poor housing, malnutrition and breakdown of health care facilities are common in the area. Socially, *C. edulis* chewing results in diversion of household income among poor families and reduced productivity (Cox, 2003).

Globally, at the end of 2011, an estimated 34 million people were living with HIV that causes Acquired Immune Deficiency Syndrome (AIDS). HIV prevalence shot up to 17% from 2001, a reflection of the continued large number of new HIV infections and a significant expansion of access to antiretroviral therapy (Montana, 2007). This has helped reduce AIDS-related deaths where a total of 2.5 million deaths have been averted in low and middle-income countries since 1995 (Brian, 2005). According to UNAIDS (2011) report, in 2010 there were 2.7 million new HIV infections globally which is 15% less in 2001 and 21% below the number of new infections at the peak of the epidemic in 1997.

HIV and AIDS disease burden has big impact on the economy of any country especially at community level with worst affected being children, women and different vulnerable groups (KAIS, 2012). Nyambene region of Meru County mainly rely on *C. edulis* for social-economic benefit especially the northern strip (Arimi, 2003). The level of education though in these areas

is often low since residents start working in *C. edulis* plantations at early age hence making them drop out of schools. They abandon education at early stages leading to an increase in the level of illiteracy in the region. They live in towns to sell *C. edulis* products sent by their family and friends. However, among them are girls who fall victim to these and engage in prostitution. These trends have led to widespread of HIV in the region.

Sub-Saharan Africa has remained the region that is most heavily affected by HIV in the world. In 2010, about 68% (22.9 million) of all people living with HIV resided in sub-Saharan Africa, a region with only 12% of the global population (Mutangadura *et al.*, 2010). The region also accounts up to 70% of new HIV infections despite the notable decline in the rate of new infections in the region (Abuye *et al.*, 2004). The prevalence in the region currently stands at 5% and almost half of the deaths from AIDS-related illnesses in 2010 occurred in southern Africa with the worst hit country being South Africa (Mutangadura *et al.*, 2010).

Since Kenya recorded its first case of HIV in 1984, the AIDS epidemic has evolved to become one of the central impediments to national health, well being and development. AIDS has deepened poverty, slowed economic growth, reduced life expectancy and worsened other infectious diseases (NAS COP, 2010). Kenya is estimated to have over 1.5 million people living with HIV and AIDS (KAIS, 2012). The control of HIV and AIDS has been a major challenge with high prevalence varying across the region, low levels of testing, discordance within couples, relationships and concurrent epidemics of sexually transmitted infections makes management of the disease epidemic difficult and complex (Brian, 2008). Life expectancy in Kenya has fallen sharply largely because of the heavy impact of HIV, (Gelmon *et al.*, 2009), although it has begun to rebound in recent years, as HIV-related mortality has declined. According to KAIS (2007), Eastern Kenya where Nyambene is centrally located

has HIV prevalence of 4.6% followed by central Kenya counties 3.6% and north eastern counties 0.81%. Other counties include Nyanza with the highest prevalence of 14.9%, Nairobi 8.8%, coast 8.1%, Rift Valley 6.3% and western Kenya at 5.4%.

### **1.2 Statement of the problem**

The prevalence of HIV and AIDS is high in *C. edulis* growing and business zones as compared to other regions of Eastern, Kenya. Despite its popularity, there is ample evidence of the adverse effects of habitual use of *C. edulis* on mental, social wellbeing and adverse effect on human reproductive system i.e. association with erectile dysfunction and low birth weight report. Knowledge, practice and attitude toward *C. edulis* use has never been established or documented in regard to the high prevalence of HIV in the region. Other demographic characteristics e.g. social-economic, knowledge and behavioural factors need to be unveiled.

### **1.3 Significance of the study**

The study utilized participants from rural and urban set up in identifying factors that influence the HIV prevalence as well as the knowledge and demographic factors involved in the spatial diffusion of the epidemic at the local scale in the region. It provides direction and leadership for the development of an innovative and multidisciplinary HIV and AIDS research portfolio that addresses the current and unique dimensions of use as they relate to the disease. The study provides county administration and all stakeholders with essential information to plan and implement HIV intervention effectively among *C. edulis* and drug users and assist with the monitoring and evaluation of programs targeting HIV/AIDS and STIs in Nyambene region of Meru County specifically in *C. edulis* growing zones.

#### **1.4 Research questions**

1. What is the prevalence of HIV and AIDS in *C. edulis* growing zones of Nyambene, Kenya?
2. What are the effects of *C. edulis* use on the CD4 and viral load counts among PLWA?

#### **1.5 Null hypothesis**

1. There exists no relationship between chewing *C. edulis* and HIV infection among *C. edulis* chewer in Meru County, Kenya.
2. There is no relationship between HIV-infected and HIV-uninfected *C. edulis* users to CD4 and viral load counts in HIV positive patients.

#### **1.6 General objective**

To determine the relationship between HIV and AIDS in persons aged 15 years and above and *C. edulis* use in Nyambene region of Meru County, Kenya.

##### **1.6.1 Specific objectives**

1. To determine HIV prevalence among *C. edulis* using persons in Nyambene region of Meru County, Kenya.
2. To determine social-demographic, knowledge and behavioral risk factors related to HIV infection among *C. edulis* users.
3. To determine the effects of *C. edulis* use to the CD4 and viral load counts of HIV positive patients.

**1.7 Limitation of the study**

Participant's willingness to respond positively and accurately to the questionnaire and take part in HIV test, CD4 and viral load count was a setback throughout the study.

## CHAPTER TWO

### LITRATURE REVIEW

#### **2.1 HIV and AIDS situation in Kenya by 2011**

Over 38 million people are living with HIV and AIDS worldwide with 25.3 million of them living in sub-Saharan Africa (Mutangadura *et al.*, 2010). The Kenya Demographic and Health Survey KDHS, (2012) estimates that over 1.5 million people in Kenya between ages of 15 to 49 are infected with HIV. Average prevalence rate of HIV infections is 8.8% in women, 5.5% in men and 7.15% across the country. Among 15-19 year olds, the ratio of infected women is about four times that of men while the hardest hit are widows and divorced women, with an HIV prevalence of 17% and 21% respectively (Montana *et al.*, 2007). Nyanza province leads with HIV prevalence (14.9%) where in every two widows; one is likely to be infected. For every infected man there are about two infected women while 44% of new infections occur in couples in stable relationships (Tanser, 2002). Previous studies have shown that HIV prevalence does not vary significantly among women across religious affiliation. Catholics, Protestants, other Christians or having not religious affiliated men have shown almost similar prevalence at 5.4%, 5.7% and 5.5% respectively. The prevalence is lower in Muslim men (3.3%) and unspecified religions at 2.6% (NAS COP, 2009). Since the epidemic began, HIV has claimed the lives of at least 1.8 million people in Kenya. In 2012, an estimated 49,126 people in Kenya died of AIDS-related causes (KNBS, 2012).

#### **2.1.1 Knowledge and disclosure of HIV and AIDS status**

Knowledge of one's HIV status is essential for accessing HIV care, treatment, knowing the disease burden and preventive services (Zaba *et al.*, 1999). Nearly 98.2% respondent who had ever been tested for HIV were willing to share their last HIV test results while 83.6% found to be HIV

infected were not aware of the HIV infection. 77.9% reported a partner of unknown HIV status while 5.9% of couples were HIV discordant where one partner is HIV positive, the other is HIV negative (Chemaitelly *et al.*, 2012). 43.4% of women and 44.4% of men have an HIV infected primary partner (Montana *et al.*, 2007). Such proportions have been reported in both the general population (Walque, 2007; Lurie *et al.*, 2003) and specifically among women and their partners attending antenatal clinics (Farquhar, 2004).

In general very few people are aware of their partner's HIV status (Walque, 2007). Women and men in casual partnership are more likely to report a partner of unknown HIV status. More women than men may report other types of partnerships which can be categorized as boyfriend/girlfriend, casual, married or other (KAIS, 2012). According to KDHS (2011), many Kenyan women become infected despite engaging in very low levels of risk behaviour. In 2008–2009, women who had not had intercourse in the previous 12 months had higher HIV prevalence (15.8%) than women who had high-risk sex without a condom (13.4%). Information-based approaches combined with counselling have been observed to increase disclosure among people living with HIV/AIDS in countries such as Uganda, Kenya and Zimbabwe. Stigma appears to mediate the relationship between misconception and willingness to disclose HIV status in the event of infection in women but not men (Xang *et al.*, 2007). Less than 40% of young people in developing countries are estimated to have basic information about AIDS and HIV prevention. This knowledge gap might be due to the frequently expressed objections of political and religious leaders to sexual behavioural change programmes known to reduce HIV infection rates, such as integrated condom programming (Willy, 2010).

### **2.1.2 Role of counselling**

In the fight against HIV, knowledge is power. By providing individuals with knowledge of their own HIV status, HIV testing and counselling plays a critical role in the fight against HIV. Kenya has made considerable strides towards its goal of achieving 80% knowledge of HIV status. These are in pursuit of a widening array of innovative approaches to promote and deliver testing and counselling services. Yet considerable gaps remain, underscoring the need for intensification of efforts to increase testing uptake and link those who test HIV-positive to needed treatment, care and support (KDHS, 2012). Optimal care should be ensured in meeting both the medical and psychological needs of a patient. However; studies have shown that care that meets all medical needs may fail to meet a client's emotional or social needs and vice-versa (Aldana *et al.*, 2001). It is therefore important that adequate time is set aside for counselling so that appropriate and informed decision on therapy and its implications are made by the patient (WHO, 2011). All the positive messages initiated during the pre and post-test counselling should be reinforced during counselling for HIV and sexually transmitted diseases. Matters that should be emphasized in counselling are dynamics in disease progression, financial considerations, nutrition, emotional support, and disclosure of test results to spouse or partner especially in HIV positive patients. Counsellors should also help patients to make decisions on prevention of transmission especially among discordant partners in getting pregnant, marriage and sexual behaviour.

### **2.1.3 Modes of HIV transmission**

Vaginal or anal sex without a condom with someone who is infected is perceived as the main route of HIV transmission globally (Murray, 2002). The likelihood that an HIV-infected person will transmit the virus to another is directly related to the infected individual's viral load (Quinn, 2000).

High virus levels in individuals with a new case of HIV infection makes them unusually infectious (Pilcher *et al.*, 2004). Contact with the blood of someone who has HIV and AIDS especially during transfusion pose a great risk especially to health professionals. Receiving an injection from an unsterilized needle that was previously used by someone with HIV also account for high prevalence among intravenous drug users (Hubbard, 2007). An estimated 2.5% of new HIV infections among adults in Kenya in 2006 occurred in health care facilities (Gelmon *et al.*, 2009). Gouws, 2006 in his modeling estimated that no more than 0.6% of transmission in Kenya could be attributed to unsafe injections. Heterosexual transmission is the route by which 77% of people with AIDS have become infected with HIV in Kenya (Guows *et al.*, 2006). Transmission during labour and deliveries occurs when the infant sucks, imbibes or aspirate maternal blood or cervical secretions that contain HIV or when it has other mucous membrane exposure accounting for 40% transmission in Kenya (Brian, 2008). The KAIS 2007 indicated that 9.6% of pregnant women in Kenya were HIV-positive with minimal differences between urban and rural residence, a 30% increase from the 7.3% reported in the KDHS 2003.

## **2.2 *Catha edulis* - The plant and its economies**

*Catha edulis* is a flowering, evergreen plant grown by grafting and cultivated as a bush or small tree. It is mainly found in Ethiopia, Yemen, Somali, Sudan, Madagascar and South Africa, but it is also seen in Turkestan and Afghanistan (Cox, 2003). In East Africa its main production areas are around Mt. Kenya. It has been widely used since the thirteenth century as a recreational drug by the indigenous people of East Africa, the Arabian Peninsula and throughout the Middle East. In Kenya consumers also refer to *C. edulis* using less familiar street names such as *Veve*, *Muguka*, *Goks*, *Gomba*, *Mbachu*, *Mairungi*, *Alele*, *Giza* or *Halwa*. (Arimi *et al.*, 2003). Other street names used in Yemen are *Qat*, *Kat*, *Chat* and *Quaadka* (Fekaduk, 2009).

In regard to economical aspects of *C. edulis*, countries can be grouped in four categories. Countries that grow the plant for domestic use only e.g. Madagascar. Those that grow *C.edulis* but also import to supplement limited domestic supply e.g. Yemen. Countries that grow *C. edulis* for domestic use and for export e.g. Kenya and Ethiopia and countries that import all their requirements from others include Somalia and Djibouti. *C. edulis* provides employment to estimated 400,000 people in Kenya. These include farmers, harvesters, packers, loaders, transporters wholesale and retail traders. The Municipal Council of Maua levies cess on *C. edulis* which they use in the development projects of the area. It is estimated that 86% of Nyambene region in Meru population depend directly or indirectly on *C. edulis* for their livelihood (Sikiru, 2009). Market for this product spread locally, nationally in major towns in Kenya and internationally to United Kingdom, Somali Europe and Arab world (Arimi *et al.*, 2003).



Figure 2.1 *Catha edulis* bundles ready for sale



Figure 2.2 Bundles of *Catha edulis* being transported to the airport for international market



Figure 2.3 *Catha edulis* bundle on display in local market



Figure 2.4 Mature *Catha edulis* plant twigs.

### **2.3 Drug and substance abuse situation in Kenya**

Drug and Substance Abuse (DSA) is one of the major social problems in Kenya with common and easily identifiable manifestations in public health. Half of drug abusers in Kenya are aged between 10-19 years with over 60% residing in urban areas and 21% in rural areas (Friedman, 2006). Taking drugs at an early age of 14 or younger greatly increases the chances of developing drug problems in future. Commonly abused drugs in Kenya being alcohol, tobacco, bhang (marijuana), glue, *C. edulis* and other psychotropic drugs and have varied physiological effects (Emukule *et al.*, 2009). There are adverse consequences like insomnia, prolonged loss of appetite, increased body temperature, greater risk of hepatitis and HIV/AIDS infection (Perkinson, 2012).

The prevalence of HIV/AIDS among injection drug users is estimated between 68-88%. The UNODC (2012) report documented a relationship between injectable, non injectable drug use and HIV/AIDS. The emergence of high HIV prevalence in drugs users' population has been abated by a notable rise in the use of heroin in Kenya (Beckerleg *et al.*, 2005). DSA has a complex cause and effect relationship. The direct causes of DSA may include easy availability of cheap drugs and other substances. Young adults have the highest DSA prevalence (Emukule *et al.*, 2009). Idleness in association with peer pressure easily drive them into DSA (Friedman *et al.*, 2006). In most of these situations, parents and other guardian's lack the skills to intervene. DSA has many possible underlying causes. They include: weak DSA awareness programmes, limited skills and personnel capacity of the law enforcers, unemployment and low prioritization of DSA (Dajoh *et al.*, 2010). The implementation of effective awareness programmes is often affected by limited facilities and personnel skills. Since these programmes may be accorded low priority as they are often underfunded (Willy *et al.*, 2010). The programmes are also supported by weak institutional framework in which roles, partnerships and human rights perspectives of DSA are not strongly articulated (Friedman *et al.*, 2006).

#### **2.4 Pharmacology of *C. edulis***

*Catha edulis* contains two central nervous system (CNS) stimulants, namely cathinone and cathine. Cathinone (alpha-aminopropiophenone) is the principal active stimulant (Kabede, 2002). It is structurally similar to d-amphetamine and almost as potent as a CNS stimulant. Cathine, also called d-norpseudoephedrine, is about 10 times less potent than cathinone as a CNS stimulant (Dajoh *et al.*, 2010). Cathinone levels are highest in the freshly cut *C. edulis* plant. Once cut, levels of cathinone start declining. Cathinone has analogous mechanisms of action with

pharmacological properties that are reminiscent of those induced by amphetamine, i.e. anorexia as well as hypermotility (Kalix *et al.*, 1985). Cooling the plant material will reduce the rate of decline in cathinone levels such that detectable levels may be found at least 10 days post cutting. Cathine remains stable in *C. edulis* after the plant has been cut.

*Catha edulis* produces amphetamine-like effects. They include increased levels of energy, increased self-esteem, euphoria, increased libido, excitement, and increased activity for social interaction (Kalix *et al.*, 1985). The users also feel relaxed and are talkative. Sympathomimetic effects may include elevated blood pressure, dilated pupils, hyperthermia, arrhythmias, and increased respiration. The effects of *C. edulis* use usually last between 1½ and 3 hours (Giannini, 1982). After-effects of *C. edulis* use have been reported as lack of concentration, numbness and insomnia and leads to psychological dependence. Chronic use of *C. edulis* can lead to behavioural changes and impairment of mental health (Fekaduk *et al.*, 2009). One is automatically disqualified from participating in international tournaments such as the Olympic games, World Cup football and other games if detected to have used *C. edulis* (Ganda *et al.*, 2005). Intoxication gives you a false belief of enhanced sexual arousal and performance (Dawit *et al.*, 2005). This excitement or ‘high’ and accompanying false courage often leads to risky sexual behaviour (Giannini, 1982). Clinical manifestations include manic behaviour with grandiose delusions, violence, physical exhaustion, anorexia suicidal depression characterized by paranoid delusions (Dajoh *et al.*, 2010). Biochemically, *C. edulis* leaves decreased plasma cholesterol, glucose and triglycerides in rabbits (Al Habori *et al.*, 2004) and increased plasma alkaline phosphatase and alanine aminotransferase in white rabbits (Mamary *et al.*, 2002).

A cohort in determinant of CD4 counts among HIV-negative Ethiopians and identification of factors susceptible to explain the low counts, show CD4 counts are independently and positively associated with body mass index. Additionally there is an increase in lymphocyte count, female gender through increase in CD4%, cigarette smoking through increase in CD4 and *C. edulis* use through an increase in both lymphocytes and CD4 counts (Abuye *et al.*, 2004).

### **2.5 Effect of *C. edulis* use in relation to HIV transmission**

Chewing *C. edulis* constricts the vessel supplying blood to the reproductive tract thereby causing inhibited urine flow and inability to sustain erection (Arimi *et al.*, 2003). *C. edulis* also causes spermatorrhea (Giannini, 1982). Here chewers are forced to use or abuse sedatives and to indulge in alcohol as a means of overcoming the side effects (Emukule *et al.*, 2009). In women the dehydrating effect of *C. edulis* dries the lining of the reproductive tract leading to pain during sexual intercourse and blistering. The micro injuries are routes of HIV entry and can cause reproductive tract infection and other STIs (Arimi *et al.*, 2003).

*Catha edulis* consumption affects the potency of male sexuality by affecting spermatogenesis and plasma testosterone concentration (Mwenda *et al.*, 2005). *C. edulis* has been implicated in male impotence. Both cathinone and cathine have effects similar to D-amphetamine. The latter has been associated with impotence among drug addicts. No epidemiological studies are available to repudiate possible contribution of *C. edulis* in impotence (Dhadphale *et al.*, 2008).

In Kenya, issues of substance abuse have become an integral part of HIV prevention activities due to the high risk behaviours associated with substance abuse and high HIV prevalence rates among

the substance abusing population (Dajoh, 2010). Maternal use of illicit drugs such as cocaine and heroin has been associated with a risk up to three-fold higher of delivering an HIV infected baby (Kissling, 2005). Cigarette smoking and *C. edulis* use during pregnancy may also increase the risk of transmission. The potential risk from drug use appears to be most pronounced when the proportion of CD4 cells is high at above 29% (Burns *et al.*, 1994). A study by Emukule *et al.* (2009) in Mombasa County, Kenya, confirmed high *C. edulis* and bhang use among FCSWs, in addition to alcohol and cigarettes. Combined use of alcohol and *C. edulis* is associated with more sexual partners, increased risk of sexual violence and moderate-high perception of HIV infection. It recommend further research on substance careers, networks and causes to determine how to control *C. edulis* and bhang use among FCSWs. *C. edulis* chewing induces excessive sexual arousal, impotence and spermatorrhoea leading to strained relations between spouses or married couples. It is most likely to cause family fragmentation and or multiple sexual practices. *C. edulis* chewing habit may thus be pointed as one of those risky behaviours that could fuel the spread of HIV. In this regard, a link has been shown to exist between *C. edulis* use and increased exposure to HIV/AIDS among prostitutes in Djibouti (Ted, 2000).

In a study by Dawit *et al.* (2005), stratified analyses for *C. edulis* chewing on one hand, and *C. edulis* chewing and the sexes on the other, indicated that the percentage of HIV cases was invariably higher among Ethiopian chewers than in non chewers ( $p < 0.001$  (OR = 2.32, 95% CI = 1.75, 3.07)). High rate of HIV cases in chewers was strongly associated with similarly high rates of multiple sexual activity ( $p < 0.001$  (OR = 2.03, 95% CI = 1.36, 3.02)).

## **2.6 Effects of *C. edulis* to fertility**

A study in Saudi Arabia on the effects of *C. edulis* addiction on semen parameters and sperm ultra structure demonstrated significant negative correlation between duration of its consumption and all semen parameters which include semen volume, sperm count, sperm motility, motility index and percentage of normal spermatozoa. Upon electron microscopy, different patterns of deformation are demonstrated and include both the head and flagella incomplete spermatozoa, aflagellate heads, headless flagella and multiple heads and flagella (Abuye *et al.*, 2004). Deformed heads show aberrated nuclei with immature nuclear chromatin and polymorphic intranuclear inclusion; these are associated with a chromosomal defect. The study showed deleterious effects of *C. edulis* addiction on semen parameters in general and sperm morphology in all long time addicts (Shoula, 2010).

The overwhelming evidence, however, suggests that the habit causes a high frequency of spermatorrhoea and decreased libido and, at a later stage, impotence as observed in Somalia and Djibouti, where as high as 60% of the male chewers in those countries were reported to be impotent (WHO, 2011).

*Catha edulis* is genotoxic and has teratogenic effects on the foetus if regularly consumed by pregnant mothers resulting to low birth weight (Friedman *et al.*, 2006). *C. edulis* consumption may have detrimental effects on uteri-placental blood flow (Al-Habori *et al.*, 2004) and as a consequence, on foetal growth and development (Mwenda *et al.*, 2005). This is a risk factor contributing to high infant motility in communities where *C. edulis* is commonly chewed (Arimi *et al.*, 2003).

## CHAPTER THREE

### MATERIALS AND METHODS

#### 3.1 Location of the study

Participants were drawn from Nyambene region of Meru County which is the main *C. edulis* growing zone in Kenya with a population of 761,419 people (KNBS, 2010). Samples collected were analysed at Nyambene Hospital and public health offices provided necessary information on the disease burden in the county.

#### 3.2 Study design

This was a cross-sectional group based study where HIV prevalence among *C. edulis* using participants and its possible effects on the level of CD4 cells and viral load among PLWA was determined. The researcher described the association between variables i.e. demographic characteristics, social-economic, HIV-TB co infection, maternal health care attendance factors in relation to HIV.

#### 3.3 Study variables

Dependent variable was the use of *C. edulis* while independent variables were sex, age, marital status, level of education, TB co infection, occupation and social-cultural factors such as knowledge, source of information behavioural risk factors and perceptions on HIV and AIDS.

#### 3.4 Target population

Sexually active male and female participants aged 15 years and above who use *C. edulis* in Nyambene region of Meru County were targeted in the study. They included the general

population and persons attending various health centre's VCT, ANC and TB clinics in the region. A control group of *non-C.edulis* users was also recruited in the study.

### 3.5 Inclusion criteria

Inclusion criteria involved individuals aged above 15 years and above, *C. edulis* using and *non-C. edulis* using persons who were willing to participate in HIV counselling and testing. Participants for baseline CD4 and viral load determination were only sampled from WHO HIV Clinical stage 1. Inclusion of participants aged 15 years and above is in-line with KAIS (2007, 2012) and other HIV prevalence data surveys previously done by UNAIDS (2012) and NASCOP (2009).

#### 3.5.2 Exclusion criteria

Those who were excluded from the study were persons from other regions, those who had not resided in Meru County for the last 5 years, individuals who were not willing to participate in the study and persons with mental illness.

### 3.6 Sample size

The sample size was obtained through calculation using Fisher *et al.* (1998) equation using extrapolation HIV prevalence report published by KDHS, 2012.

Hence:  $N = N_x + N_y \times 1/2$

$$N_x = \frac{ZP^2(1 - P_x)D}{d^2} + N_y = \frac{ZP^2(1 - P_y)D}{d^2} \times 1/2$$

Where: N - Average number of sample required

$N_x$  and  $N_y$  = Minimum sample size required in HIV and *C. edulis* use respectively.

Z - Standard error (1.96).

$P_x$  - Estimated prevalence - 20% (KDHS, 2011 20-50 years old persons prevalence).

$P_y$  - Estimated percentage - 25% (people who use *C. edulis* in Nyambene region).

d - Precision required (95% or 0.05).

D - Design effect =1.

$$N = \frac{1.96 \times 0.20^2(1 - 0.20)1}{0.005^2} + N_y = \frac{1.96 \times 0.25^2(1 - 0.25)1}{0.005^2} \times 1/2$$

$$N = 246 + 288 \times 1/2 = 267$$

A stratified probability sampling technique was used where twelve participants from each study area were recruited. These areas are Laare, Mutuati, Mailitatu, Kianjai, Giutine, Kiegoi, Murika, Mbeo, Kimeria Njogu, Kanuni, Mikinduri, Miathene, Muringene, Kieni kia Inono, Kathama ka indi, Muthara, Muri, Karama, Kahero and Mutwanjuri villages. Fifteen participants were sampled from larger Maua town. At the village level, one participant from a neighbourhood of five families was recruited while two participants in a group of ten hospital attendees were recruited from each health facilities in the region. These participants were selected from VCT, maternity, TB and antenatal clinics. A control group of 267 *non-C. edulis* using persons was recruited alongside study participants. Twenty HIV positive blood samples obtained from *non-C. edulis* using persons acted as control group in determining effects of *C. edulis* to CD4 cells and viral load levels.

### 3.7 Questionnaire

The content of the individual questionnaire was partially adopted from the standard AIDS Indicator Survey Questionnaires developed by Marco, (2003) and other previous surveys conducted in Africa to feature basic demographic characteristics and sexual activity, social category, knowledge and attitude on HIV and AIDS, testing and other health issues e.g. tuberculosis and antenatal healthcare. Secondary audiences included allies who could influence or provide access to the primary audience as common leaders or health authority, public health outreach officials, employers, employees and association leaders in *C. edulis* business. The questionnaire was translated to Swahili and local dialect to avoid communication barrier. Questionnaire was pretested on a sample of five randomly selected respondents. The interviewer corrected unclear questions and revised them accordingly to ensure its reliability and validity by excluding irrelevant questions which irritated the respondent (Appendix 2). The following statistical formula was also used to determine the magnitude of the responses to the questionnaire as percentage:

$$\% \text{ of responses} = \frac{n}{N} \times 100$$

Where: N = Total number of respondents

n = number of responses

### 3.8 Sample collection and analysis

The researcher collected blood samples from the arm by venipuncture using an evacuated tube collection system. 5 ml of blood was collected into a 'red top' glass tube without anticoagulant for HIV test and additional 2 ml blood into a special 'green top' blood collection tube (Becton Dickson, BD) Vacutener (CD4 Stabilization Blood Collection System) designed to stabilize CD4 cells for up to seven days.

### **3.8.1 HIV testing**

The samples were first tested according to the manufacturer's recommendation using rapid HIV Determine test (Batch code 240431/R3) that has 99.87% specificity and 99.98% sensitivity while VIRONOSTICA HIV-1 Antigen (Ref: 284033) with 99.97% specificity was used as an HIV confirmatory test. Seropositive samples for HIV were referred for immediate CD4 cell and viral load counts test (Branson, 2000).

### **3.8.2 CD4 cell and viral load counts**

Stabilized whole blood specimen for CD4 cells and viral load testing were prepared in the field at the end of each day. Only samples found to be reactive for HIV using the serial HIV testing algorithm described earlier were eligible for a CD4 cell and viral load counts. Single platform technology was used to determine both absolute and percentage lymphocytes subsets values from each CD4 tube of blood using BD FACS Comp software and BD CaliBRITE reagents. For quality control of CD4 testing, internal controls with known CD4 quantities were included with each run. When the system detected an error with the control, results from the run was discarded, followed by rectification based on error appearing on machines screen. Progressive and retrogressive monitoring of CD4 and viral load counts data for 3 months demonstrated the effects of *C. edulis* use among participant's immune system as compared to the control group (Branson, 2000).

### **3.8.3 Destruction of specimens**

Serum, plasma and packed cells remaining after testing were destroyed through incineration.

### **3.9 Validity of HIV, CD4 cells and viral load counts test results**

Due to time lapse between sample collection and returning test results, reported results reflected participant's HIV status, CD4 cells and viral load counts at the time of specimen collection. CD4 cells and viral load count results are varied for 3 months among HIV positive participants hence the need for continuous monitoring regardless of HIV WHO Clinical Stage.

### **3.10 Return test results to the participants**

Trained VCT counsellors informed the participants of their results following laid down procedure. They used professional counselling messages for each test to guide them during their sessions with the participants that ensured consistency in the quality of counselling.

### **3.11 Comprehensive referrals**

Post-test services were made available to HIV positive participants, either by referral or direct provision of services. They included HIV care specialist, male circumcision services, STI services, in-patient services, TB services, PMTCT, family planning, outpatient services, home based family care, post-test club, ongoing counselling PLWA support group or legal services depending on pre-counselling information given.

HIV negative participants either by referral or direct provision of services were referred to prevention counselling, partner testing and disclosure, emotional support, referral to additional prevention services as needed e.g. needle exchange for injecting drug users (IDUs), condoms education and distribution and Post Exposure Prophylaxis (PEP). Participants excluded from the study based on mental illness were referred to psychiatrist care at various county health facilities.

### **3.12 Statistical treatments of data**

Data processing included a series of steps to prepare laboratory and questionnaire data for analysis. Initial step was to code, edit and transform it into electronic format and ensure concordance between the soft and hard copies. Next step was to merge the three sets of data i.e. questionnaire, HIV test, CD4 cells and viral load counts data. The researcher then used Statistical Package for the Social Sciences (SPSS) version 16 to compute p-value, means and standard deviations to determine whether there are significant differences between groups and examine relationships among variables. Data gathered was limited to the determination of factors that affect the sexual behaviour, knowledge and social-economic aspect of Nyambene region in reference to HIV and AIDS. Comparisons were drawn between the overall responses to the questions and the differing responses. Three-month data collection interval of CD4 cells and viral load counts among HIV positive participants was analysed depending on their time of entry into the research. Data retrieval from participants who previously had CD4 and viral load counts tested were merged with current results and control group data which all featured in the final computation. This assisted the researcher in coming out with a conclusion on the effect of using *C. edulis* to the CD4 cells and viral load count of HIV positive participants.

### **3.13 Prevalence rate data analysis**

Prevalence rate was used to measure relative frequency of HIV in Nyambene region of Meru County. Point prevalence rate expressed findings of two specific groups in the population. These subgroups were those that use *C. edulis* as compared to control group and general population HIV prevalence. The prevalence rate was determined using the following formulae and presented using tables, pie charts and graphs:

$$\frac{\text{Total HIV positive } C. \textit{edulis} \text{ users sampled}}{\text{Total population of } C. \textit{edulis} \text{ users sampled}} \times 100 = \textit{HIV Prevalence}$$

Other specific demographic groups i.e. marital status, education level, age, pregnancy and business type HIV prevalence rates were determined as follows:

$$\frac{\text{Total HIV positive } C. \textit{edulis} \text{ users sampled in a specific demographic group}}{\text{Total population of } C. \textit{edulis} \text{ users sampled in the demographic group}} \times 100 = \textit{HIV Prevalence}$$

### **3.14 Ethical consideration**

This study was ethically approved by Kenyatta University Ethics Review Committee (Ref: PKU/070/162) and The National Commission for of Science, Technology and Innovation (Ref: CST/RDC/12A/013/11) while NASCOP granted the permission to access general population and different departments and units within Ministry of Public Health and Sanitation facilities in Nyambene region of Meru County (Ref: NASCOP/ADMIN/SUPP/2012/26). Approval to interact with patients and visitors in county health centres and general public was obtained from the Nyambene County Medical Officer of Health (DMOH) office.

Participants were privately informed on the purpose of the study and the importance of knowing their status to seek the respondent agreement to take part in HIV test and subsequent CD4 and viral load determination. The respondent had a right to decline to participate or discontinue with the study at any stage. In some cases oral consent in Kiswahili and local dialect was appropriate particularly where written and signed consent form was appropriate or if written form constituted a risk to distract participant. In adolescents aged 15-17 years; a written consent was first be obtained from parent/guardian before obtaining assent from the adolescents themselves.

Names of participants taken after recruitment were translated into codes which were used throughout the research work to ensure confidentiality. Coding procedure involved first two letters i.e. MH to stand for Maua Hospital, followed by three numerical numbers i.e. 001-267, a serial number on the date the sample was collected followed by M or F that represented male or female gender. The last alphabetical letter stands for control group (C) or test group (T). Hence MH/034/FC meant 34<sup>th</sup> female control group participant from Maua Hospital. All samples had their respective test label. Each participant was assured that all information that they provided was confidential especially blood samples, test results and filled questionnaire forms by the researcher.

## CHAPTER FOUR

### RESULTS

#### 4.1 HIV prevalence among *C. edulis* using persons (15 years and above) in Nyambene region

HIV prevalence among participants by age group, education level, occupation, marital status, business type, residence, pregnancy and couple participation varied with specific group.

##### 4.1.1 HIV prevalence across gender

Overall HIV prevalence rate among participants in Nyambene region of Meru County was higher among females (8.1%) than in males (7.6%). Average HIV prevalence in the region was estimated to be 7.85%. However there was no significant difference between HIV prevalence and gender (Table 4.1).

**Table 4.1 HIV prevalence across gender**

Gender	HIV positive		HIV negative		Total		p – value
	%	N	%	N	%	N	
Male	7.6	10	92.4	121	<b>49.6</b>	<b>131</b>	p = 0.0119, df =1
Female	8.1	11	91.9	125	<b>50.4</b>	<b>136</b>	
<b>Total</b>	<b>7.8</b>	<b>21</b>	<b>92.2</b>	<b>246</b>	<b>100</b>	<b>267</b>	

##### 4.1.2 HIV prevalence by age group

Highest HIV prevalence (36.4%) was reported among females in 36-45 age group and males aged 15-25 (40.0%). In overall, high HIV prevalence was observed among 36-45 years old participants. No significant difference ( $p = 9.957$ ,  $df = 4$ ) was observed between various age groups and HIV prevalence rate by gender (Table 4.2).

**Table 4.2 HIV status by age group**

HIV Results	Age groups						p - value
	15-25	26-35	36-45	46-55	Above 55	Total	
<b>Male</b>							9.957
HIV –ve	27(22.3%)	31(25.6%)	30(24.8%)	14(11.6%)	19(15.7%)	<b>121(100%)</b>	
HIV +ve	4(40.0%)	1 (10.0%)	3 (30.0%)	2 (20.0%)	0 (0.0%)	<b>10(100%)</b>	
<b>Female</b>							
HIV +ve	24(19.2%)	16(12.8%)	32(25.6%)	26(20.8%)	27(21.6%)	<b>125(100%)</b>	
HIV –ve	1(9.1%)	4 (36.4%)	4(36.4%)	1(9.6%)	1(9.1%)	<b>11(100%)</b>	
<b>Total</b>	<b>56(21.0%)</b>	<b>52(19.5%)</b>	<b>69(25.9%)</b>	<b>43(16.1%)</b>	<b>47(17.5%)</b>	<b>267 (100%)</b>	

#### 4.1.3 HIV prevalence by marital status

Widowed and separated or divorced *C. edulis* using participants had an HIV prevalence rate of 16.7% and 18.2% respectively. Married monogamous participants had the lowest HIV prevalence rate (5.5%) followed by those in married polygamous at 5.6%. However no significant difference ( $p = 0.518$ ) was observed between marital status and HIV prevalence (Table 4.3).

**Table 4.3 HIV prevalence by marital status**

Marital status	HIV positive		HIV negative		Total		p - value
	%	N	%	N	%	N	
never married	7.1	1	92.9	13	<b>5.2</b>	<b>14</b>	0.518
partner not living together	8.3	3	91.7	33	<b>13.5</b>	<b>36</b>	
partner living together	7.3	4	92.7	51	<b>20.6</b>	<b>55</b>	
married monogamous	5.5	6	94.4	103	<b>40.8</b>	<b>109</b>	
married polygamous	5.6	1	94.4	17	<b>6.7</b>	<b>18</b>	
Widowed	16.7	4	83.3	20	<b>8.9</b>	<b>24</b>	
separated/ divorced	18.2	2	81.8	9	<b>5.3</b>	<b>11</b>	
<b>Total</b>	<b>7.8</b>	<b>21</b>	<b>92.2</b>	<b>246</b>	<b>100</b>	<b>267</b>	

#### 4.1.4 HIV prevalence by occupation

*Catha edulis* users with no occupation had the highest HIV prevalence (11.3%) followed by those who were in skilled occupations (8.7%) and the professionals (8.7%). Students and unskilled occupation participants had a lower HIV prevalence rate of 6.2% each (Table 4.4).

**Table 4.4 HIV prevalence by occupation**

Occupation	HIV positive		HIV negative		Total		p - value
	%	N	%	N	%	N	
None	11.3	6	88.7	47	<b>19.6</b>	<b>53</b>	1.1489
Unskilled	6.2	8	93.8	121	<b>48.3</b>	<b>129</b>	
Skilled	8.7	4	91.3	42	<b>17.2</b>	<b>46</b>	
Professional	8.7	2	91.3	21	<b>8.6</b>	<b>23</b>	
Students	6.2	1	93.8	15	<b>6.3</b>	<b>16</b>	
<b>Total</b>	<b>7.8</b>	<b>21</b>	<b>92.2</b>	<b>246</b>	<b>100</b>	<b>267</b>	

#### 4.1.5 HIV prevalence by education level

Participants with secondary school education had the highest level of HIV infection rate of 47.6% while those with post-secondary education and those having no formal education had the same HIV prevalence rate of 14.3% each. There was a significant relationship in education level to HIV status of the participants ( $r = 0.126$ ,  $p = 0.042$ ). More of those who were relatively more educated were HIV positive (Table 4.5).

**Table 4.5 HIV prevalence by education level**

Education Level	HIV positive		HIV negative		Total		p – value
	%	N	%	N	%	N	
no formal education	14.3	3	26.8	66	<b>25.8</b>	<b>69</b>	0.042, $r = 0.126$
primary sch.education	23.8	5	37.8	93	<b>36.7</b>	<b>98</b>	
secondary sch. edu.	47.6	10	25.6	63	<b>27.3</b>	<b>73</b>	
post sec. sch. education	14.3	3	9.8	24	<b>10.1</b>	<b>27</b>	
<b>Total</b>	<b>7.8</b>	<b>21</b>	<b>92.2</b>	<b>246</b>	<b>100</b>	<b>267</b>	

#### 4.1.6 HIV prevalence by residence and gender

Urban residents have a significantly higher risk of HIV infection (male 9.6% and female 9.3%) than rural residents (male 2.7% and female 5.1%). No significant difference ( $p = 2.250$ ) between Meru residence and HIV prevalence was observed (Table 4.6).

**Table 4.6 HIV prevalence by residence and gender**

Gender	Residence	HIV positive		HIV negative		Total		p –value
		%	N	%	N	%	n	
<b>Male</b>	Urban	9.60	9	90.0	85	35.2	94	2.250, $df = 1$
	Rural	2.70	1	97.0	36	13.8	37	
<b>Female</b>	Urban	9.30	9	90.7	88	36.3	97	
	Rural	5.00	2	94.9	37	14.7	39	
<b>Total</b>		<b>7.80</b>	<b>21</b>	<b>92.2</b>	<b>246</b>	<b>100</b>	<b>267</b>	

#### 4.1.7 HIV prevalence by business type and gender

HIV prevalence was high in female (17.1%) and male (8.5%) participants in *C. edulis* business. No significant difference exists between business type and HIV prevalence rate (Table 4.7).

**Table 4.7 HIV prevalence by business type and gender**

Business type	Gender	HIV positive		HIV negative		Total		p – value
		%	N	%	N	%	N	
<i>C. edulis</i>	Male	8.5	4	91.5	43	<b>17.6</b>	<b>47</b>	1.468, df=1
	female	1.2	7	82.9	34	<b>15.6</b>	<b>41</b>	
Other	Male	7.7	3	92.3	36	<b>14.6</b>	<b>39</b>	0.400, df=1
	female	6.5	2	93.5	29	<b>11.6</b>	<b>31</b>	
Non	Male	6.7	3	93.3	42	<b>16.8</b>	<b>45</b>	0.757, df=1
	female	3.1	2	96.9	69	<b>23.8</b>	<b>64</b>	
<b>Total</b>		<b>7.8</b>	<b>21</b>	<b>92.2</b>	<b>246</b>	<b>16.6</b>	<b>267</b>	

#### 4.1.8 HIV prevalence by sexual orientation, couple participation and pregnancy

All participants with no sexual orientation were HIV negative whereas all HIV positive participants (7.5%) were heterosexual regardless of gender. No discordance case was detected while participants who tested as individuals, 8.0% were HIV positive. All the pregnant women sampled at ANC clinics tested HIV positive. Among the women participants who were not pregnant, 6.7% were HIV positive while 93.3% were HIV negative. All male participants were circumcised and no one of them was tested at ANC clinics. Significant difference was observed between pregnancy and HIV prevalence rate ( $\chi^2 = 23.682$ ,  $p = 0.05$ ) and in TB and HIV co infection ( $\chi^2 = 12.844$ ,  $p = 0.05$ ) (Table 4.8).

**Table 4.8 HIV prevalence by sexual orientation, couple participation and pregnancy**

	HIV negative		HIV positive		Total		p - value
	%	N	%	N	%	N	
<b>Sexual orientation</b>							
Heterosexual	92.5	245	7.5	20	<b>99.3</b>	<b>265</b>	0.172
No sexual experience	100	2	0	0	<b>0.7</b>	<b>2</b>	
<b>Participation</b>							
Individual	92	241	8	21	<b>98.5</b>	<b>263</b>	0.347
Couple	100	4	0	0	<b>1.5</b>	<b>4</b>	
<b>Pregnancy</b>							
Pregnant	0	0	100	2	<b>0.8</b>	<b>2</b>	23.682
Not pregnant	3.3	125	6.7	9	<b>99.2</b>	<b>134</b>	
<b>Circumcision</b>							
Male	92.4	121	10	10	<b>100</b>	<b>131</b>	0.0119
<b>HIV-TB co infection</b>							
TB positive	68.8	11	31.2	5	<b>22</b>	<b>16</b>	12.844
TB negative	93.6	235	6.4	16	<b>22</b>	<b>251</b>	

#### 4.2 Results of social-demographic, knowledge on HIV and behavioural risk factors

There were slightly more female participants (50.9%) in the study than there were males (49.1%). Participants were grouped into 10 year age groups. The age group of 26-35 years had the majority females (61.5%) and fewer males (38.5%) whereas 45-55 years age group had least participants of males (37.2%) as compared to females (62.8%). Participants with no occupation were 73.6% males and 6.4% females while 68.8% females and 31.3% males were students. Significant difference however exists between occupation and gender ( $\chi^2 = 0.001$ ,  $p = 19.410$ ). Almost equal gender participation (50.0%) by marital status groups was obtained in partners living together, married polygamous couples, widowed and the never married. 49.2% of male participants were residents of Nyambene urban areas while 51.3% of female participants resided in rural areas.

Male participants in *C. edulis* business that include drivers, farmers and retailers were 53.4% while 55.7% were in other businesses which are not associated with *C. edulis*. Most female participants (58.7%) were not in any business. No significant difference exists between residence ( $p = 0.006$ ) and business type ( $p = 4.543$ ). All male participants (49.4%) were heterosexuals while 2 female participants had no sexual experience in their lives. Pregnancy among women participants was established were only 2 female participants were pregnant. Significant difference between pregnancy and women participation was observed ( $\chi^2 = 0.001$ ,  $p = 267.00$ ). None of the sampled participants was homosexual. 50.0% of male and female participants were counselled, interviewed and tested as couple. There was significant difference ( $\chi^2 = 0.001$ ,  $df = 1$ ,  $p = 0.001$ ) between couple participation and gender (Table 4.9).

**Table 4.9 Social-demographic, knowledge on HIV and behavioural risk factors**

Demographics	Clusters	Gender		N	p-value
		Male	Female		
<b>Age groups</b>	15-25	55.40%	44.60%	267	7.989
	26-35	61.50%	38.50%		
	36-45	47.80%	52.20%		
	46-55	37.20%	62.80%		
	55 and above	40.40%	59.60%		
<b>Occupation</b>	None	73.60%	26.40%	267	19.41
	Unskilled	48.10%	51.90%		
	Skilled	37.0%	63.00%		
	Profession	34.80%	65.20%		
	Student	31.20%	68.80%		
<b>Marital status</b>	never married	50.00%	50.00%	267	0.245
	partner living together	50.00%	50.00%		
	partner not living together	50.90%	49.10%		
	married monogamous	47.70%	52.30%		
	married polygamous	9 50.0%	9.50%		
	Widowed	50.00%	50.00%		
	separated/divorced	45.50%	54.50%		
<b>Residence</b>	Nyambene urban	49.20%	50.80%	267	0.006
	Nyambene rural	48.70%	51.30%		
<b>Education level</b>	no education attained	72.50%	27.50%	267	33.288
	pri. school education	28.60%	71.40%		
	sec. school education	56.20%	43.80%		
	post-sec. school ed.	44.40%	55.60%		
<b>Business type</b>	<i>C. edulis</i> business	53.40%	46.60%	267	4.543
	other business	55.70%	44.30%		
	no business	41.30%	58.70%		
<b>Pregnancy</b>	Yes	0.00%	100.00%	267	0.001
	No	0.00%	100.00%		
	not applicable	100%	0.00%		
<b>Participation</b>	Couple	50.00%	50.00%	267	0.001
	Individual	49.00%	51.00%		
<b>Sexual experience</b>	Yes	49.40%	50.60%	267	1.941
	No	0.00%	100.00%		
<b>Sexuality</b>	Heterosexual	49.40%	50.60%	267	1.941
	no experience	0.00%	100.00%		

#### 4.2.1 HIV Prevention methods – Abstinence, Condom use and Being faithful (ABC)

When considering the participants' knowledge on prevention methods of HIV infection, the participants' views on abstinence, being faithful to one sexual partner and condom use were established. Participant's perception on abstinence effectiveness in controlling spread of HIV was 93% (Figure 4.1), faithfulness among couples at 91.8% (Figure 4.2) and condom use at 61.0% (Figure 4.3).

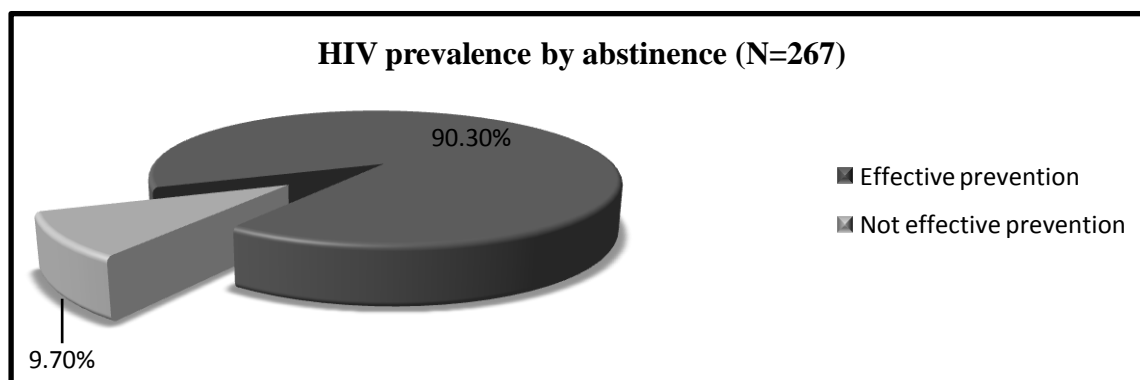


Figure 4.1 HIV prevention by abstinence

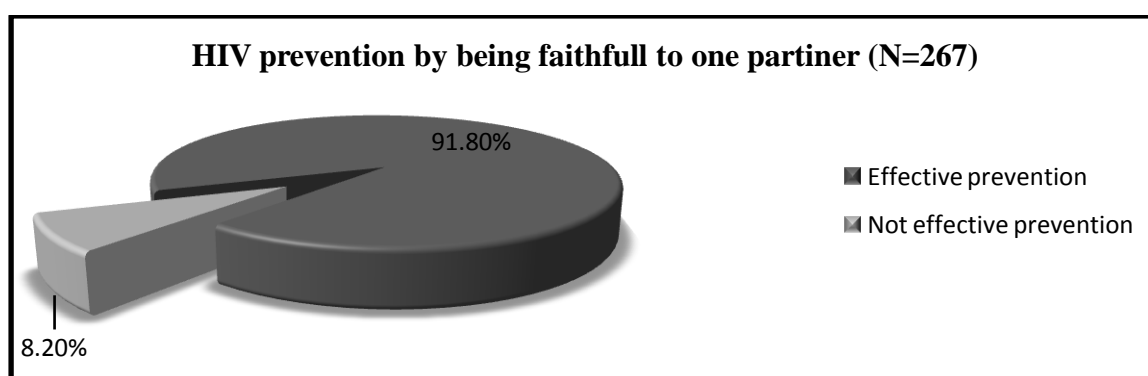


Figure 4.2 HIV prevention by being faithful to one partner

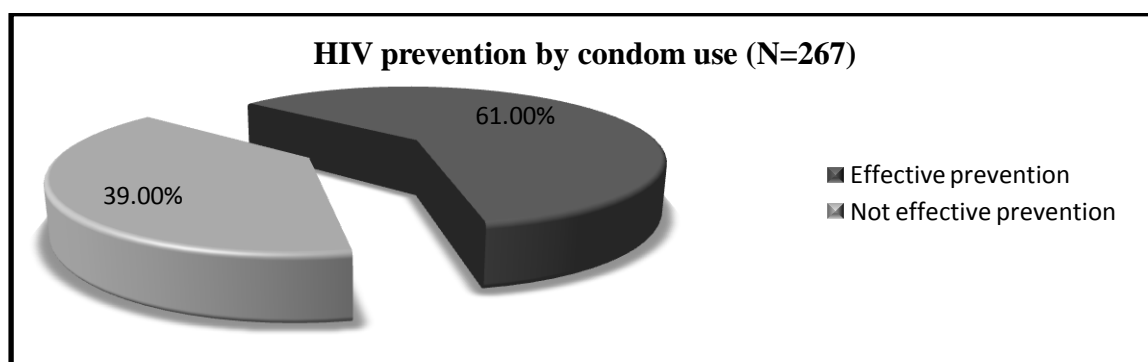


Figure 4.3 HIV Prevention by condom use

#### 4.2.2 Relationship between knowledge on HIV/AIDS ABC and HIV status

Participant's knowledge on HIV prevention by use of condoms was significantly related to their HIV status ( $r = 0.165$ ,  $p = 0.007$ ). HIV positive participants were more aware of HIV prevention by use of condoms than those who were HIV negative. More of those who felt that HIV can be prevented by abstinence were HIV negative while more of the positive participants felt otherwise ( $r = 0.002$ ,  $p = 0.973$ ). Similarly, more of the participants who are not aware that HIV can be prevented by being faithful to ones partner were found to be HIV positive ( $r = 0.091$ ,  $p = 0.139$ ) (Table 4.10).

**Table 4.10 Relationship between knowledge on HIV/AIDS ABC and HIV status**

HIV Prevention methods (ABC)	HIV Status		
	r – value	p - value	Sig. Relationship
Abstinence	- 0.002	0.973	$p \leq 0.05$
Being faithful to one partner	- 0.091	0.139	
Condom use	0.165*	0.007	

#### 4.2.3 *Catha edulis* use, prevention and knowledge in relation to HIV rate of infection

Among the participants who never used condoms, 6.6% were found to be HIV positive while 93.4% were HIV negative. 12.5% of those who always used condoms in the last 12 months were also found to be HIV positive. There was no significant differences in condom use in the last 12 months and HIV status of the respondents ( $\chi^2 = 2.898$ ,  $p = 0.408$ ). Individual decision to take an HIV test which is regarded as a healthy way in combating HIV was reflected by 211 participants who had previously tested for HIV. Among those who had undergone HIV tests before, 8.5% were found to be HIV positive. Participants who often use *C. edulis* reported 9.9% HIV prevalence rate. No significant difference was observed between frequency of *C. edulis* use and HIV infection rate. Participants who said there is a relationship between *C. edulis* use and HIV had 6.7% HIV prevalence rate. No significant difference exists between participant's perceptions on *C. edulis*-HIV relationship and their

HIV status. Participants who admitted that using *C. edulis* has affects on health had 23.5% HIV infection rate as compared to 6.8% who declined. Significant difference exist between *C. edulis* use effects on health and HIV infection rate ( $\chi^2 = 6.148$ ,  $p = 0.013$ ). Among the respondents who admitted the presence of effects of using *C. edulis* to sexuality, 90.5% tested HIV negative, 7.7% of the respondents who delinked *C. edulis* effects to sexual activity were HIV positive and 92.3% tested negative (Table 4.11).

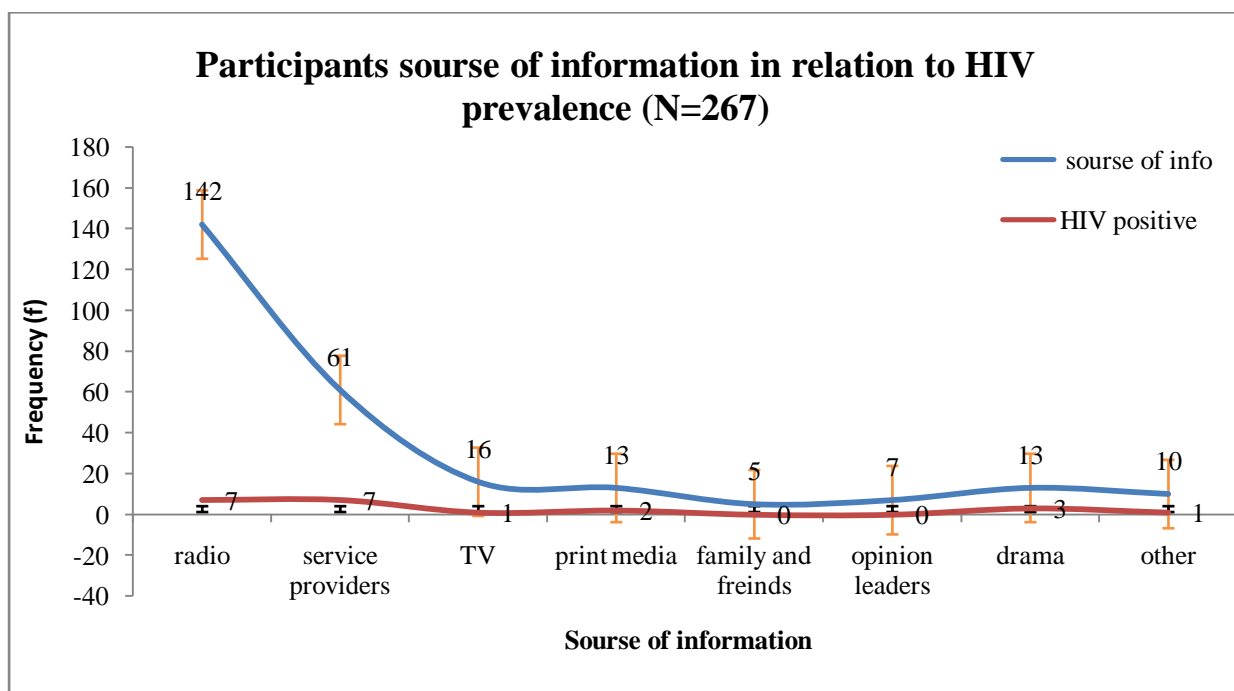
#### 4.11 *Catha edulis* use, prevention and knowledge in relation to HIV rate of infection

Questionnaire	HIV test results		N	p – value
	Negative	Positive		
<b>Condom use</b>				
Never	93.40%	6.60%	267	0.408
Sometimes	92.60%	7.40%		
Always	87.50%	12.50%		
No sex last 12 months	100.00%	0%		
<b>Ever tested HIV</b>				
Tested	91.50%	8.50%	267	0.615
Never tested	94.60%	5.40%		
<b><i>C. edulis</i> use</b>				
Often use	90.10%	9.90%	267	0.31
Not often use	92.90%	7.10%		
<b>Know what HIV /AIDS is</b>				
Male	92.40%	7.60%	267	
Female	91.90%	8.10%		
<b><i>C. edulis</i> and HIV relationship</b>				
Relation exist	93.30%	6.7	267	0.733
No relation	90.70%	9.30%		
Cannot tell	93.10%	6.90%		
<b>Health/dairy activities</b>				
Effect	76.50%	23.50%	267	0.034
No effect	93.2	6.80%		
<b>Sexuality</b>				
Effect	90.50%	9.50%	267	0.508
No effects	92.30%	7.70%		

#### 4.2.4 Participants source of information in relation to HIV prevalence

The most common source of information on HIV among participants was radio (142), followed by service providers that include outreach groups and community health worker at 61 participants. Among participants who got information from radio, low level of HIV infection was observed followed by service providers (Figure 4.4).

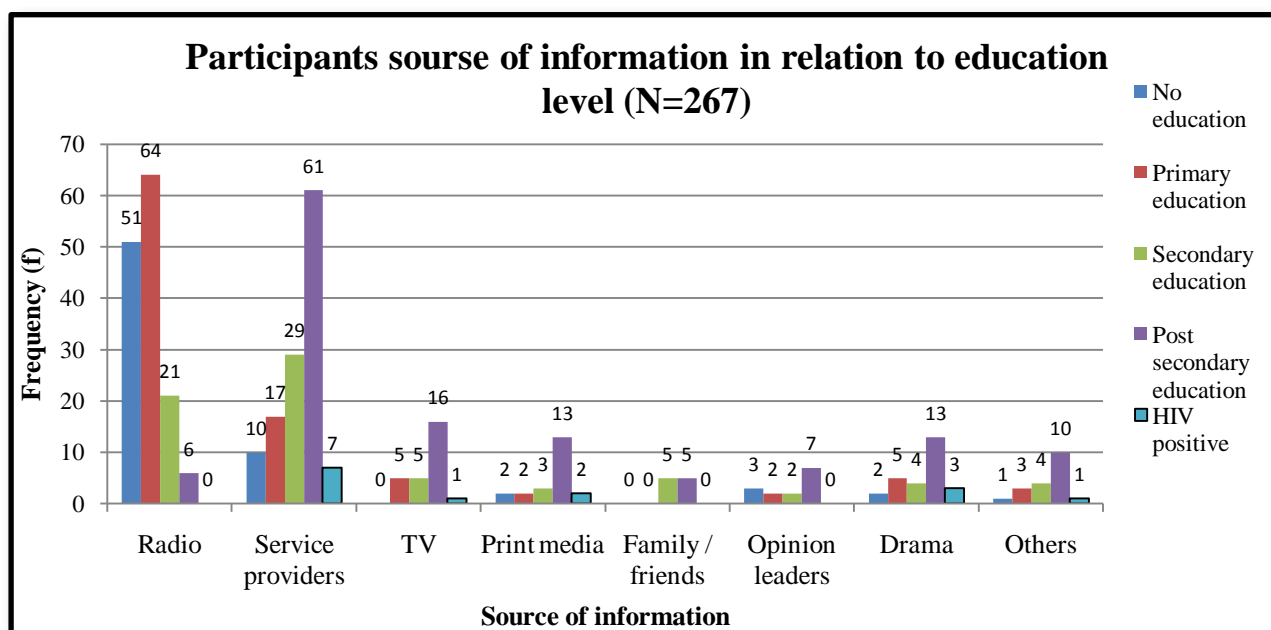
**Figure 4.4 Participants source of information in relation to HIV prevalence**



#### 4.2.5 Participants source of information in relation to education level

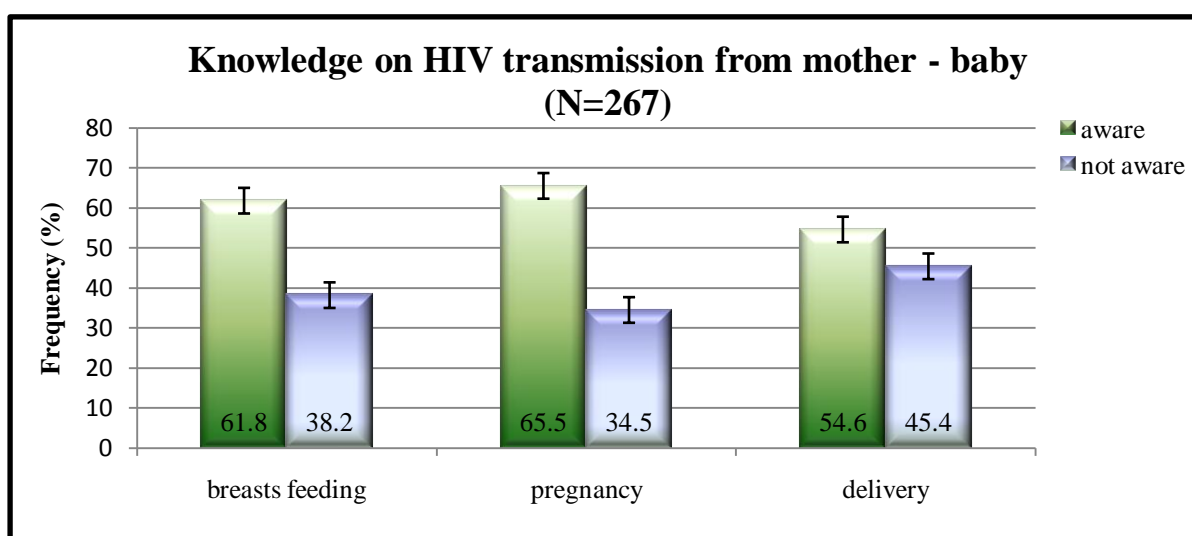
Participants with no formal education (51) and some primary school education (64) mostly got information on HIV/AIDS from radio. Television news, programmes and documentaries mostly targeted participant with post secondary school education (16). There was significant difference ( $\chi^2 = 87.761$ ,  $df = 7$ ,  $p = 0.001$ ) in sources of information and education level (Figure 4.5).

**Figure 4.5 Participants source of information in relation to education level**



#### 4.2.6 Knowledge on HIV transmission from mother to baby during breast feeding, during pregnancy and in delivery

Most participants were aware that HIV can be transmitted from mother to her baby by breast feeding (61.8%) mother to her baby during pregnancy (65.5%) and during delivery (54.6%). 45.4% of the participants were not aware that HIV can be transmitted from mother to her baby during delivery (Figure 4.6).



**Figure 4.6 Knowledge on HIV transmission from mother to baby during breast feeding, during pregnancy and in delivery**

#### 4.2.7 Education level in relation to HIV acquisition and transmission routes

Education level varied significantly on the correct responses given by participants. 80.8% of participants with secondary school education answered the question correctly on HIV transmission from mother to her baby by breast feeding. 70.4% and 57.1% participants with post secondary education and primary school education respectively gave the correct answer on the same question. Participant's response on HIV transmission from mother to baby during pregnancy was assessed where correct responses given by respondents varied. 40.8% of the respondents with some primary school education had the highest score while the lowest score of 20.5% recorded among secondary school educated participants. Responses given by participants on HIV transmission from mother to baby during delivery was below average. A slightly higher percentage (58.0%) of participants with no formal education were able to answer the question correctly as compared to primary, secondary and post secondary school educated respondents at 45.9%, 34.2% and 51.95% respectively.

All participants were aware that HIV can be transmitted from one person to another by sharing a needle except one participant (1.4%) with no education background. Majority of participants regardless of education background answered the question on possible HIV transmission by buying *C. edulis* from PLWA correctly. Only 2.9% and 2.0% of participants with no formal education and primary school education respectively answered the question incorrectly. Participant's knowledge on HIV acquisition by chewing *C. edulis* was assessed based on their education level. Correct responses obtained from primary school educated (99.3%), secondary school educated (94.5%) and post secondary school educated (96.3%) did not significantly vary. However significant difference ( $\chi^2 = 5.812$ ,  $p = 0.121$ ) exist between education level and knowledge on HIV acquisition by *C. edulis* use (Table 4.12).

**Table 4.12 Education level in relation to HIV acquisition and transmission**

<b>Transmission mode</b>	<b>Transmission</b>	<b>No transmission</b>	<b>n(%)</b>	<b>N</b>	<b>p-value</b>
<b>Breast feeding</b>					
No formal education	58.00%	42.00%	69	267	21.249
Primary school education	45.90%	54.10%	98		
Secondary school education	34.20%	65.80%	73		
Post secondary education	51.90%	48.10%	27		
<b>During delivery</b>					
No formal education	55.10%	44.90%	69	267	8.381
Primary school education	42.90%	57.10%	98		
Secondary school education	19.20%	80.80%	73		
Post secondary	29.60%	70.40%	27		
<b>During pregnancy</b>					
No formal education	34.80%	65.20%	69	267	10.252
Primary school education	40.80%	59.20%	98		
Secondary school education	20.50%	79.50%	73		
Post secondary education	48.10%	51.90%	27		
<b>Sharing a needle</b>					
No formal education	98.60%	1.40%	69	267	2.88
Primary school education	100.0%	0.00%	98		
Secondary school education	100.0%	0.00%	73		
Post secondary education	100.0%	0.00%	27		
<b>Buying <i>C. edulis</i> from PLWA</b>					
No formal education	2.90%	97.10%	69	267	2.634
Primary school education	2.00%	98.00%	98		
Secondary school education	0.00%	100.00%	73		
Post secondary education	0.00%	100%	27		
<b>Using <i>C. edulis</i></b>					
No formal education	14.50%	85.50%	69	267	5.812
Primary school education	6.10%	93.90%	98		
Secondary school education	5.50%	94.50%	73		
Post secondary	3.70%	96.30%	27		
<b>Sharing a needle</b>					
No formal education	98.60%	1.40%	69	267	2.88
Primary school education	100.00%	0.00%	98		
Secondary school education	100.00%	0.00%	73		
Post secondary	100.00%	0.00%	27		
<b>Buying <i>C. edulis</i> from PLWA</b>					
No formal education	2.90%	97.10%	69	267	2.634
Primary school education	2.00%	98.00%	98		
Secondary school education	0.00%	100.00%	73		
Post secondary	0.00%	100.00%	27		
<b>Sharing a cup of coffee, alcohol''/ makali'</b>					
No formal education	17.40%	82.60%	69	267	2.386
Primary school education	16.30%	83.70%	98		
Secondary school education	9.60%	90.40%	73		
Post secondary	18.50%	81.50%	27		

### 4.3 Effects of *C. edulis* use to the CD4 and viral load of PLWA

In order to establish the effects of *C. edulis* use to CD4 cells count and HIV viral load, all HIV positive participants were further subjected to CD4 cells and viral load counts. These results were compared to a control group of equal number of HIV positive non *C. edulis* using participants recruited randomly from the study area. Sampling frame here involved one participant from each of the 22 villages regardless of social-demographic factors.

#### 4.3.1 CD4 counts among HIV positive participants

Among the HIV positive participants, 90.5% had CD4 count of above 250cells/mm<sup>3</sup> while 9.5% participants had less than 250 cells/mm<sup>3</sup> CD4 cells counts. Only HIV positive participants were monitored on their second CD4 cells counts after 3 months where 90.5% had 250cells/mm<sup>3</sup> and above counts and 9.5% had less than 250 cells/mm<sup>3</sup> CD4 cells counts. Response by 4.8% respondents was not achieved in second count (Table 4.13).

**Table 4.13 CD4 counts of HIV positive participants**

HIV status	CD4 count clusters (cells/mm <sup>3</sup> )				Total
	0	1-250	Above 250	Not available	
<b>First count - 1<sup>st</sup> month</b>					
HIV negative	0 (0%)	2 (9.5%)	19 (90.5%)	-	<b>21 (100.0%)</b>
HIV positive	246 (100%)	246 (100%)	0 (0%)	-	<b>246 (100%)</b>
<b>Second count after 3 months</b>					
HIV negative	0 (0%)	2 (9.5%)	18 (90.5%)	1 (4.8%)	<b>21 (100%)</b>
HIV positive	246 (100%)	246 (100%)	0 (0%)	-	<b>246 (100%)</b>

#### 4.3.2 Participants HIV status, frequency of *C. edulis* use and CD4 counts

CD4 counts among HIV negative participants were not included in the study. 92.9% of HIV positive participants who often use *C. edulis* had CD4 count of over 250cells/mm<sup>3</sup> during the first count. In the second count after 3 months, 14.3% of those who often use *C. edulis* had CD4 counts between 1-250 cells/mm<sup>3</sup> while 7.1% of participant who do not often use *C.*

*edulis* had CD4 counts between 1-250cells/mm<sup>3</sup>. 92.9% of participants who do not often use *C. edulis* had CD4 counts of 250cells/mm<sup>3</sup> and above while 85.7% of participants who use *C. edulis* had CD4 counts of 250cell/mm<sup>3</sup> and above. However no significant difference was observed between *C. edulis* use and CD4 first and second counts (Table 4.14).

**Table 4.14 Participants HIV status, frequency of *C. edulis* use and CD4 counts**

HIV status	<i>C. edulis</i> use (f)	CD4 Count clusters in first reading					p – value
		0 cells/mm <sup>3</sup>	1-250 cells/mm <sup>3</sup>	Over 250 cells/mm <sup>3</sup>	Not available	Total	
<b>First CD4 count – 1<sup>st</sup> month</b>							
HIV –ve	Often	64 (100%)	-	-	-	<b>64 (100%)</b>	20.000, df=19
	Not often	182 (100%)	-	-	-	<b>182 (100%)</b>	
HIV +ve	Often	-	1 (14.3%)	6 (85.7%)	-	<b>7 (100%)</b>	
	Not often	-	1 (7.1%)	13 (92.9%)	-	<b>14 (100%)</b>	
<b>Second CD4 count – after 3 months</b>							
HIV –ve	Often	64 (100%)	-	-	-	<b>64 (100%)</b>	20.000, df =19
	Not often	182 (100%)	-	-	-	<b>182 (100%)</b>	
HIV +ve	Often	-	1 (14.3%)	6 (85.7%)	-	<b>7 (100%)</b>	
	Not often	-	1 (7.1%)	13 (92.9%)	-	<b>14 (100%)</b>	

### 4.3.3 Mean distribution of CD4 counts across gender

It was established that there was no differences in the CD4 counts in the groups but the individual CD4 counts within the groups differed on the second count after 3 months. Considering the CD4 counts in male and in female, the findings was subjected to two sample t-test and the results showed that there was no significant differences in the male first CD4 counts (mean 394.70) from the female first CD4 counts (mean 632.20), ( $t = 2.067$ ,  $df = 9$ ,  $p = 0.690$ ). No significant difference exist between second male CD4 count (mean 885.60) and female CD4 count (mean 867.20) ( $t = 0.208$ ,  $df = 9$ ,  $p = 0.840$ ). Using a paired t-test to establish variations in the CD4 counts, the result showed that there was significant difference in the CD4 counts on the first day of the individuals to the second counts after three months of the same individuals ( $t = 6.009$ ,  $df = 19$ ,  $p = 0.001$ ) (Table 4.15).

**Table 4.15 Mean distribution of CD4 counts across gender**

CD4 counts (cells/mm <sup>3</sup> )							
	Gender	N	X	SD	SE Mean	Paired t – test	
<b>1<sup>st</sup> count 1<sup>st</sup></b>	Male	10	394.70	156.45	49.47	0.690, p=2.067	0.001, p=6.009,
	Female	10	632.20	276.83	87.54		
	<b>Total</b>	<b>20</b>	<b>513.45</b>	<b>250.48</b>	<b>56.01</b>		
<b>2<sup>nd</sup> count</b>	Male	10	885.60	257.82	81.53	0.840, p=0.208	
	Female	10	867.20	168.44	53.26		
	<b>Total</b>	<b>20</b>	<b>876.40</b>	<b>212.17</b>	<b>47.43</b>		
<b>1<sup>st</sup> Control</b>	Male	10	667.30	308.65	97.60	0.920, p=0.929	0.006, p=3.091,
	Female	10	653.20	264.70	83.70		
	<b>Total</b>	<b>20</b>	<b>660.25</b>	<b>279.94</b>	<b>62.59</b>		
<b>2<sup>nd</sup> Control</b>	Male	10	502.90	207.62	65.65	0.885, p=0.399	
	Female	10	409.00	240.32	75.99		
	<b>Total</b>	<b>20</b>	<b>455.95</b>	<b>223.82</b>	<b>50.05</b>		

#### 4.3.4 Participants HIV status and viral load count

Few HIV positive participants (9.5%) had undetectable viral load of less than 50 copies/ml viral load. 57.1% of the participants had viral load between 1001-10000 copies/ml while 4.8% had viral load of over 10001copies/mm<sup>3</sup>. On the second count, 42.9% of the participants had viral load counts of over 10001copies/ml while no participant had undetectable viral load. 33.3% had viral load of between 1001-10,000copies/ml while 9.5% of participants did not turn up for viral load count (Table 4.16).

**Table 4.16 Participants HIV status and viral load count**

HIV status	Viral load count (copies/ml)						Total
	Not detected	50-1000	1001-10000	Over 10001	Not available	not applicable	
	<b>1<sup>st</sup> count viral load count – first month</b>						
negative	-	-	-	-	-	246 (100%)	246(100%)
positive	2 (9.5%)	6 (28.6%)	12 (57.1%)	1(4.8%)	-	-	21 (100%)
<b>Total</b>	<b>2(0.72%)</b>	<b>6(2.4%)</b>	<b>12(4.5%)</b>	<b>1(0.4%)</b>	-	<b>246(91.9%)</b>	<b>267(100%)</b>
	<b>2<sup>nd</sup> count viral load count - after 3 months</b>						
negative	-	-	-	-	-	246 (100%)	246 (100%)
positive	1 (4.8%)	3 (14.3%)	7 (33.0%)	9 (42.9%)	2 (9.5%)	-	21 (100%)
<b>Total</b>	<b>1(%)</b>	<b>3(%)</b>	<b>7(%)</b>	<b>9(%)</b>	<b>2(%)</b>	<b>246(100%)</b>	<b>267(100%)</b>

#### 4.3.5 HIV status, frequency of *C. edulis* use and viral load counts

Undetected viral load, which is a count between 1-50 HIV RNA copies/millilitre was detected in 14.3% of HIV positive participants who often chew *C. edulis*, 57.1% of their counterparts had viral load of between 50-1000 copies/ml while 2.8% had viral load between 1001-10001 copies/ml. 71.4% of participants who do not often use *C. edulis* had viral load between 1001-10001 copies/ml. In the second viral load count after 3 months, 42.9% of HIV positive participants who often use *C. edulis* had viral load between 1000-10001copies/ml, 28.6% had viral load of over 10001copies/ml while 42.9% of participants who not often use *C. edulis* had over 10001copies/ml viral load. Using a two sample t-test to compare the viral load of those who often chew *C. edulis* with the load for those who do not often use, the result showed that there was no significant difference in the viral loads in the two counts i.e. first and second viral load counts (Table 4.17).

**Table 4.17 HIV status, frequency of *C. edulis* use and viral load counts**

<i>C. edulis</i> use	Not applicable	Not detected	50-1000	1001-10000	Over 10001	Total	t- test
<b>First viral load count HIV RNA copies/ml – first month</b>							
<b>Often</b>							
HIV –ve	64 (100%)	0 (0%)	0 (0%)	0 (0%)	-	<b>64 (100%)</b>	0.130, P=0.098
HIV +ve	0 (0%)	1 (14.3%)	4 (57.1%)	2 (2.8%)	-	<b>7 (100%)</b>	
<b>Not often</b>							
HIV –ve	182 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	<b>182 (100%)</b>	
HIV +ve	0 (0%)	1 (7.1%)	2 (14.3%)	10 (71.4%)	1 (7.1%)	<b>14 (100%)</b>	
<b>Total</b>	<b>246</b>	<b>2</b>	<b>6</b>	<b>12</b>	<b>1</b>	<b>267(100%)</b>	
<b>Second viral load count HIV RNA copies/ml - after 3 months</b>							
<b>Often</b>							
HIV –ve	64 (100%)	0 (0%)	0 (0%)	0 (0%)	-	<b>64 (100%)</b>	0.230, P=0.816
HIV +ve	0 (0%)	2 (28.6%)	3 (42.9%)	2 (28.6%)	-	<b>7 (100%)</b>	
<b>Not often</b>							
HIV –ve	184 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	<b>184 (100%)</b>	
HIV +ve	0 (0%)	1 (7.1%)	3 (28.6%)	6 (42.9%)	2 (14.3%)	<b>12 (100%)</b>	
<b>Total</b>	<b>248</b>	<b>3</b>	<b>7</b>	<b>8</b>	<b>2</b>	<b>267(100%)</b>	

#### 4.3.6 Mean distribution of viral load counts across gender

Using a paired t-test to establish variations in the viral load, the result showed that there was no significant difference in the viral load on the first day of the individuals to the counts after three months of the same individuals ( $t = 0.568$ ,  $df = 19$ ,  $p = 0.577$ ). Considering the viral load in male and in female, the findings was subjected to two sample t-test and the results showed that there was no significant differences in the male 1<sup>st</sup> viral load count (mean 4244.9) from the 1<sup>st</sup> female viral load count (mean 1293.5) ( $t = 2.142$ ,  $df = 9$ ,  $p = 0.610$ ). There was still no significant difference between 2<sup>nd</sup> male viral load (mean 5437.8) and 2<sup>nd</sup> female viral load (mean 8913.8) ( $t = 0.891$ ,  $df = 9$ ,  $p = 0.396$ ). Mean separated using Turkeys' HSD (Table 4.18).

**Table 4.18 Mean distribution of viral load counts across gender**

	Gender	N	X	SD	SE Mean	Paired t – test	
<b>1<sup>st</sup> count</b>	Male	10	4244.9	4554.53	1440.27	2.142, p=0.610	0.568, p=0.577
	Female	10	1293.5	11477.67	3629.56		
	<b>Total</b>	<b>20</b>	<b>8590.0</b>	<b>9438.21</b>	<b>2110.44</b>		
<b>2<sup>nd</sup> counts</b>	Male	10	5437.8	4554.53	1440.27	0.891, p=0.396	
	Female	10	8913.8	9664.18	3056.08		
	<b>Total</b>	<b>20</b>	<b>7175.8</b>	<b>7566.11</b>	<b>1691.83</b>		
<b>1<sup>st</sup> control group</b>	Male	10	1801.9	1195.57	378.07	0.717, p=0.491	1.807, p=0.870
	Female	10	2197.8	2727.45	862.49		
	<b>Total</b>	<b>20</b>	<b>1999.8</b>	<b>2059.62</b>	<b>460.54</b>		
<b>2<sup>nd</sup> control group</b>	Male	10	4255.6	4368.14	1381.32	0.350, p=0.735	
	Female	10	2197.8	2727.45	862.49		
	<b>Total</b>	<b>20</b>	<b>1999.8</b>	<b>2059.62</b>	<b>460.54</b>		

#### 4.3.7 Correlation for the viral load and the CD4 counts

Viral load and CD4 counts were evaluated for both counts (1<sup>st</sup> and 2<sup>nd</sup> counts), the results showed that there was a significant relationship in the viral load to the number of CD4 counts ( $r = -0.537$ ,  $p = 0.001$ ). This indicated that the higher the level of CD4 counts in an individual the lower the level of viral load recorded (Table 4.19).

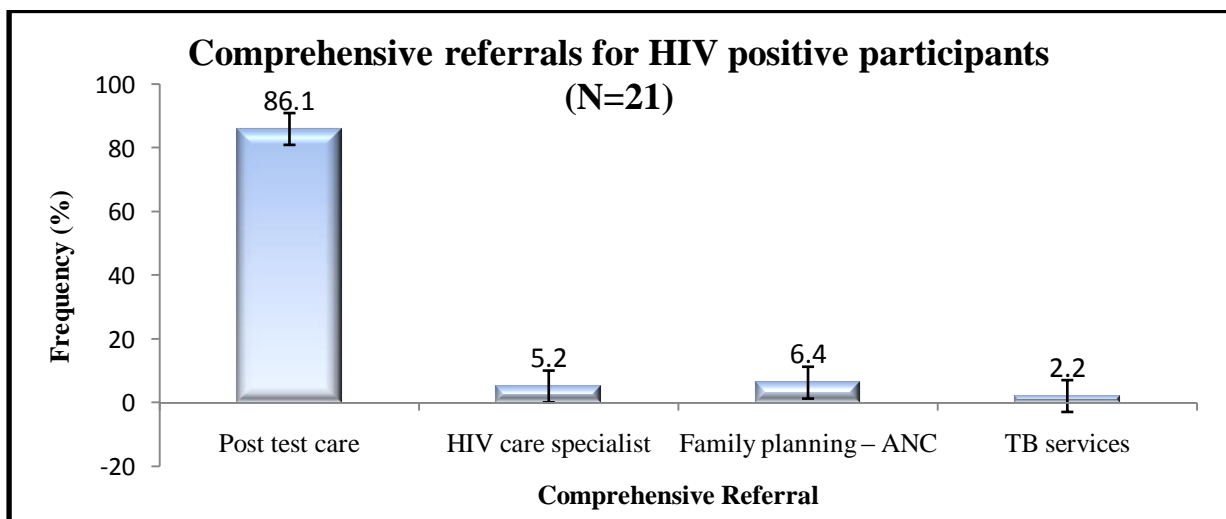
**Table 4.19 Correlation for the viral load and the CD4 counts**

		CD4 cells count	Viral load
CD4 cells count	Pearson Correlation	1	--.537**
	Sig. (2 - tailed)		0.001
	N	40	
	Pearson Correlation	0.001	1
	Sig. (2 - tailed)		
	N		40

\*\* Correlation is significant at the 0.01 level (2-tailed).

#### 4.4 Comprehensive referrals

HIV positive participants (5.2%) were referred to HIV care specialist while those with TB co infection (2.2%) and all TB cases were referred to TB clinics. Antenatal mothers (96.4%) were referred to ANC. All participants who tested negative for HIV (86.1%) were referred to Post-test care. No referral was made to psychiatrist (Figure 4.7).



**Figure 4.7 Comprehensive referrals**

#### 4.5 Overall response by the participants

Overall response in recruitment of participants into the study and filling of the questionnaire was high but the numbers declined during the stage of blood draw for HIV test. A correlation was established between the mean of eligible participant and the mean of those who tested for HIV (Table 4.20).

#### 4.20 Overall response by the participants

Participation	N	$\bar{x}$	Std. Deviation	Std. Error $\bar{x}$	r- value
Eligibility level	309	127.60	151.03741	67.54598	0.032
Questionnaire	283	113.20	151.03741	67.54598	
HIV testing	267	106.80	137.41434	61.45356	

#### 4.6 HIV prevalence in Nyambene County (January – May, 2012)

Overall female HIV prevalence was higher than males. Maternity clinics had the lowest HIV prevalence rate (2.90%) while ANC that recorded the second lowest HIV prevalence rate (3.50%) had no paternal HIV test. ANC also recorded a high number of declines where out of 489 people counselled, 149 mothers declined to know their HIV status. TB clinic was leading with HIV prevalence of 34.8% whereas VCT centres recorded the highest number of clients at 1753 (Table 4.21).

**Table 4.21 HIV prevalence data in Nyambene County (January – May, 2012) - MoPH**

Gender	Participation	County hospital departments/clinics				
		VCT	DCT	ANC	Maternity	TB Clinic
<b>Female</b>	Counselled	796	46	489	69	23
	Tested	796	36	340	69	23
	HIV positive	60	11	12	2	8
	HIV prevalence	7.5%	30.5%	3.50	2.90%	34.8%
<b>Male</b>	Counselled	957	79	0	0	59
	Tested	957	79	0	0	59
	HIV positive	52	16	0	0	7
	HIV prevalence	5.40%	20.2%	0 (0.0%)	0 (0.0%)	20.2%
<b>Total</b>	<b>Counselled</b>	<b>1753</b>	<b>125</b>	<b>498</b>	<b>69</b>	<b>82</b>
	<b>Tested</b>	<b>1753</b>	<b>115</b>	<b>340</b>	<b>69</b>	<b>82</b>
	<b>HIV positive</b>	<b>112</b>	<b>27</b>	<b>12</b>	<b>2</b>	<b>15</b>
	<b>HIV prevalence</b>	<b>6.3%</b>	<b>23.50</b>	<b>3.50%</b>	<b>2.90%</b>	<b>18.30%</b>

## CHAPTER FIVE

### DISCUSSION

#### 5.1 HIV prevalence

The study established that average HIV prevalence in 2012 among *C. edulis* users in Nyambene region of Meru County was higher (7.85%) than the overall region's HIV prevalence (6.45%) and VCT centres quarterly prevalence update (6.3%). HIV prevalence among persons aged 15 years and above decreased nationally from 7.2%, as measured in KAIS 2007 to 5.6% in 2012 (KIAS, 2012). Women who use *C. edulis* especially those aged between 36-45 and males aged 15-25 years are considerably at a higher risk of being infected with HIV. This study agrees with a previous study by Schwartlander (2011) that high rates of HIV prevalence are observed to be highest among young ages. Young people are less likely than adults to exhibit accurate, comprehensive understanding of how to prevent HIV transmission (Tegang *et al.*, 2007). In such a young and comparatively sexually inexperienced segment of the population, HIV prevalence is regarded as a useful surrogate for HIV incidence (KDHS, 2012).

Separated or divorced *C. edulis* users are at a higher risk of HIV infection (18.2%) followed by widowed (16.7%). According to KIAS (2012), both women and men who reported that they were widowed had high HIV prevalence (20.3% and 19.2% respectively). Those who reported they had never married or cohabited had the lowest HIV prevalence (2.7% and 1.3%, respectively). Previously done studies suggest that HIV prevalence has remained high among widowed (27.6%) and separated/divorced (14.1%) in 2007 and widowed (31.8%) and separated/divorced (15.1%) in 2003. This can be attributed to the fact that they are more likely to have many sexual partners than other marital groups. The study is in-line with previously done research that suggest the risk of becoming infected with HIV is directly

correlated with the number of sexual partners (Mishra *et al.*, 2009, Amornkul *et al.*, 2009, Mattson *et al.*, 2007).

*Catha edulis* use is significantly related to education level, work status and high risk of HIV infection. Those who have completed secondary school and those in no professional occupation have higher prevalence than those with either less or more education and those in other professions. Higher educational attainment has always been associated with high risky sexual behaviour that predisposes one to HIV acquisition especially during periods of HIV epidemic (Buve *et al.*, 2002). In sub-Saharan Africa generally, educational attainment is inversely correlated with HIV prevalence for women, at least according to surveys conducted over the last 10–15 years (Hargreaves *et al.*, 2008). The higher socioeconomic status the more exposed money gives people greater disposable income, increase leisure time, increased ability to travel and to use commercial sex partners (Ciomwari *et al.*, 2012).

Urban residents are historically more likely to be HIV-infected than rural dwellers. However, there is a notable distinction between men and women in this regard (NASCO, 2011). The risk associated with Nyambene urban residence is even greater; urban women are twice as likely to be infected as rural men. This is attributed to their increased mobility and social cultural interactions. High HIV prevalence was also observed among female participants in *C. edulis* business as compared to people in no or other business. Increased mobility due to nature of their business and security often provided by men other than their spouses could be the contributing factor. Urbanisation and modernisation exchange tradition village norms for an urban modern ethos with fewer restrictions on sexual behaviour and marriage (Buve *et al.*, 2002 and UNFPA, 1999) in turn lead to high HIV prevalence.

All the pregnant women sampled at ANC clinics tested positive for HIV. No male spouse participation was recorded. Absence was the main reason for non-response among men. According to 5 months (January-May, 2012) data from Nyambene District MoPH, HIV prevalence was low among ANC mothers and in maternity ward while no man was tested for HIV during that period. On the other hand lack of circumcision is considered a risk factor for HIV infection, in part because of physiological differences that increase the susceptibility to HIV infection among uncircumcised men. Several prior studies in Kenya have shown a significant relationship between male circumcision and HIV risk (KDHS, 2012). All male participants in the study were circumcised and accounted for 7.6% HIV prevalence rate. The proportion of men who were circumcised increased nationally from 85% in 2007 to 91% in 2012 (KIAS, 2012).

People with HIV are estimated 20 to 37 times more likely to develop tuberculosis than people who do not have the infection (WHO, 2011). The study established that there exist significant difference between HIV and TB co infection. HIV prevalence among TB infected *C. edulis* users was high at 31.2% which is similar to data by Nyambene District MoPH, (34.8%). In 2010, 41% of the notified TB cases were HIV infected in Kenya. The dual epidemic is particularly pervasive in Africa, where 80% of the total global burden of dual HIV/TB cases is found (NASCO, 2009).

### **5.1.2 Social demographic, knowledge and behavioral risk factors on HIV**

Awareness of HIV, an understanding of how it may be transmitted, and a perception of individual risk are essential to sexual risk reduction, although they are often insufficient on their own to prevent transmission. Although various demographic and socioeconomic conditions put the educated at greater risk of HIV infection it has been hypothesized that they

will be more likely to change their behaviour in response to information about HIV (Ciomwari, 2012). The education level among participants was low. Most common source of information on HIV/AIDS was the radio especially among people with no formal education and those with primary school education while family and friends played the least role in educating masses on HIV/AIDS. This is also reflected by KIAS, 2012 Report that put radio and service providers as the most common source of information on HIV/AIDS while drama and opinion leaders as less common source regardless of residence.

Knowledge and behavioral risk factors about ABC HIV prevention methods varied by the specific knowledge question asked. Over 90% of the respondents were aware that abstinence and being faithful to one partner reduces chances of acquiring HIV. Though condom provision accounts for 5.7% of all HIV prevention spending in Kenya (Gelmon *et al.*, 2009), 60% of participants were aware that condom use reduces chances of contracting HIV and very few participants always used it. Low levels of consistent condom use were observed among individuals who reported a sexual partner of discordant or unknown HIV status. This observation held for both women and men participants. In turn they had highest HIV prevalence when compared to their counterparts who never used or sometimes used a condom. Proper use of condom compounded by sexual partners could be the contributing factor to the high prevalence rate. In a previous study by NASCOP (2009), 73% of adult women and 79% of adult men surveyed in knew that condoms use could prevent HIV transmission. Studies have shown that Kenyan men are more likely to use condoms during intercourse with a female sex worker than when they have sex with their spouse or regular partner (Fekaduk *et al.*, 2007).

All *C. edulis* using participants in the study knew what HIV/AIDS is as compared to respondents interviewed in the 2010, when asked whether they heard of an illness called HIV/AIDS, 99.0% of females and all males answered yes (KNBS, 2010). Half of the participants linked *C. edulis* use to HIV and had a prevalence rate of 6.7%. Knowledge on HIV transmission from one person to another by buying *C. edulis* from PLWA was high at 98.55%. When compared to NASCOP, (2011) National Report, 68.0% of men and 80.0% women respondents said there's no risk of purchasing vegetables from an HIV infected vendor. According to Pathfinder International report, 2009 one-third of individuals surveyed in North-East Province and in the Eastleigh neighbourhood of Nairobi said it was reasonable to refuse to buy goods from a person living with HIV.

Almost all participants said *C. edulis* use does not affect their sexuality and daily activities. This was perceived as denial by respondents when compared to previously done research on *C. edulis* adverse effects to sexuality by Arimi *et al.*, (2003), Dhadphale *et al.*, (1981), El-Shoura *et al.*, (2010), Emukule *et al.*, (2009), Mwenda *et al.*, (2008), and adverse effects to health by Dajoh (2010), Fekaduk (2007), Ganda (2010), Giannini (1982) and Kalix, (1985).

Formal education seemed to play a big role in knowledge on different HIV transmission routes (UNAIDS, 2011 and WHO, 2011). Lack of knowledge on HIV transmission routes from mother to baby by breast feeding and during delivery was evident by less than half of participants able to give a correct answer to this question respectively. However there was significant difference on education level and breast feeding, pregnancy and HIV transmission during delivery. Significant difference exists between education level and knowledge on HIV acquisition by *C. edulis* use. Some participants believe that HIV can be transmitted by

sharing a cup and sexual partner who use *C. edulis*. This shows lack of proper education on different HIV transmission routes.

All male participants had previous sexual experience. Only 0.7% female participants had no sexual encounter and tested negative for HIV. In a previous study (NASCOP, 2009), women who had not had intercourse in the previous 12 months had higher HIV prevalence (15.8%) than women who had high-risk sex without a condom (13.4%). Women's greater physiological susceptibility to HIV infection is compounded by a series of social, economic and legal disadvantages that expose women and girls to potentially dangerous situations or reduce their ability to take actions to reduce their risk of infection (KDHS, 2012). All participants with previous sexual experience were heterosexuals. Although heterosexual intercourse remains the driving force in Kenya's epidemic, accounting for more than 77% of all new infections, other transmission routes contribute a much larger share of new HIV infections than previously estimated (Guows *et al.*, 2006).

It was revealed that a large number of participants had previously undergone an HIV test where 8.5% of them were found to be HIV positive. This showed willingness among *C. edulis* users to participate in testing and counselling for HIV as an entry point to HIV prevention, treatment, care and support. According to KNBS, 2010 women are significantly more likely to have been tested than men, perhaps as a result of the emphasis on HIV testing in antenatal settings. While nearly three-quarters of adult women (73.5%) have ever been tested, only 58.6% of men have ever received an HIV test.

### 5.1.3 CD4 cells and viral load counts in relation to *C. edulis* use

Viral load and CD4 counts are two measures used to monitor the health status of individuals infected with HIV. The likelihood that an HIV-infected person will transmit the virus to another is directly related to the infected individual's viral load (Quinn *et al.*, 2000). Usually within weeks of initial exposure to HIV, the infected individual experiences a dramatic surge of viral replication, which continues until the body's immune system mounts a response that temporarily lowers the viral load (Piatak *et al.*, 1993). Due to such high virus levels, individuals with a new case of HIV infection are unusually infectious (Pilcher *et al.*, 2010). Over half (57.1%) of the 21 HIV positive participants had a viral load of 1001 – 10000 copies/ml in first count and 42.9% had a viral load of over-10000 copies/ml after 3 months in their second count. This shows how infectious the participants were during the study hence the need for comprehensive referral to ART specialist. There was significant difference between *C. edulis* users CD4 cells count (mean 684.50) and non-*C. edulis* users which were the control group (mean 467.65) ( $t = 2.825$ ,  $df = 19$ ,  $P = 0.011$ ) hence *C. edulis* use compounded with other factors, increases CD4 levels.

Significant relationship between CD4 counts and viral load was observed ( $r = 0.537$ ,  $P = 0.001$ ). The study agrees with previous studies by Hargreaves *et al.*, 2006 that an increase in viral load is often followed by a fall in CD4 count, which is frequently followed by an illness. Viral load has an impact on the CD4 count as an increase of virus in the blood leads to a reduction in CD4 T cells, meaning that there is a greater risk of developing symptomatic HIV in the following years (Hargreaves, 2006). Most *C. edulis* users had high baseline CD4 counts of over 250cells/mm<sup>3</sup> as compared to the control group (non *C. edulis* users). Viral load mean difference in male's CD4 cells (730cells/ml) count as compared to female's

(855cells/ml). There was significant difference in the CD4 counts on the first day of the individuals to the counts after three months of the same individuals ( $p = 0.001$ ).

In considering frequency of *C. edulis* use, the study established that there was no significant difference between CD4 and viral load count of participants who often use and those who do not. Other external factors can be attributed to this. External forces such as infections, time of the day, smoking, stage in the menstrual cycle, oral contraceptive use, rest and stress can affect CD4 counts. External factors such as vaccinations and infections and it is also possible that the time of day the test is taken makes a difference in viral load count (Hargreaves, 2012).

## 5.2 Conclusion

- 1) HIV prevalence rate among *C. edulis* chewers aged 15 years and above in Nyambene region of Meru County is higher as compared to the 2012 quarterly general population HIV prevalence of the region.
- 2) Women who chew *C. edulis* were more likely to be infected with HIV particularly age groups 26-35 and 36-45 while young males of 15-25 years, widowed and monogamous men and women are most vulnerable.
- 3) *Catha edulis* chewing is a risk behavior for the spread of HIV infection and lack of family and friend participation in HIV education is an obstacle that eventually reflects to high HIV prevalence among *C. edulis* users.
- 4) *Catha edulis* use compounded with other factors increases the count of CD4 cells in the body. On the other hand *C. edulis* use has no effects to the viral load counts of PLWA. This indicated that the higher the level of CD4 counts in an individual the lower the level of viral load.
- 5) *Catha edulis* use is significantly related to education level and high risk of HIV infection. Education attainment seems to put residents at a higher risk of HIV infection.
- 6) Knowledge about HIV transmission of mother-to-child during pregnancy, during delivery, by breast feeding and knowledge about efficacy of condoms was low among *C. edulis* users across gender regardless of education level and age.

### 5.3 Recommendation

- a) The proportion of *C. edulis* chewing participants who tested as couple and partners at all levels was very low despite high eligibility hence the need by all stakeholders to emphasize on voluntary HIV testing and counseling with support for mutual disclosure. Within PMTCT programs, counseling should emphasize the advantages of partner participation to encourage women to inform and convince male partners to come for VCT.
- b) The public in the region should develop and adhere to personalized risk-reduction and treatment strategy especially *C. edulis* business people and users who travel a lot to HIV endemic areas hence continued risk of HIV infection.
- c) Specific gaps in education, knowledge, behavior and attitude on different HIV transmission routes and protection measures need to be encouraged targeting *C. edulis* users and the general population of Nyambene region.
- d) When designing prevention strategies and intervention, decision-making should not only target individuals, but also aim to change the aspects of social-economic contexts that increase vulnerability to HIV of *C. edulis* using persons and communities in its growing regions.

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**APPENDICES.****APPENDIX 1: Checklist materials**

**Name of location ----- Date of counselling and testing -----**

(The investigator should see these materials before starting any procedure).

- a) Determine HIV testing kits ( ) available ( ) not available
- b) Examination gloves ( ) available ( ) not available
- c) Dry cotton swabs ( ) available ( ) not available
- d) Spirit and alcohol swabs ( ) available ( ) not available
- e) Elastoplasts ( ) available ( ) not available
- f) Syringes 5ml ( ) available ( ) not available
- g) Gauge '21 and '23 needles ( ) available ( ) not available
- h) Pipette Yellow & Blue tips ( ) available ( ) not available
- i) Labels ( ) available ( ) not available
- j) Well set counselling room ( ) available ( ) not available
- k) Record cards ( ) available ( ) not available
- l) Pen and pencil ( ) available ( ) not available
- m) Flip charts ( ) available ( ) not available
- n) Newsletter for clinic provider ( ) available ( ) not available
- o) Record dairy ( ) available ( ) not available
- p) Booklets ( ) available ( ) not available
- q) Posters ( ) available ( ) not available
- r) Glass slides ( ) available ( ) not available
- s) Vacutener Clot/plain tubes & EDTA Tubes ( ) available ( ) not available
- t) Vacutener needles, gauge ( ) available ( ) not available
- u) Sodium hypochlorite (JIK) ( ) available ( ) not available

## APPENDIX 2: Questionnaire / Maswali / Jiulia

### English:

Hello. My name is Njue James Kinoti, a Master of Science (Infectious Diseases) student at Kenyatta University. I am doing a research on HIV prevalence and ‘miraa’ abuse in Meru region and its effect on CD4/CD8 and viral load. I would like to request you to take part in this dissertation since your views are very important and will help in determining the disease burden in the region as well as enable you know your HIV status. Questions will take less than fifteen minutes and some will be on your personal sexual behaviour and social-economic life. It is up to you to agree or disagree to take part in this study. If I ask any question you don’t want to answer or irritates you, inform me so that I can proceed to the next one. You can stop the interview at any time at your will. You can also ask for any statement you did not hear right or on anything concerning the research. All answers you give will be confidential and will not be shown to anyone. The research is not political in any way. If you have any question on you rights in this study or if you feel offended by participating in this research work contact any addresses given. Thank you.

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### Swahili:

Habari. Jina langu ni Njue James Kinoti, mwanafunzi wa chuo kikuu cha Kenyatta (magonjwa ambukizi). Ninafanya utafiti kuhusu kuenea kwa ugonjwa wa ukimwi kati ya watu wanaokula miraa, madhara yake kwa chembechembe (CD4/CD8) na kiwango cha virusi hivyo kwa damu ya wanaoghua hapa Meru. Kushiriki kwa utafiti huu kutakuwezesha kujua hali yako na hali ya jamii yako. Maswali yatachukua taklimu dakika kumi na tano na yataangazia maisha yako kiundani na uchumi wako. Kushiriki ni kwa ihari. Nikiuliza swali tata ama la kero, niambie na nitaweza kulitupilia mbali na kuendelea. Unaweza kusimamisha maswali haya wakati wowote na kuuliza nirudie. Majibu yote yatakuwa siri kati yangu na wewe. Utafiti huu si wa kisiasa na ukihisi umedhulumiwa kwa njia moja au nyingine kwa kushiriki, shauriana na anwani nitakazokupa. Asante

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### Kimeru:

Muuga. Ritwa riakwa ni Njue James Kinoti, muritwa kuuma Kenyatta University (Mirimo ya kugwatithanua). Ndirutha utabithi bwa gutamba kwa murimo jwa muingo ki ariigi ba miraa aa Meru na mathara ma kuria miraa ki CD4/CD8 na kiwango kia virusi kia tharike. Ningukuria ukuume ki utabithi buu nontu ukaumba kumenya ugima bwa mwiri jwaku na wa atu baku. Chiuria bikajukia dakinga ikumi na itana na imwe cia chiuria ino ikonie mauntu ma ndani ma uchiari bwaku na kithugumo giaku. Ni aku gutonya ki kithomo giki kana ukare. Ndakuria kiuria kiria utikwenda kana giukwinyiria mbira kenda tuumba gwita mbere na kiuria kiingi na norungamie utabithi uu wenda igita rionthe. Noumbire gucokera kiria kilia utiraikua bwega. Macokio yaku yonthe ni ya siri na yationwa ni mtu kinya uriiku. Utabithi juu ti jwa kisiasa na njira yonthe. Ugaikua utawiru ni utabithi buu, aria na umwe wa antu baa ngakunenkera namba yoo. Nibwega.

Number/namba  Date/tarehe/tariki /2012 Study site----- (Tick appropriately inside the brackets)

**1. Gender / jinsia / mumbile**

(1) male / mwanaume / murume (2) female / mwanamke / mwekuru.

**2. Age group / rika / itinda**

(1) 15-25 (2) 26-35 (3) 36-45 (4) 45-55 (5) >56.

**3. Residence for the last 1 year/makao kwa mwaka uliopita/ gikaro mwaka muthiru**

(1) Meru (2) Meru environs / mazingira ya Meru / akui na Meru. (3) Other / kwingine / kungi.

**4. Marital status / ndoa / kihiko.**

(1) Never married / sijawahi olewa / ntimwiku.  
 (2) partner, not living together / nimeolewa, hatukai na mchumba wangu / tutikaraga amwe  
 (3) partner, living together / ninakaa na mchumba wangu / ninguli, tukaraga namucore  
 (4) married, monogamous / ndoa ya mchumba mmoja / kihikokia ummwe  
 (5) married, polygamous / ndoa ya wengi / ntiguri ninka  
 (6) widowed / mchumba alifaliki / mucore aiankwire  
 (7) separated / divorced / taraka / nitwatiganile

**5. Occupation / kazi unayoifanya / wira waku.**

(1) None / hakuna / gutiu. (2) Unskilled / asiye na maarifa / atina maarifa.  
 (3) Skilled / maarifa / ena maarifa. (4) professional / gwiji / obisi. (5) Student/mwanafunzi/murutwa.

**6. What kind of business do you do / unafanya biashara ipi / urutaga biacara iriku?**

(1) Miraa business/biashara ya miraa/wira wa miraa.  
 (2) Other business/biashara nyingine/wira ungi.  
 (3) no business/sina biashara/tina biacara.

**7. Education level / kisomo chako / kithomo giaku?**

(1) None/sina kisomo/ntithomi.  
 (2) Some primary/shule ya msingi/irathi jia nthi.  
 (3) Secondary school / shule ya upili / irathi jia keru.  
 (4) Post p secondary / masomo ya juu / kithomo kia iguru.

**8. Client interviewed as / umeojiwa kama / waulua jiulia ta?**

(1) Individual / pekee / gwenka. (2) couple/bwana na bibi / murume na muka. (3) Group / kikundi

**9. Client pregnant (women) / mjamjito / wina nda**

(1) yes / ndio / ii. (2) no / la / hali.

**10. Has client ever had sex / umawaishiliki ngono / walorutha wendo**

(1) yes / ndio / ii. (2) no / la / hali.

**11. Sexual partners in the last 12 months / mpenzi mwaka uliopita / mucore mwaka muthiru**

(1) heterosexual / na jinsia tofauti / muka-murume  
 (2) homosexual / ushoga / muka-muka kana murume-murume

**12. Condom use in the last 12 months /kutumai mpira mwaka uliopita/gutumira mubira mwaka muthiru**

(1) never /sijawahi/ntarotumira  
 (2) sometimes/nyakati nzingine/limwe na limwe  
 (3) always/kila wakati/lionthe  
 (4) no sex last 12months /sijasiliki ngono mwaka uliopita/ ntatrutha wendo mwaka muthiru  
 (5) no steady partner/ sina mpenzi wa kipekee /ntina murata wakwa  
 (6) never had sex / sijawahisiliki ngono maishani mwangu/ ntarorutha wendo maishani makwa

13. **Do you know what HIV and AIDS are / unajua ukimwi nin nini / niwiji muingo nimbi?**  
 ( 1 ) yes / ndio / ii. ( 2 ) no / la / hali.
14. **Condom use with non-steady partner (partner you don't know their HIV status)/unatumia mpira kwa mpenzi hujua hali yake ya ukimwi / nitutumagira mubira ki mntu hutije kethirwa ena murimu wa muingo?**  
 never / la / ali  
 sometimes / nyakati zingine zingine / limwe na limwe  
 always / kila wakati / lionthe  
 no sex last 12months / sijashiliki ngono mwaka uliopita/ ntrutha mapenzi mwaka muthilu  
 never had sex / sijawahi fanya mapenzi / tharutha wendo
15. **Do you chew miraa / huwa unasaga miraa / niusagaga miraa?**  
 ( 1 ) no / la / hali  
 ( 2 ) often / nyakati zingine / limwe na limwe  
 ( 3 ) daily / kila siku / tunku cionte
16. **Do your friends chew miraa/marafiki wako hula miraa/arata baku mibasagaga?**  
 ( 1 ) yes / ndio / ii. ( 2 ) no / la / hali.
17. **Does miraa affect your health or daily activities / miraa uthulu utendakazi wako / miraa nithukagia wira waku?**  
 ( 1 ) yes / ndio / ii. ( 2 ) no / la / hali.
18. **Does miraa affect your sexual performance/miraa inathulu uzazi wako/miraa nithukagia ujali waku?**  
 ( 1 ) yes / ndio / ii. ( 2 ) no / la / hali.
19. **Is there a relationship between HIV/ AIDS and miraa use / kuna uhusiano kati ya kusaga miraa na ugonjwa wa ukimwi / kwina ngatano ya murimu wa mukinnga na kulia miraa?**  
 ( 1 ) yes / ndio / ii. ( 2 ) no / la / hali.
20. **Knowledge of HIV/AIDS source / unapata habali za ukimwi kutoka wapi / ugwataga nteto jia muingo ku?**  
 ( 1 ) Radio.  
 ( 2 ) TV / runinga.  
 ( 3 ) Print / gazeti / ngatheti.  
 ( 4 ) Family and friends / familia na marafiki / mujii na arata.  
 ( 5 ) Service providers / wafanyikazi wa afya / aruti wira ba ugima wa mwili.  
 ( 6 ) Psychiatrist.  
 ( 7 ) Drama / uingizaji/michetho.
21. **Can you get infected with HIV by taking miraa / unaweza ambukizwa ukimwi kwa kusaga miraa / nougwate HIV nikusaga miraa?**  
 ( 1 ) yes / ndio / ii. ( 2 ) no / la / hali.
22. **Can you protect yourself from HIV or other STIs by chewing miraa / unaweza jiziua kutokana na ukimwi na magonjwa ya zinaa kwa kula miraa / nowiligirie kugwata muingo na isonono na kulia miraa**  
 ( 1 ) yes/ndio/ii ( 2 ) no/la/hali
23. **Can you contract HIV by having a sexual partner who chews miraa / unawezapatwa na ukimwi kwa kua na mpenzi akulae miraa / nougwatwe ni muingo ni kugia murata ulia asagaga?**  
 ( 1 ) yes / ndio / ii. ( 2 ) no / la / hali.
24. **Can people get HIV/AIDS by chewing miraa / mtu anawezaambukizwa ukimwi kwa kula miraa/ nougwatwe ni muingo ni kusaga miraa?**  
 ( 1 ) yes / ndio / ii. ( 2 ) no / la / hali.

25. Can you acquire HIV/AIDS by buying miraa from HIV infected people / unawezaambukizwa ukimwa kwa kununua miraa kutoka kwa walioambukizwa ukimwi / nougwatwa ni muingo ni kugulila mwajje wa mikingo miraa?  
( 1 ) yes / ndio / ii. ( 2 ) no / la / hali.
26. Can HIV virus that course AIDS be transmitted from mother to her baby by / ukimwi unawezaenezwa na njia hii / muingo niugwatithanagwa na njira ino?  
(i) Breast feeding / kunyonysha / gwonkia. ( 1 ) yes / ndio / ii.  
(ii) During pregnancy/kubeba mimba / ihu ( 1 ) yes / ndio / ii.  
(iii) During delivery / kuzaa / kuziala ( 1 ) yes / ndio / ii.
27. Can a person acquire HIV by sharing a cup of 'kahawa'/tea/bear/ 'makali' / unawezaambukizwa ukimwi kwa kitugawa na kunywa kahawa, chai ua pombe / nougwate muingo ni kunyua kau/cai kana chobi amwe?  
( 1 ) yes / ndio / ii. ( 2 ) no / la / hali.
28. Can a person acquire HIV by sharing a needle with HIV patient / unaweza ambukizwa ukimwi kwa kitumia sindano moja na mgojwa wa ukimwi / nougwate muingo ni gutumira sindano imwe na mwajje wa mikingo?  
( 1 ) yes / ndio / ii. ( 2 ) no / la / hali.
29. Are these methods effective in protection against contracting HIV / njia hizi zinaweza kuzuia kuenea kwa ukimwi/ njira ino no iligilie kuenea kwa murimu wa muingo  
(i) Abstinence / kutoshiliki ngono / kulegana na ngono. ( 1 ) yes / ndio / ii.  
(ii) Being faithful / kuwa mwaminifu / gwitikania ( 1 ) yes / ndio / ii.  
(iii) Condom use / kutumia mpira. ( 1 ) yes / ndio / ii.
30. Has client had an HIV test / umewahi pimwa ukimwi tena / walothimwa muingo lingi?  
( 1 ) yes / ndio / ii. ( 2 ) no / la / hali.

-----To be filled by researcher-----

31. Confirmed HIV results, today.  
( 1 ) negative ( 2 ) positive ( 3 ) inconclusive ( 4 ) not done
32. Couple discordant.  
( 1 ) yes ( 2 ) no
33. Referred to:  
( 1 ) HIV care specialist/ARV  
( 2 ) Male circumcision services  
( 3 ) STI services  
( 4 ) TB services  
( 5 ) Family planning / ANC  
( 6 ) Ongoing cancelling  
( 7 ) PLWA support group  
( 8 ) Psychiatrist.

### APPENDIX 3: Consent form

#### HIV test Consent form / Ihali ya kipimo cha Ukimwi / Gwitikilia kithimi kia murimu wa muingo.

**ENGLISH:** HIV (Human Immunodeficiency Virus) a virus that causes AIDS (Acquired Immune Deficiency Syndrome) is tested by detecting its antibodies in blood. This study involves asking you to give few drops of blood (show vacutainer) to be taken from your arm or finger prick for HIV antibody test. The test will take less than thirty minutes. I will not be able to tell you your cd4 levels from the few drops I will collect from your finger but blood taken from the arm will do only if your test results are HIV positive. cd4 and viral load levels results will take three days and so you will come with this card (show card) bearing your code number to collect them. Only authorized personnel will have access to this information. I may legally release the results of this test to the following: (a) you, the consumer or the parent, legal guardian, or person/agency granted custody of a minor or incompetent client. (b) The person/legal entity named on *Authorization for Release of Information* form signed by you, or by the parent or guardian of a minor or incompetent client. (c) A health care provider who has a legitimate need to know such information to provide immediate and specific health care services to you. It is my standard of care that your blood sample will be processed and results compiled confidentially for the purpose of my research or public health statistics. Note: although your name is a requirement, it will be translated into a code (only known by me) which will be used throughout the research.

**I have read, understood and sort clarification on the information on this sheet. ( )YES ( )NO. I give permission for \_\_\_\_\_ to collect my blood samples in order to detect whether or not I have HIV antibodies in my bloodstream. I request the HIV antibody test (Participant's Signature) \_\_\_\_\_ (Guardian Sign) \_\_\_\_\_ Witness \_\_\_\_\_. Test results will be discussed with me privately and I will be refereed appropriately.**

**SWAHILI:** Kipimo cha ukimwi ni thibitisha ya kuwoko kwa chembechembe zinazopigana na virusi vya HIV kwa damu zinazosababisha ugonjwa wa ukimwi. Kwa utafiti huu ninakuomba unipe tone kidogo za damu kutoka kwa mshipa wa mkono au kidole (onyesha chupa) yakupima ugonjwa wa ukimwi. Tone za damu kutoka kwa kidole hazitatosha kupima chemecheme za cd4 na viral load lakini damu kutoka kwa mshipa itatumuna ikiwa utapatikana na unungua ukimwi. Kupata majibu haya ya cd na viral load nitauomba uje na kadi uliyo na namba ya siri nitakayokupa baada ya siku tatu. Sheria inanilihusu kutoa majibu yako kwa: (a) wewe, uliopimwa au mzazi ama kundi linaloitikiwa na sheria kumlea ama kumweka mtoto amamremavu (b) mtu ama kundi lililo kubaliwa kisheria kwa kifungu *Authorization for Release of Information* iliotejiwa sahihi na wewe ama mzazi wa mremavu (c) muhudumu wa afya kwa nia ya matibabu Ni jukumu langu kuhakikisha vipimo hivi vinafanya kwa siri na kwa manufaa ya afya yako nay a jamii. Kumbuka jina lako litageuzwa kuwa numbali ya kipekee na ya siri. Majibu yako na jina lako halitatumika kwa uthabiti mwingine.

**Nimesoma na nikauliza maswala tatanishi kuhusu uthabiti huu kama ilivyoandikwa kwa karatasi hii. ( )NDIO ( )LA. Napeana ruhusa kwa \_\_\_\_\_ kunitoa damu ya kupima ugonjwa wa ukimwi. Naruhusu \_\_\_\_\_ (mzazi au mlezi sahihi) \_\_\_\_\_ Majibu yatatolewa kwangu pekee na naomba nitumwe kwa hudhuma za afya zaidi. Tarehe \_\_\_\_\_ muhudumu wa afya / mshahidi \_\_\_\_\_**

**KIMERU:** Kithimi kia muingo ni kia kumenya kithirwa muntu ena cells ilia iruhaga na virusi jia HIV ilia i litaga murimu wa muingo. Mbele ngakulia unennkele ndamu nini (ona cuba) kuuma mukiani wa njala kana kiara ya kuthima muingo.. Kithimi giki ni kia ndakinga mirongo ithatu. Macokio ma kithimi giaku kia cd4 na viral load kuuma ndamu ya mukia , indi ndamu ya kiala itiumba kethirwa kithimi kwa kiauga wina muingo. Ningukulia wije na kandi ino ina namba yaku ya siri kujukia macokio ma kithimi kiu. Sheria niimbitikilitie kuonia antu baba macokio mau: (a) gweu muthimwa kanamujari kana mwikali mwikilie ni sheria gwikala na kaana kana muntu atikwiumba, (b) muntu kana gikundi gititilie ni sheria ki *Authorization for Release of Information* fomu ilia ugasaina kana isainwe ni mujiali wa mwana kana muntu atikwiumba (c) muruti wira wa ugima wa mwili ena gitumi kia guguthia ki ugima waku. Nigukwila lingi kithimi giki gikethilwa gi kia siri kigwe nani. Macokio maku makagwatanwa nontu bwa kumenyera ugima wa mwili waku na wa ekali ba ntula ino. . Lilikana litwa liakaulwa indi lisenjwa gutwika numba ya siri ilia igatumika. Litwa liaku lititumika ki uthabiti uu indi likandikwa kin mahuku ma mithimi wa ithimi ciaku na gitu muntu ungiakona .

**Nkuthoma, nderewa na ndauria jiuila jionthe gikonie uthabiti uu ta ulia wandiki karatasini gaka: ( )II ( )ALI. Ninkunenkera rutha \_\_\_\_\_ alute ndamu yakwa anthime kethirwa ndina murimu wa muingo kana ali ndamuni yakwa. Ninkulia nthimwe murimu (sahini yakwa) \_\_\_\_\_ sahini ya mujiali \_\_\_\_\_. Macokio makwa ma kithimi makerwa nii aki na nkerwa kungi kwa kuthondekwa nkuruki. Tariki \_\_\_\_\_ Muthimi / mashaidhi \_\_\_\_\_.**

**APENDIX 4: Results collection card****RESULTS COLLECTION CARD****HIV Prevalence among *Catha edulis* (miraa) using persons in Nyambene Region Meru County, Kenya.**

Code ----- Date -----

KU Ethics Ref: PKU/070/162,  
Kenya University, Ethics Review Committee P.O. Box 43844, 00200 Nairobi, Kenya Tel: 020 810901-19 ext 57183/4  
e-mail: kuerc.chairmam@ku.ac.ke

NACOSTI Ref: NCST/RCD/12A/013/11  
National Council for Science, Technology and Innovation, P.O. Box 30623 00100, Nairobi, Kenya.  
e-mail: secretary@ncst.go.ke Tel: 254020221371, fax:254020 318245

NASCOP Ref: NASCOP/ADMIN/SUPP/2012/26  
National AIDS and STI Control Program, Kenyatta National Hospital Grounds, P.O. Box 19361 00200 Nairobi Kenya,  
e-mail: head@nascop.or.ke Tel: 0755409108

DMoH Nyambene District

## APPENDIX 5: KUERC Ethical clearance letter



KENYATTA UNIVERSITY  
ETHICS REVIEW COMMITTEE

Fax: 8711242/8711575  
Email: [kuerc.chairman@ku.ac.ke](mailto:kuerc.chairman@ku.ac.ke)  
[kuerc.secretary@ku.ac.ke](mailto:kuerc.secretary@ku.ac.ke)  
Website: [www.ku.ac.ke](http://www.ku.ac.ke)

P. O. Box 43844  
Nairobi, 00100  
Tel: 8710901/12

Our Ref: KU/R/COMM/51/121

Date: December 13<sup>th</sup>, 2012

James Kinoti Njue  
School of Health Sciences  
Kenyatta University  
P. O. Box 43844, Nairobi.

Dear Mr. Njue,

APPLICATION NUMBER PKU/070/I62 OF 2012 – ‘THE PREVALENCE OF HUMAN IMMUNODEFICIENCY VIRUS (HIV) AMONG *CANTHA EDULIS* (MIRAA) USING PERSONS IN MERU, KENYA – VERSION 3

1. IDENTIFICATION OF PROTOCOL

The application before the committee is with a research topic, *The Prevalence of Human Immunodeficiency Virus (HIV) Among Cantha Edulis (Miraa) using Persons in Meru, Kenya – version 3* dated 13<sup>th</sup> December 2012.

2. APPLICANT

James Kinoti Njue  
School of Health Sciences  
Kenyatta University  
P. O. Box 43844, Nairobi.

3. SITE

Meru, Kenya.

4. DECISION

The committee has considered the research protocol in accordance with the Kenyatta University Research Policy (section 7.2.1.3) and the Kenyatta University Ethics Review Committee Guidelines, and is of the view that against the following elements of review,

- (i) Scientific design and conduct of study,
- (ii) Recruitment of research participant,
- (iii) Care and protection of research participants,
- (iv) Protection of research participant’s confidentiality,
- (v) Informed consent process,
- (vi) Community considerations.


AND APPROVED that the research may proceed for a period of ONE year from 13<sup>th</sup> December, 2012


5. ADVICE/CONDITIONS

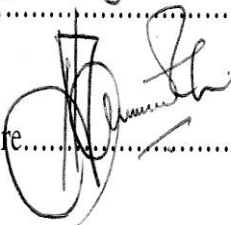
- i. Progress reports are submitted to the KU-ERC every six months and a full report is submitted at the end of the study.
- ii. Serious and unexpected adverse events related to the conduct of the study are reported to this board immediately they occur.
- iii. Notify the Kenyatta University Ethics Committee of any amendments to the protocol.
- iv. Submit an electronic copy of the revised proposal to KU-ERC.

When replying, kindly quote the application number above.

If you accept the decision reached and advice and conditions given please sign in the space provided below and return to KU-ERC a copy of the letter.

  
 f PROF. NICHOLAS K. GIKONYO  
 CHAIRMAN ETHICS REVIEW COMMITTEE

  
 I ..... accept the advice given and will fulfill the conditions therein.

Signature  ..... Dated this day 18 of DECEMBER 2012.

cc. Vice-Chancellor  
 Director: Institute for Research Science and Technology

**APPENDIX 6: NSCTI Research authorization letter**

REPUBLIC OF KENYA

**NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY**

Telephone: 254-020-2213471,2241349  
 254-020-310571,2213123, 2219420  
 Fax: 254-020-318245,318249  
 when replying please quote  
**secretary@ncst.go.ke**

P.O. Box 30623-00100  
 NAIROBI-KENYA  
 Website: www.ncst.go.ke

Our Ref:

Date:

**NCST/RCD/12A/013/11****29<sup>th</sup> January, 2013**

James Kinoti Njue  
 Kenyatta University  
 P.O.Box 43844-00100  
 Nairobi.

**RE: RESEARCH AUTHORIZATION**

Following your application dated *18<sup>th</sup> January, 2013* for authority to carry out research on "*The prevalence of human immunodeficiency virus (HIV) among Catha Edulis (Miraa) using persons in Meru, Kenya,*" I am pleased to inform you that you have been authorized to undertake research in **Nyambene District** for a period ending **30<sup>th</sup> April, 2013**.

You are advised to report to **the District Commissioner, the District Education Officer and the District Medical Officer of Health, Nyambene District** before embarking on the research project.

On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.

  
**DR M.K. RUGUTT, PhD, HSC.**  
**DEPUTY COUNCIL SECRETARY**

Copy to:

The District Commissioner  
 The District Education Officer  
 The District Medical Officer of Health  
 Nyambene District.

APPENDIX 7: NCSTI Research permit

PAGE 2

PAGE 3

**Research Permit No: NCST/RCD/12A/013/1**

**THIS IS TO CERTIFY THAT:**

**Date of issue: 29<sup>th</sup> January, 2013.**

**Prof./Dr./Mr./Mrs./Miss/Institution: James Kinoti Njue**

**Fee received: KSH. 1,000**

**of (Address) Kenyatta University**


**P.O.Box 43844-00100, Nairobi.**

**has been permitted to conduct research in**

**Location: Nyambene District Eastern Province**

**on the topic: The prevalence of human immune deficiency virus (HIV) among Catha Edulis (Miraa) using persons in Meru, Kenya.**

**for a period ending 30<sup>th</sup> April, 2013.**



**Applicant's Signature: [Signature]**

**Secretary: [Signature]**

**National Council for Science & Technology**

**APPENDIX 8: MoPHS - NASCOP Letter of support****MINISTRY OF PUBLIC HEALTH & SANITATION**

Telephone: 2729502  
 • Fax: 2710518  
 E-mail: head@nascop.or.ke  
 Office Mobile: 0775-409108  
 Skype: nascop.ke

NATIONAL AIDS & STI CONTROL PROGRAM  
 Kenyatta National Hospital Grounds  
 P.O. Box 19361, 00202  
**Nairobi**

*When replying please quote*  
 Ref: NASCOP/ADMIN/SUPP/2012/26

Date: 23<sup>rd</sup> May 2012

The Medical Superintendents,  
 • Nyambene District Hospital  
 • Meru District Hospitals

Dear Sir/Madam,

**Re: Letter of support for Njue James Kinoti: MSC Student at Kenyatta University**

The above named is a student at the Kenyatta University undertaking a postgraduate Degree in M.Sc Infectious diseases. He has expressed interest to conduct a study to determine the association between HIV and chewing Miraa among the clients of your hospital.

The study has been approved by the University and by KNH ethical review board.

As the main consumers of the findings we wish to agree with the study intention and request that you accord him the necessary support to carry out his study.

Thank you.

Dr. Peter Cherutich, MBChB, MPH.  
 Ag: HEAD, NASCOP

**APENDIX 9: KU Graduate school research authorisation letter**

**KENYATTA UNIVERSITY  
GRADUATE SCHOOL**

E-mail: [dean-graduate@ku.ac.ke](mailto:dean-graduate@ku.ac.ke)

P.O. Box 43844, 00100  
NAIROBI, KENYA  
Tel. 8710901 Ext. 57530

Website: [www.ku.ac.ke](http://www.ku.ac.ke)

Our Ref: P150/21248/2010

DATE: 17<sup>th</sup> September, 2012

The Permanent Secretary,  
Ministry of Higher Education, Science & Technology,  
P.O. Box 30040,  
**NAIROBI**

Dear Sir/Madam,

**RE: RESEARCH AUTHORIZATION NJUE JAMES KINOTI- REG. NO. P57/21248/2010**

I write to introduce Mr. Njue James Kinoti who is a Postgraduate Student of this University. He is registered for M.Sc. degree programme in the **Department of Medical Laboratory sciences**.

Mr. Kinoti intends to conduct research for a proposal entitled, **“The Prevalence of Human Immunodeficiency Virus (HIV) among Cantha Edulis (Miraa) Abusing persons in Meru, Kenya”**

Any assistance given will be highly appreciated.

Yours faithfully,

**MRS. LUCY N.MBAABU  
FOR: DEAN, GRADUATE SCHOOL**





**Appendix 11: KU Graduate School research approval letter****KENYATTA UNIVERSITY  
GRADUATE SCHOOL**E-mail: [dean-graduate@ku.ac.ke](mailto:dean-graduate@ku.ac.ke)Website: [www.ku.ac.ke](http://www.ku.ac.ke)P.O. Box 43844, 00100  
NAIROBI, KENYA  
Tel. 810901 Ext. 57530**Internal Memo****FROM:** Dean, Graduate School **DATE:** 11<sup>th</sup> September, 2012**TO:** Njue James Kinoti  
C/o Medical Laboratory Sciences **REF:** P150/21248/2010**SUBJECT: APPROVAL OF RESEARCH PROPOSAL**  
=====

This is to inform you that Graduate School Board, at its meeting of 3<sup>rd</sup> September, 2012, approved your Research Proposal for the M.Sc Degree, **Subject to linking the two elements on the title”.**

Thank you.

**JOHN M. ODONGI**  
**FOR: DEAN, GRADUATE SCHOOL**

c.c. Chairman, Department of Medical Laboratory Sciences

## Supervisors:

1. Dr. Alice Muchugi  
C/o Department of Biochemistry and Biotechnology  
Kenyatta University
2. Dr. Antony Kebira  
C/o Plant and Microbial Sciences  
Kenyatta University.

## APPENDIX 12: cd4 and viral load raw data

Test participants					Control group				
Gender	CD4 Counts cells/mm <sup>3</sup>		Viral load counts HIV-RNA copies/ml		Gender	CD4 Counts cells/mm <sup>3</sup>		Viral load counts HIV-RNA copies/ml	
	CD4 <sub>1</sub>	CD4 <sub>2</sub>	VL <sub>1</sub>	VL <sub>2</sub>		CD4 <sub>1</sub>	CD4 <sub>2</sub>	VL <sub>1</sub>	VL <sub>2</sub>
<b>Male</b>					<b>Male</b>				
<b>1</b>	201	550	9743	12346	<b>1</b>	667	674	4384	2331
<b>2</b>	233	453	6321	4431	<b>2</b>	456	345	4234	1890
<b>3</b>	345	980	1462	3241	<b>3</b>	678	569	1265	3771
<b>4</b>	371	1078	984	4289	<b>4</b>	638	314	1302	253
<b>5</b>	348	781	8839	5618	<b>5</b>	345	251	11012	2341
<b>6</b>	467	1056	411	1056	<b>6</b>	1105	674	537	2331
<b>7</b>	221	734	7252	9431	<b>7</b>	342	341	12341	201
<b>8</b>	563	1160	6321	12601	<b>8</b>	1067	378	673	2309
<b>9</b>	553	843	648	902	<b>9</b>	334	892	6134	2391
<b>10</b>	645	1221	468	463	<b>10</b>	1041	591	674	201
$\bar{x}$	<b>394.70</b>	<b>885.60</b>	<b>4244.9</b>	<b>5437.8</b>	$\bar{x}$	<b>667.30</b>	<b>502.90</b>	<b>4255.6</b>	<b>1801.9</b>
<b>Female</b>					<b>Female</b>				
<b>11</b>	815	1031	859	50	<b>11</b>	998	663	567	1340
<b>12</b>	1120	689	13370	657	<b>12</b>	453	555	334	234
<b>13</b>	478	668	14256	29386	<b>13</b>	543	213	1934	1001
<b>14</b>	569	1082	12384	6349	<b>14</b>	678	543	7828	8910
<b>15</b>	1004	1056	6438	14842	<b>15</b>	1012	231	345	902
<b>16</b>	574	692	28436	768	<b>16</b>	478	532	1445	2901
<b>17</b>	234	749	34643	8346	<b>17</b>	1029	771	234	1078
<b>18</b>	671	891	1438	578	<b>18</b>	589	243	6134	50
<b>19</b>	483	791	16408	9421	<b>19</b>	391	339	1902	890
<b>20</b>	374	1023	1120	18741	<b>20</b>	361	0	6781	4672
$\bar{x}$	<b>632.20</b>	<b>867.20</b>	<b>12935.0</b>	<b>8913.8</b>	$\bar{x}$	<b>653.20</b>	<b>409.00</b>	<b>2750.4</b>	<b>2197.8</b>
<b>Total <math>\bar{x}</math></b>	<b>513.45</b>	<b>876.40</b>	<b>8590.0</b>	<b>7175.8</b>	<b>Total <math>\bar{x}</math></b>	<b>660.25</b>	<b>455.95</b>	<b>3503.0</b>	<b>1999.8</b>

## Overall participant's response

Sample groups	Steps in research participation		
	Eligible participants	Questionnaire	HIV tests
General population	256	245	247
TB patients	24	18	16
ANC	13	7	2
Couples	16	13	2
<b>Total</b>	<b>309</b>	<b>283</b>	<b>267</b>

### Appendix 13: Social-demographic, knowledge on HIV and behavioural risk factors related to HIV infection

Demographics	Demography clusters	Gender			p - value
		Male	Female	Total	
<b>Gender</b>		131 (49.1%)	136 (50.9%)	<b>267 (100.0)</b>	
<b>Age groups</b>	15-25	31 (55.4%)	25 (44.6%)	<b>56 (100%)</b>	7.989
	26-35	32 (61.5%)	20 (38.5%)	<b>52 (100%)</b>	
	36-45	33 (47.8%)	36 (52.2%)	<b>69 (100%)</b>	
	46-55	16 (37.2%)	27 (62.8%)	<b>43 (100%)</b>	
	55 and above	19 (40.4%)	28 (59.6%)	<b>47 (100%)</b>	
<b>Occupation</b>	None	39 (73.6%)	14 (26.4%)	<b>53 (100%)</b>	19.410
	Unskilled	62 (48.1%)	67 (51.9%)	<b>129 (100%)</b>	
	Skilled	17 (37.0%)	29 (63.0%)	<b>46 (100%)</b>	
	Profession	8(34.8%)	15 (65.2%)	<b>23 (100%)</b>	
	Student	5 (31.2%)	11 (68.8%)	<b>16 (100%)</b>	
<b>Marital status</b>	never married	7 (50.0%)	7 (50.0%)	<b>14 (100%)</b>	0.245
	partner living together	18 (50.0%)	18 (50.0%)	<b>36 (100%)</b>	
	partner not living together	28 (50.9%)	27 (49.1%)	<b>55 (100%)</b>	
	married monogamous	52 (47.7%)	57 (52.3%)	<b>109 (100%)</b>	
	married polygamous	9 (50.0%)	9 (50%)	<b>18 (100%)</b>	
	Widowed	12 (50.0%)	12 (50.0%)	<b>24 (100%)</b>	
	separated/divorced	5 (45.5%)	6 (54.5%)	<b>11 (100%)</b>	
<b>Residence</b>	Meru urban	94 (49.2%)	97 (50.8%)	<b>191 (100%)</b>	0.006
	Meru rural	37 (48.7)	39 (51.3%)	<b>76 (100%)</b>	
<b>Education level</b>	no education attained	50 (72.5%)	19 (27.5%)	<b>69 (100%)</b>	33.288
	pri. school education	28 (28.6%)	70 (71.4%)	<b>98 (100%)</b>	
	sec. school education	41 (56.2%)	32 (43.8%)	<b>73 (100%)</b>	
	post-sec. school ed.	12 (44.4%)	15 (55.6%)	<b>27 (100%)</b>	
<b>Business type</b>	<i>C. edulis</i> business	47 (53.4%)	41 (46.6%)	<b>88 (100%)</b>	4.543
	other business	39 (55.7%)	31 (44.3%)	<b>70 (100%)</b>	
	no business	45 (41.3%)	64 (58.7%)	<b>109 (100%)</b>	
<b>Pregnancy</b>	Yes	0 (0.0%)	2 (100.0%)	<b>2 (100%)</b>	267.0
	No	0 (0.0%)	134 (100.0%)	<b>134 (100%)</b>	
	not applicable	131 (100%)	0 (0.0%)	<b>131 (100%)</b>	
<b>Participation</b>	Couple	2 (50.0%)	2 (50.0%)	4 (100%)	0.001
	Individual	129 (49.0%)	134 (51.0%)	<b>263 (100%)</b>	
<b>Sexual experience</b>	Yes	131 (49.4%)	134 (50.6%)	<b>265 (100%)</b>	1.941
	No	0 (0.0%)	2 (100.0%)	<b>2 (100%)</b>	
<b>Sexuality</b>	Heterosexual	131 (49.4%)	134 (50.6%)	<b>265 (100%)</b>	1.941
	no experience	0 (0.0%)	2 (100.0%)	<b>2 (100%)</b>	

**Appendix: 14 *C. edulis* use, HIV prevention and knowledge in relation to rate of infection**

	<b>HIV test results</b>			<b>p – value</b>
	<b>HIV Negative</b>	<b>HIV Positive</b>	<b>Total</b>	
<b>Condom use</b>				
Never	171 (93.4%)	12 (6.6%)	<b>183 (100.0%)</b>	0.408
Sometimes	25 (92.6%)	2 (7.4%)	<b>27 (100.0%)</b>	
Always	49 (87.5%)	7 (12.5%)	<b>56 (100.0%)</b>	
No sex last 12m	1 (100.0%)	0 (0%)	<b>1 (100.0%)</b>	
<b>Ever tested HIV</b>				
Tested	193 (91.5%)	18 (8.5%)	<b>211 (100.0%)</b>	0.615
Never tested	53 (94.6%)	3 (5.4%)	<b>56 (100.0%)</b>	
<b><i>C. edulis</i> use</b>				
Often use	64 (90.1%)	7 (9.9%)	<b>71 (100.0)</b>	0.310
Not often use	182 (92.9%)	14 (7.1%)	<b>196 (100.0%)</b>	
<b>Know what HIV /AIDS is</b>				
Male	121 (92.4%)	10 (7.6%)	<b>131 (100.0%)</b>	
Female	125 (91.9%)	11 (8.1%)	<b>136 (100.0%)</b>	
<b><i>C. edulis</i> and HIV relationship</b>				
Relation exist	112 (93.3%)	8 (6.7)	<b>120 (100.0)</b>	0.733
No relation	107 (90.7%)	11 (9.3%)	<b>118 (100.0%)</b>	
Cannot tell	27 (93.1%)	2 (6.9%)	<b>29 (100.0)</b>	
<b>Health/dairy activities</b>				
Effect	13 (76.5%)	4 (23.5%)	<b>17 (100.0%)</b>	0.034
No effect	233 (93.2)	17 (6.8%)	<b>250 (100.0%)</b>	
<b>Sexuality</b>				
Effect	19 (90.5%)	2 (9.5%)	<b>21 (100.0%)</b>	0.508
No effects	227 (92.3%)	19 (7.7%)	<b>246 (100.0%)</b>	

**Appendix 15: Central location of Meru County in Kenya**

