IDENTIFICATION OF PLANTS USED FOR TREATMENT OF MALARIA AND FACTORS INFLUENCING THEIR USE IN BORO DIVISION SIAYA COUNTY, KENYA

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I57/7387/2002

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October, 2014
DECLARATION

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

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Department of Plant Sciences
DEDICATION

To my loving children: Alfie, Daisy, Vanessa and Angelo
ACKNOWLEDGEMENTS

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## ACRONYMS AND ABBREVIATIONS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>ACT</td>
<td>Artemisinin Based Combination Therapy</td>
</tr>
<tr>
<td>AQ</td>
<td>Amodiaquine</td>
</tr>
<tr>
<td>ITNs</td>
<td>Insecticide Treated Nets</td>
</tr>
<tr>
<td>MOH</td>
<td>Ministry of Health</td>
</tr>
<tr>
<td>RBM</td>
<td>Roll Back Malaria</td>
</tr>
<tr>
<td>RITAM</td>
<td>Research Initiative on Traditional Anti-Malarials</td>
</tr>
<tr>
<td>SP</td>
<td>Sulfadoxine-Pyrimethamine</td>
</tr>
<tr>
<td>UNICEF</td>
<td>United Nations Children’s Fund</td>
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<td>WHO</td>
<td>World Health Organization</td>
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ABSTRACT

Malaria is a public health problem in more than 90 countries inhabited by over 2.4 billion people. Currently the cheapest drugs for treatment of malaria are becoming ineffective as malarial parasites develop resistance. Historically, local communities have used local flora for prophylaxis and treatment of malaria for centuries. The objective of the study was to determine the plant sources of anti malarial herbs and factors influencing their use in Boro Division, Siaya County. The specific objectives of the study included examination of the community knowledge on malaria treatment and control, prevalence of malaria infection, the health seeking behavior, identification/documentation of herbal plants used to treat malaria, factors influencing the choice of use of herbal medicine, effectiveness of herbal medicine in the treatment of Malaria and community use herbal plants to control malaria. The site of the study was Boro division which is one of the divisions that make up Siaya county. The study used both analytical and descriptive design in obtaining the information concerning the current status of herbal medicine in Boro Division, Siaya county, Kenya and a description of what exists with respect to variables or conditions in the area of study. The target population was from Boro Division of Siaya County and consisted of adult population in each village that were selected as participants. However, the key informants were herbal medicine users. Given that the population of study area was greater than 10,000 the Fisher et al. (1998) formula was applied to determine the sample size giving a total of 244 respondents. Primary data from Boro Division, Siaya County was collected using questionnaires, while secondary data was collected through reviewing records of the study relevant to the subject. Quantitative
data was analyzed using descriptive and inferential statistics (correlation, regression and chi square), while qualitative data was analyzed using content analysis. Presentation of data was in form of tables, where it provides successful interpretation of the findings. Descriptive data was provided in form of explanatory notes. The study concluded that there is continuous usage of herbs implying that the community has good knowledge about malaria and can readily distinguish it from other fever types of diseases; malaria prevalence is common in the area; health seeking behavior of the local community is characterized by going to the herbalist for treatment, getting medicine from the herbalist; preference of herbal medicine is based on socio-economic factors such as religion, marital category, and educational level, number of children, monthly income and number of financial dependants, increased accessibility/availability of herbs, low cost of traditional medicine, negotiable prices and payment format. The most frequently used herb for treatment of malaria is ogaka \((Aloe latevitia)\). The local community prevents/controls malaria by reducing mosquitoes through burning of logs and plants such as \(Albizia coriaria\) and use of green form of plants as repellants.
CHAPTER ONE: INTRODUCTION

1.1 Background Information

Malaria is a public health problem in more than 90 countries inhabited by over 2.4 billion people (40% of the world’s population) (WHO, 2002a). Sub-Saharan Africa alone accounts for over 40% of the 300-500 million global malaria cases. Globally, malaria is responsible for 1 million deaths annually; of which majority are children under 5 years of age (WHO, 2000a). It exerts toll on morbidity, mortality, economic and social development of the affected country. Currently, the affordable drugs for treatment of malaria are becoming ineffective as malarial parasites develop resistance (Murphy and Basri, 1993). Alternative drugs are often too expensive for the poor and in many rural areas use of herbal remedies is popular. Large percentages of western populations now use some form of alternative medicine (57 % in Australia, 46 % in Germany, and 49 % in France. Between 1991 and 1997 the use of herbal medicines in the United States grew by 380 %. People are turning to alternative medicine because it is safe and it works. Over 80 per cent of the world population use alternative medicine as the basis of the healthcare system (Larsen, 1999). In developing countries, up to 20%- 80% of the population use herbal medicine for their health care needs (WHO, 2003).

Historically, local communities have used local flora for prophylaxis and treatment of malaria for centuries (Etkin, 1997). However, National malaria programmes in Africa have largely ignored the potential of traditional healers even though they are consulted very often by communities in the rural areas (Bitwha et al., 1997). The climatic conditions and ecology of the Lake Victoria region of Kenya provides ideal conditions
for malaria transmitting mosquitoes making the disease endemic throughout the year (Ruebush et al., 1995). The local indigenous rural population has continued to use and appreciate traditional medicine as a source of health care. Identification of local herbs used by indigenous communities to treat malaria is important as this provide background information required for the discovery of new herbal based anti-malarial drugs in future research.

This study investigated use of traditional medicine and remedies in treatment and management of malaria in Boro Division, Siaya County with the aim of identifying anti-malarial herbs for future chemical and biological analysis.

1.2 Problem statement

Traditional herbal medicines have been the only source of treatment for many indigenous rural communities. The underlying issues that determine the use of herbal treatment is the increasing costs of medical services as malarial parasites become resistant to affordable drugs such as chloroquin (Shakoor et al., 2011). The efficacies of herbal medicines in the treatment of malaria have been recognized for a long time (WHO, 2003) and are common among Kenyan communities, but there’s hardly any information in the diversity of plant species used for malaria in Kenya, hence the need to identify and document these herbs.

1.3 Justification

Malaria is the single most important cause of ill health, death and poverty in Sub-Saharan Africa (Sachs and Malaney 2002; Kilama, 2005; United Nations, 2005). The disease is
believed to be a major obstruction to social and economic development in Africa. It causes enormous misery and suffering through the pain from fevers and the anguish of bereavement. It is estimated that there are as many as 300 million acute cases of malaria worldwide each year, resulting in one million deaths and most of victims are children aged less than five years (WHO, 2004).

According to Kilama (2005) and Sendagire et al. (2005), four major problems are associated with the management of malaria. The most important problem is that the parasites which cause malaria are resistant to or are developing resistance to the most widely available, affordable and safest first line treatments. Secondly, the control programmes of the mosquitoes which transmits malaria is made difficult by their resistance to a wide range of insecticides. Lastly, many countries in Africa lack the necessary infrastructure and resources to manage and control malaria. WHO (2004) noted that owing to the widespread suffering and death caused by malaria and the failure of the safest and most affordable antimalarials to treat the disease effectively, in many cases because of drug resistance, there was an urgent need to develop new drugs or vaccines for the treatment, management, prevention and control of malaria. This project sought to document traditional knowledge about malaria including traditional treatments, existing malaria treatment and control practices and the social economic factors that influence people in Boro Division, Kenya to turn to herbal medicine in the treatment of malaria.

Plants are usually identified for study on the basis of traditional reputation for effectiveness, usually for preventing or treating malaria. The identification of herbal
plants used traditionally to treat malaria will be useful in giving direction to finding alternative and effective drugs in future research. Such studies could serve as the focus for future interventions aimed at promoting improved malaria treatments in households. Most of the previous studies on malaria are based on modern interventions with little attention being given to the fact that most major contemporary drugs for malaria have been derived from plants initiated by local knowledge.

1.4 General Objective

To determine the plant sources of anti malarial herbs and factors influencing their use in Siaya County

1.4.1 Specific objectives

(i) To assess the community knowledge, attitude and practices about malaria and its control.
(ii) To determine prevalence of malaria infection.
(iii) To determine the health seeking behavior
(iv) To identify/ document herbal plants used to treat malaria
(v) To determine factors influencing the choice of use of herbal medicine
(vi) To establish how effective herbal medicine is in the treatment of Malaria in Boro Division
(vii) To examine whether the community use herbal plants to control malaria
1.5 Research questions

(i) What is the prevalence rate of malaria in Boro Division?

(ii) What is the level of awareness of malaria in Boro Division?

(iii) What is the level of herbal usage compared to contemporary medicine in Boro Division?

(iv) Which plants are used to provide medicine in Boro Division?

(v) Which socio-economic factors influence the choice of herbal medicine in Boro Division?

(vi) How effective are herbal medicine in the treatment of Malaria in Boro Division?

(vii) To what extent does the community use herbal plants to control malaria?

1.6 Null Hypothesis

(i) The community knowledge on malaria treatment and control is low in Boro Division.

(ii) Malaria prevalence rate in Boro Division is low.

(iii) The level of herbal usage compared to contemporary medicine in Boro Division is low.

(iv) Socio-economic factors do not affect the use of herbal medicine in Boro Division

(v) Use of herbal medicine in the treatment of Malaria in Boro Division is not effective

(vi) The community does not use herbal medicine to control malaria
1.7 Significance/Scope

In practice the findings of the study will be able to benefit the local communities of Boro division and other communities in the country as it will facilitate the recognition and use of herbal medicine in the treatment of malaria in conventional setting. The research finding will facilitate the use of herbal medicine to treat malaria hence reducing the cost of treatment especially to the low income groups in both urban and rural areas. The results of the study will facilitate the government and health authorities to recognize herbal medicine and enact legislation policies and rules to regulate its use. In theory, the study will add to the existing knowledge on herbal and at the same time provide a basis for future investigation by other researchers and academicians who will be able to find research gaps a basis of further investigation.

1.8 Scope of the Study

This research was limited to identification of plants used for treatment of malaria and factors affecting their use in Boro Division, Siaya County in Kenya. The study location was chosen because it is a malaria prone area and, besides, according to Taylor and Bogdan (1998), an ideal research setting is one where the observer has easy access, is able to establish immediate rapport with participants, and can gather data that is directly related to the research interests. The study focused on determining of plants used for treatment of malaria and factors influencing their use. The study covered the period between 2008 and 2009.
1.9 Limitation and delimitation of the study

The study encountered limitations of language and interpretation as some of the respondents could not respond in English or Kiswahili hence there was the difficulty of communication which affected the pace of gathering data. However, local teachers were incorporated in the research team and were able to interpret and aid in communication.
CHAPTER TWO: LITERATURE REVIEW

2.1 Global malaria burden

An estimated 300-500 million cases of malaria, resulting in over 1 million deaths were reported annually and about 40% of the deaths occurred in Sub-Saharan Africa. This made malaria Africa’s leading cause of mortality and contributed to 10% of the continent’s disease burden (WHO, 2002a). According to Terlouw (2003), malaria cases had continued to increase steadily over the last decades. In Kenya, malaria remains the most devastating and formidable problem. Out of Kenya’s population of over 40 million, 70% (28 million people) live in malaria prone areas and are at risk of infection (GOK, 2011). Each year, an estimated 6000 pregnant women suffer from malaria-associated anaemia and 34000 children below the age of five years die from malaria. Poor populations particularly in rural setups bear the brunt of this disease burden. They often cannot access effective treatment due to inadequate infrastructure, limited resources and consequently rely on traditional medicinal plants for their basic health care needs. Many communities in Africa have strong tradition of using medicinal plants to treat illnesses. Malaria is one such illness that has been treated over the years using herbal medication (Hill, 1996).
2.2 Epidemiology of malaria

Malaria is a parasitic infectious disease transmitted by an infected female anopheles mosquito (Knell, 1991). The disease is characterized by cyclical bouts of fever, headache, muscle and joint pains, nausea and general malaise. Untreated malaria can result in anaemia, kidney failure, coma and death (Alaii, 2003). According to Cox et al. (2003), humans are generally host to four species of malaria parasites; *Plasmodium falciparum*, *Plasmodium vivax*, *Plasmodium ovale* and *Plasmodium malariae*. *Plasmodium falciparum* is the most common protozoan disease in Kenya (GOK, 2011). The parasite infection is associated with a high risk of severe disease and death especially among those with little or no acquired immunity to malaria such as children between the ages of 6-24 months (WHO, 2000b). Pregnant mothers are mostly affected by malaria. Malaria contributes to neonatal and maternal mortality and causes low birth weight babies. It has recently been estimated that during pregnancy, malaria in sub-Saharan Africa contributes to 30-35% of preventable low birth weight babies and as such causes 55,000 to 200,000 infant deaths each year (Terlouw, 2003).

2.3 Impact of malaria on socio-economic resources

Malaria exerts severe toll on socio-economic resources including direct cost to Government and patients for hospital admissions, outpatient consultations, cost to households for treatment sought outside the official system and cost due to absenteeism from productive work or education (Nyamongo, 1999). Malaria accounts for 8 million outpatient treatments at Government health facilities each year. The disease accounts for at least 1.3% reduction in Africa’s economic growth annually, with approximately US$
12 billion loss annually (Gallup and Sachs, 2001). Malaria has significant measurable direct and indirect costs that place major constraints on economic development in Kenya thus constraining efforts on wealth creation. Among the direct costs of malaria is the high personal and public expenditure necessitated by treatment. It is estimated that every household affected by malaria spends approximately US$20 annually for clinical management of the malaria attacks. It was also estimated that 170 million working days annually are lost due to malaria in Kenya (GOK, 2001a). Poor populations particularly in rural areas bear the brunt of this disease burden. They often cannot access effective treatment due to inadequate infrastructure, limited resources and consequently rely on traditional medicinal plants for their basic health care needs. The overall goal of National malaria strategy was that by the year 2013, to have at least 80% of people living in malaria risk areas using appropriate malaria preventive interventions (National Malaria Strategy2009-2017).

2.4 General overview of traditional medicine

The World Health Organization defined traditional medicine as the “total combination of knowledge and practices whether explicable or not used in diagnosing, preventing or eliminating physical, mental and social disease which may rely exclusively on the past experience and observation handed down from generation to generation verbally or in writing” (WHO, 2001a). Traditional medicine has a long history of use. It has been in existence for many centuries and has been developed in every community as a response to the challenge of maintaining health and treating diseases worldwide (Heggenhougen and Pada, 1998). Bannerman (1993) estimated that traditional medicine caters for the
health needs of over 40% of the African population. This figure echoes an earlier estimate of 40% reported by Etkin and Ross (1982). The most popular drugs for malaria originate from plants, for example, Quinine from the bark of *Cinchona* tree and *Artemisinin* derived from *Artemisia annua* (WHO, 2001a).

According to WHO – Kobe report (WHO, 2001a), equitable access to health care had not been realized in Africa. Only half of the population in the region had access to formal health care. Due to this disparity, traditional medicine provided the only source for health care especially for poor patients (Deressa and Engusellassie, 2003). On the other hand, even when Western health facilities are available, traditional medicine is viewed as an efficient acceptable form of treatment from a cultural perspective and treatment with plant products have also managed incurable diseases. In Ghana, Kenya and Mali, research had shown that a course of pyremethamine-sulphadoxine costed several dollars yet total out- of- pocket health expenditure in Kenya and Ghana was only US$ 6 per capita annually (Bloland, 1993). In essence, some populations simply cannot afford chemical drugs. In Benin and Sudan, a World Bank poverty assessment found that 70% of the populations rely on traditional medicine (McCombie, 1996). Likewise, a household survey carried out in Mali, Ghana, Nigeria and Zambia found that 60% of the children with fever were treated with herbal medicines at home (UNICEF, 1998).

Traditional Chinese Medicine (TCM) is effectively used in China and accounts for 30-50% of the total medicinal consumption in China (WHO, 2001a). In 1999, Australia registered 17,000 herbal products (Maher, 1999). According to Sharma (1999), most
plant products are still processed using old traditional methods, which do not ensure efficiency, stability and safety. The importance of herbal medicine ought to be revisited and efforts made to integrate them into the health care delivery system. However, recent findings indicate that all herbal medicines may not be safe as several negative consequences are reported from herbal drugs (Pal and Shukla, 2003). The potential of traditional medicine should therefore be developed successfully through enhancing efficacy and limiting toxicity. Safety should be the starting point for development strategy for herbal medicines. The 1993 WHO clinical guidelines on the evaluation of herbal medicines consider that clinical evaluation is ethical where drugs have long been in traditional use (WHO, 2000b).

2.5 History of malaria control in the pre-eradication era

During the Roman times, draining surface water and encouraging people to avoid unhealthy places, covered small areas and a small number of people because this measure was repetitive and relied on behavior change (Sharma, 1999). Being bulky and costly to transport Cinchona bark used for treatment of malaria was limited to Latin America where the tree grew and to those who could afford it in Europe. Strong financial motives led to eradication of malaria during the construction of the Panama Canal. Unfavorable environmental conditions to malaria vectors and large investment of resources led to eradication of Anopheles gambiae in Brazil and in Egypt (Gramicia and Beasles, 1998). All this indicated that attempts to control malaria in the pre-eradication era were underlined by high costs and relatively ineffective control measures, except where there were strong economic, military or political motives.
2.6 Malaria control measures and their limitations

The current measures for malaria control can be classified into vector control, chemotherapy, chemoprophylaxis and personal protection (WHO, 2000b).

2.6.1 Vector control

The reduction of the number of mosquito vectors can be achieved using several methods. One of them is elimination of the mosquito breeding habitats in which the aquatic stage of the mosquito is destroyed (environmental control). This method involves funding and characterizing all breeding habitats, then altering them through permanent or recurrent changes on land, water or vegetation. Malaria control by this method is commonly used in highways of road construction, irrigation schemes and flood control schemes (Rajagopalan et al., 1991), but because of the high initial capital costs and high recurrent costs, it is an expensive method and therefore not practical in every locality.

Biological measures for the control of mosquitoes involving the introduction of pathogens and predators of larvae and pupa stages into the mosquito breeding sites have been used. Knell (1991) found out that various types of biological control methods have some success in combating malaria, for example; fish such as Guppies which breed rapidly and eat mosquito larvae may be valuable especially in enclosed water collections. New research in Kisii Central County has shown that after only 15 weeks of introducing Nile tilapia into fishponds, the fish reduced two species of Anopheles malaria vectors by over 94%. The fish also consumed three quarters of other mosquito population also, in a much more environmentally friendly manner (BMC, 2007). Two bacteria: Bacillus thuringiensis and Bacillus sphaericus produce toxins that kill larvae.
Sterilization of male mosquitoes by chemical or x-rays can reduce mosquito breeding if released in large numbers since the female Anopheles is known to mate only once in a life-time. Introduction of frogs whose diet is 60% arthropods can also reduce malaria incidence.

Chemical and physical measures used to directly kill the aquatic and the adult stage of mosquitoes involve use of DDT for house spraying and physical methods such as expanded polystyrene beads respectively. Larvicides used suffocate or poison the surface feeding/breeding larvae and pupae. This method has several problems where larvicides and applied vegetation must be cleared. Often, wind breaks the film of oil and also operations are cumbersome and costly (Zahar, 1984).

2.6.2 Chemotherapy

This is an anti-plasmodial strategy involving regular medication with anti-malarial drugs. Correct use of an effective anti-malarial drug will not only shorten the duration of malarial illness but also reduce the incidence of complications and the risk of death (WHO, 2000a). For this reason, it is presently the main strategy for malaria control in tropical Africa (WHO, 1993). However, chemotherapy has been hampered with the emergence of drug resistance parasite strains and lack of cheap alternative drugs (Wernsdosfer, 1994). For many years Chloroquine was the standard medication for treating malaria. But *P. falciparum* has become resistant to the drug and other treatments have had to be explored. Kenya has been faced with immediate and difficult decisions regarding the replacement of sulphadoxine Pyremethamine (SP) as nationally
recommended first-line therapy for uncomplicated malaria. Amodiaquine (AQ) on the other hand had a better clinical and parasitological response but its efficacy has been declining. The World Health Organization recommends that Artemisinin-based combinations should be the preferred replacement for failing monotherapy (GOK, 2011). Recommended treatment medication in Kenya from the Ministry of Health (MOH) is Artemisinin Based Combination Therapy (ACTs), e.g., Coartem (artemether-lumefantrine) or Cotexin (Dihydroartemisinin) both with derivatives from the Chinese herb artimisinin.

Access to treatment is a cornerstone of any public health programme. Due to inadequate health care, infrastructure and other reasons, chemotherapy is usually underutilized. For example only 10-20% of people that get sick with malaria seek competent treatment in Africa (Brinkman and Brinkman, 1991).

### 2.6.3 Chemoprophylaxis

This is another anti-plasmodial activity which involves regular medication with antimalarial drugs to prevent the development of the disease in susceptible individuals in whom there is demonstratable beneficial protection against malaria such as non immune travelers to malaria endemic areas (Steffen et al., 1993). Children in malaria endemic areas may benefit from chemoprophylaxis, an intervention which reduces the incidence of chronic attacks of malaria, increases hemoglobin levels and reduces infant mortality rate. However, chemoprophylaxis has problems associated with supply of drugs and other logistical aspects. These lead to low coverage of the selected groups and poor compliance (Mac-Cormark and Lwihuha, 1993). Furthermore, drug resistance hampers the long-term effectiveness of this measure.
2.6.4 Personal protection

Measures for this method include aerosol insecticides, insecticide-impregnated bed nets and curtains. Effective application of Insecticides Treated Nets (ITNs) for malaria control comprises three main components including: bed net acquisition or ownership, regular re-treatment of bed nets with insecticides and using bed nets correctly and/or consistently. Although Roll Back Malaria initiative had pledged that by the year 2004 up to 60% of children and pregnant women would have access to ITNs (WHO, 2000b), there is an urgent need to accelerate the mechanisms and resources to achieve these targets. It is important to take into account factors such as socio-cultural behaviour and economic effects. As with any tool of disease control, the introduction of ITNs requires prior understanding of community perceptions of disease prevention and control (Winch et al., 1994).

2.7 Herbal treatment for malaria

Traditional Medicine has been used to treat malaria for thousands of years and is a source of two main groups (artemisinin and quinine derivatives) of modern anti-malarial drugs. Over 1200 plant species from 160 families are used to treat malaria and fever. Many studies have been carried out on different aspects of herbal treatment for malaria. RITAM (1999) identified 12 social studies which have attempted to define the reverence of use of herbal anti-malarials; 21 ethnobotanical studies in 16 countries identified 239 plant species used for treatment of malaria and 211 pharmacological studies have revealed some in vitro or in vivo activity of extracts from 139 plant species. Over 88 compounds that are active on malaria parasites have been isolated from plants. Plants are
used as traditional medicine, food, shelter, dyes, oils, intoxicants, fuel, beverages, tools, for rituals, religious, ceremonial purposes and even as a source of cash income (Ogol et al., 2002). It is estimated that about 45% of the Kenyan population both rural and urban, use traditional medicines for their primary health care. About 400 species of plants have been recorded to be used by traditional herbalists in the treatment of various ailments including malaria (Kokwaro, 2009). Kenya now has an Association of Herbalists, though there is no regulation of them yet. The Government, however, has a policy of encouraging the formation of professional associations for traditional medical practitioners in Eastern and Southern Africa, a compilation of medicinal plants and their uses has been done (Kokwaro, 2009).

Nuwaha (2002) reported that in the Mbarara region of Uganda, people continued to treat themselves with traditional medicine and the study identified the following plants which were used:
<table>
<thead>
<tr>
<th>No.</th>
<th>Botanical Name</th>
<th>Plant Family</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Vernonia amygdalina</td>
<td>Asteraceae</td>
</tr>
<tr>
<td>2</td>
<td>Momordica foetida Schumach</td>
<td>Cucurbitaceae</td>
</tr>
<tr>
<td>3</td>
<td>Zanthoxylum chalybeum</td>
<td>Rutaceae</td>
</tr>
<tr>
<td>4</td>
<td>Lantana camara</td>
<td>Verbenaceae</td>
</tr>
<tr>
<td>5</td>
<td>Mangifera indica</td>
<td>Anacardiaceae</td>
</tr>
<tr>
<td>6</td>
<td>Chenopodium ambrosioides</td>
<td>Chenopodiaceae</td>
</tr>
<tr>
<td>7</td>
<td>Chenopodium opulifolium</td>
<td>Chenopodiaceae</td>
</tr>
<tr>
<td>8</td>
<td>Azadirachta indica</td>
<td>Meliaceae</td>
</tr>
<tr>
<td>9</td>
<td>Moringa oleifera</td>
<td>Moringaceae</td>
</tr>
<tr>
<td>10</td>
<td>Leonotis nepetifolia</td>
<td>Lamiaceae</td>
</tr>
<tr>
<td>11</td>
<td>Combretum molle</td>
<td>Combretaceae</td>
</tr>
<tr>
<td>12</td>
<td>Coffea canephora</td>
<td>Rubiaceae</td>
</tr>
<tr>
<td>13</td>
<td>Citrus sinensis</td>
<td>Rutaceae</td>
</tr>
<tr>
<td>14</td>
<td>Conyza sumatrensis</td>
<td>Asteraceae</td>
</tr>
<tr>
<td>15</td>
<td>Jatropha curcas</td>
<td>Euphorbiaceae</td>
</tr>
<tr>
<td>16</td>
<td>Kalanchoë densiflora</td>
<td>Crassulaceae</td>
</tr>
<tr>
<td>17</td>
<td>Flueggea virosa</td>
<td>Euphorbiaceae</td>
</tr>
<tr>
<td>18</td>
<td>Talinum portulacifolium</td>
<td>Portulacaceae</td>
</tr>
<tr>
<td>19</td>
<td>Ocimum gratissimum</td>
<td>Lamiaceae</td>
</tr>
<tr>
<td>20</td>
<td>Albizia zygia</td>
<td>Fabaceae</td>
</tr>
<tr>
<td>21</td>
<td>Carissa edulis</td>
<td>Pocynaceae</td>
</tr>
<tr>
<td>22</td>
<td>Acacia seyal</td>
<td>Fabaceae—Mimosoideae</td>
</tr>
<tr>
<td>23</td>
<td>Cajanus cajan</td>
<td>Fabaceae</td>
</tr>
<tr>
<td>24</td>
<td>Allium cepa</td>
<td>Alliaceae</td>
</tr>
<tr>
<td>25</td>
<td>Melia azedarach</td>
<td>Meliaceae</td>
</tr>
<tr>
<td>26</td>
<td>Harrisonia abyssinica</td>
<td>Simaroubaceae</td>
</tr>
</tbody>
</table>
Many languages have no specific term for malaria, but have several words for different types of fever. In Nigeria, Ajaiyeoba et al. (1999) found that 21 types of fever were identified by local people. Many of these could be equated with different forms of malaria. Frequency of use of herbs and drugs varied according to type of fever. Similarly, Helitzer-Allen et al., (1993) were able to subdivide the term ‘Malawian malungo’ into seven subcategories, each believed to have different causes, symptoms, and treatments. In Swahili, several words denote different illnesses that overlap to a greater or lesser extent with a biomedical diagnosis of malaria. One of the most common illnesses reported is homa, a symptom of fever and body pains, which is likely to include not only malaria, but also viral illnesses (Winch et al., 1996; Geissler et al., 2000). Kibwengo are spirits of the devil that may be encountered in the hot sun near large stones and trees; they cause
headache, stomach pains, and fever, and can be worsened by modern medicine (Oberländer and Elverdan, 2000).

Traditional medicine is preferred for the treatment of convulsions in many other ethnic groups, for example, in Madagascar, Malawi, Mali, and Zambia (Helitzer-Allen et al., 1993; Baume et al., 2000; Leon, 2002). Use of traditional herbal remedies and use of pharmaceuticals are not mutually exclusive as several studies have found that pharmaceuticals are often combined with herbs (Lipowsky et al., 1992; Jayawardene, 1993; Agyepong and Manderson, 1994; Gessler et al., 1995; McCombie, 1996; Pagnoni et al., 1997; Bugmann, 2000). These may be taken together simultaneously, or as first- and second-line treatments. Simultaneous use of drugs and herbs was reported by some traditional healers interviewed by Gessler et al. (1995) and Rasoanaivo et al. (1992); their belief is that combining the two modalities gives an additional effect.

Perceived efficacy is an important reason for the use of traditional herbal remedies and should be a key component of research on treatment seeking. It would seem logical that patients would not use a remedy unless they thought it was at least partly effective. On the other hand, some patients may use herbal remedies simply because they cannot afford pharmaceuticals. Adera (2003) found that Ethiopian patients chose traditional remedies for malaria primarily because of their greater accessibility (83%) and low cost (48%), but 7% of respondents believed that traditional remedies were more effective than modern medicine.
Traditional medicines are perceived to be effective for malaria, and particularly for convulsions or splenomegaly, thus delaying attendance at biomedical facilities for severe malaria. An equally valid interpretation could be that traditional medicines are effective for uncomplicated malaria, and that this should be investigated, while encouraging use of modern medicine for severe malaria. Nyamongo (2002) suggests that the perceived efficacy of herbal medicines is spurious and related to concomitant treatment with over-the-counter pharmaceuticals. An alternative interpretation is that some herbal medicines may potentiate the effect of pharmaceuticals, and that concomitant use may help to overcome resistance. The interpretations chosen by these authors are consistent with their aims of improving compliance with biomedicine, with no consideration of the potential value of traditional medicines.

It is widely believed that smoke from burning certain plants is repellent or lethal to mosquitoes. This has been confirmed for mosquito coils containing pyrethrum and fresh herbs such as *Hyptis saveolens* placed on glowing charcoal (Kokwaro, 1993). Plant repellents have long been used as protection against biting insects primarily to reduce nuisance biting among different cultures and communities in Africa and beyond (Warrel, 1997). Herbal medicine can be prepared and administered in form of decoctions (plant matter with water, boiled and sieved, infusions (plant matter soaked in water and applied), burning to make ash, pounding, chewing and roasting (Kokwaro, 1993). Most of the traditional herbs are poisonous if taken in large quantities (Sindiga et al., 1995). Traditional medicine must therefore be prepared with great care and accuracy.
Traditional healers with long practical experience are usually well versed with the estimates of the dosage.

Figure 1.2 Mosquito repellant shrub (*Artemisia annua*) planted next to a bedroom window

### 2.8 Socio-economic factors influencing health seeking behavior

The community’s socio-economic situation, cultural beliefs, and understanding of the diseases influence the search for treatment in the face of disease (de Bartolome and Vosti, 1995). Determinants of the demand for malaria treatment are diverse and they include malaria endemicity; family members’ susceptibilities to malaria; household size; the
perceived quality of care; current health status; accessibility to health services as well as the ability to pay for the services (Mwenesi et al., 1995).

2.8.1 Accessibility

Greater accessibility of traditional medicine was the most important reason for its use in Ethiopia, quoted by 83% of respondents in a survey (Adera, 2003). In Uganda, perceived absence of drugs at health centers is an important reason why patients do not attend the clinics for treatment against malaria (Ndyomugenyi et al., 1998). In Malawi, shortages of chloroquine led health workers to prescribe insufficient doses (Helitzer-Alen et al., 1993). Even in a project, training malaria extension worker to provide chloroquine to remote areas, one third of the workers had no chloroquine tablets for over 6 weeks (Théra et al., 1998). In many areas, distance to the health center is the limiting factor (Miguel et al., 1999; Baume et al., 2000; Okrah et al., 2002; Utarini et al., 2003). In these circumstances, the only available treatments are herbs.

2.8.2 Cost of Drugs

Lack of money is a commonly quoted reason for malaria patients not seeking modern health care (Ndyomugenyi et al., 1998; Théra et al., 2000; Leon, 2002; Mugisha et al. 2002). Even drugs provided at very low cost can be unaffordable to the very poor. For example, people were unable to afford chloroquine during a malaria epidemic in rural Malawí, and the drugs eventually had to be given away, or they would have reached their expiry date (Richardson, 1990; Foster, 1995). In Madagascar, some health professionals refuse to see patients unless they can pay; therefore, many poor patients have given up
going to modern health facilities (Leon, 2002). Similar problems have been reported in Zambia (Baume et al., 2000). Low cost was the second most important reason for use of traditional medicine, quoted by 48% of respondents in an Ethiopian survey by Adera (2003).

The preference for traditional health care in Africa may be attributed to high cost of professional health care. For many, especially those living in rural areas of developing countries, the first recourse when an illness strikes is to seek traditional healers and use of medicinal plants (Ogol et al., 2002). Use of plants for medicinal care reflects the attachment of a people to their culture (Randrianarivelohosia et al., 2003). In a rapid community survey done in Boa, Zaire, 56% of households reported that the price of treatment was the greatest obstacle to them concerning medical care (WHO, 2000a).

Relevance of herbal drugs to provision of health care was investigated in a study carried out in Ghana using the criteria of availability, accessibility, utilization and patient satisfaction. Availability of herbal drugs in the city was found to be low due to depletion of original vegetation and scarcity of commercial outlets and herbalists. Drugs were found to be quite accessible both financially and geographically.

Acceptability of herbal drugs was found to be related to popular concepts of health, disease and healing for utilization while vast differences were observed between rural and urban areas. In both rural and urban locations, it was noted that about half of all self-care treatments involve herbal medicine. Satisfaction was higher in patients treated by herbalists (Amanda and Wondergem, 1990). Likewise, another survey carried out in
Nigeria among 500 residents to determine their use of medicinal plants in treatment of malaria as home remedy showed a significant segment (40.3%) of the population use medicinal plants (Atkin, 1997). Asking people why they did not use modern health services (in Somalia), Abyan and Osman (1993) found that cost was the reason for only 50%, whereas lack of faith in doctors was the reason in the other 50%. Transport costs are usually cheaper when consulting a healer, as there is less distance to travel; the healer can often be paid in kind rather than in currency, and according to the patient’s means rather than a fixed charge (Traore et al., 1993; Bugmann, 2000).

2.8.3 Trust of Health Practitioners

In Burkina Faso, it has been observed that medical staffs at the hospital are less trusted because they are often young, do not speak local languages, and are not welcoming to patients (Bugmann, 2000). Similarly, in Peru, some medical staff resent being sent to work in poor areas and are discourteous to patients, thus deterring them (Keme, 2000). Some health care professionals even scold parents for not looking after their children properly, which discourages them from attending the clinics as has been reported in Madagascar and Zambia (Baume et al., 2000; Leon, 2002). This distrust of modern medicine may in many cases be justified.

In rural Gambia, a similar proportion of patients consulted traditional healers regardless of whether primary health facilities were available (De Francisco et al., 1994). The authors speculate that this may be due to the prevalence of traditional concepts of health
and disease, as well as the direct accountability of traditional healers to their communities.

2.8.4 Availability

Effective antimalarial herbs may not be available or known in all malarious areas. For example, in Mananjary (Madagascar) villagers reported that there were no local herbal remedies for malaria (Leon, 2002). Even where plants exist, they may not be readily available. Indeed in some areas, people leave urban centers in order to gather plants that are believed to be more effective than conventional drugs in treating malaria; this pattern of treatment seeking is common in the Maasai people of Tanzania (Burford et al., 2000). Other people may not have the opportunity to travel far for treatment, and this may reduce usage of botanical medicines, especially by city dwellers. Certain medicinal plants are becoming endangered or even extinct (FAO, 1997) and this will obviously reduce their use.

Herbal remedies are rarely made available on a large scale by public health systems. However, there are at least two exceptions to this rule. The first is Ayush-64, an Ayurvedic herbal antimalarial preparation, which was used during malaria epidemics in Rajasthan in 1994 and in Assam in 1996 (Bhatia, 1997), where over 3000 and 2200 cases were treated, respectively. The results were reportedly good, although information on this is scant. Mali’s National Formulary (Ministère de la Santé, 1998) includes a page on ‘Malarial’ an herbal remedy composed of three local plants. The indication is for “febrile states linked to malaria,” and there is a warning that parasites are not cleared completely.
However, the medicine is contraindicated in children less than 15 years old. This is the first traditional herbal remedy for malaria to be included in a National Formulary.

2.8.5 Level of Education

Level of education may also influence treatments chosen. Usually it is reported that herbal medicines are more commonly used by uneducated people. However, the differences are not very great, and a substantial proportion of educated people still choose to use traditional medicines for malaria. For example, in a survey in Zanzibar, 52% of people with no formal education used herbal remedies for malaria, compared to 42% of those with at least primary education (Alilio et al., 1998). Even those who were educated consulted their grandparents, which may have led to high levels of use of traditional medicines. Fawole and Onadeko (2001) found that educated mothers were more likely to choose a formal health facility as their first port of call, but only slightly less likely to consult a traditional healer first. One survey found that education was positively associated with knowledge of herbal medicines for malaria: in an urban secondary school in Sudan, 42% of teachers, compared to 20% of students, believed that malaria could be treated with herbal medicine (Elzubier et al., 1997).

2.9 Treatment Seeking Behaviours

Matthies (1998) examined in detail the treatment-seeking patterns of patients attending the clinics of three traditional healers in Tanzania. She found that 47% of patients at one healer’s clinic had gone directly there (and about 88% of patients at two other healers’
clinics had gone directly there). However, when asked a theoretical question about treatment seeking, only 1.8% of patients said they would consult a traditional healer as a first step for malaria treatment, but 43.9% would consult as a second step, if their first method failed (usually visiting a formal health facility or treatment with an anti-malaria drug). Since this sample was taken at a traditional healer’s clinic, it is likely to be biased. Bugmann (2000) also interviewing patients at a traditional healer’s clinic in Burkina Faso, found that 70% had tried at least one other treatment before coming to the healer.

This helps to explain the finding by De Francisco et al. (1994) that, of children dying of malaria, 62% had consulted a traditional healer. In fact, almost all of these had also consulted at least one health professional. There is no indication of the order of treatment seeking or of how many consulted a traditional healer alone. The high proportion of people consulting a traditional healer probably reflects the severity of the illness and the extent of different treatments sought. Similarly, Baume et al. (2000) report that although cases involving convulsions are more likely to be treated by traditional healers, 85% did receive modern care, and traditional treatments were most often used as a complementary rather than an alternative measure.

In a systematic verbal autopsy study of child deaths in a defined birth cohort in Guinea-Bissau, 93% had been seen at a health center or hospital in the 2 weeks before their death (Sodemann et al., 1997). Over 30% of these children died of fever or malaria. This study demonstrated that contrary to popular belief, mothers sought formal care sooner in cases of fatal illness. In comparison with a previous study at the same site, appropriate care-
seeking behaviour had increased, but child mortality had not decreased. Another factor may be that convulsions are not always recognized as being caused by severe malaria and are believed to be best treated by traditional healers. Winch et al. (1996) found that up to 64% of people said they would see a traditional healer for degedege (fever with convulsions). In Mbarara, Uganda, 50% of interviewees believed that convulsions could not be treated by modern medicine, and one respondent even said that if a child gets convulsions in the hospital, he would bring a traditional healer to treat him there, or forcibly remove the child if this was not allowed (Nuwaha, 2002). Clearly, in such circumstances it will be difficult to improve the case management of cerebral malaria without involving traditional healers.

2.9 Summary and Research Gap to be Filled

Herbal or traditional medicine has greater advantage to the individual patient than conventional medicine (Olawayo, 1990). It is cheaper and more readily available, natural and does not have toxic preservatives, binders and dyes that are part and parcel of convectional medicine. Herbal medicine is also wholesome, in that besides controlling or curing illness, it compliments the body’s efforts in the generation of carbohydrates, proteins, mineral salts and hormones vitally required in the times of sickness to speed up recovery.

It is often said that 80% of the world’s population relies on traditional medicine for their primary health care (Bannerman et al., 1983). However, it is not clear what evidence
there is for this statement (Bodeker et al., 2001), or how it relates specifically to the treatment of malaria. It is conceivable that, with widespread public health programs and the increasing availability of cheap modern antimalarials, the use of traditional medicines for malaria may have decreased. On the other hand, increasing levels of resistance to affordable drugs and the cost of more effective drugs may be driving patients back to traditional medicine. Furthermore, it is possible that the use of traditional antimalarials varies according to the availability of safe and effective herbal remedies. If this were so, research programs could focus on localities where traditional antimalarials are widely used and to identify the remedies with the greatest perceived efficacy. These could be investigated more fully, and if shown to be clinically safe and effective, their use could be promoted in other areas where the relevant plants exist or could be cultivated.
CHAPTER THREE: MATERIALS AND METHODS

3.1 Study area

The study area was Boro division which is one of the divisions that make up Siaya county as shown on the map 3.1 showing Boro Division of Siaya County s below.

Map 3.1 Boro Division  in Siaya County, Kenya

The study was conducted in April 2006 in 4 villages around Siaya County Hospital, which is within Boro Division. The villages were Kisar, Imbaya, Gombe and Uruadhi. The district experiences a bimodal type of rainfall whose distribution and amount is influenced by relief and altitude. The county is drier in the western part and wetter
towards the higher altitudes in the eastern part. On the highlands, the rainfall ranges between 800-2000 mm per annum. The lower areas receive rainfall ranging from 800-1600 mm. The long rains fall between March and June with the peak being in April and May. The short rains occur between August and November (GOK, 2001a). Poverty is a common phenomenon in the district and is characterized by inadequate accessibility to clean water, health services, sanitation and food. The main pockets of poverty can be found in lower parts of Boro, Ukwala, Uranga and Karemo Divisions. The most affected population groups include widows, orphans, single mothers and the sick.

The widespread vegetation in the district comprises of indigenous tree species mainly Acacias and shrubs. Exotic species are found only in specific areas, and have been planted by the Forest Department. Some of the indigenous tree species such as Mvule (Ober), Markhamia (Siala) and Olwa have been exploited extensively for timber and furniture.

3.2 Study design

The study used both analytical and descriptive design in obtaining the information concerning the current status of herbal medicine in Boro Division, Siaya county, Kenya and a description of what exists with respect to variables or conditions in the area of study. The descriptive method is preferred because it ensures complete description of the situation, making sure that there is minimum bias in the collection of data (Kothari, 2008).
3.3 Target population

The target population was from Boro Division of Siaya County and consisted of adult population in each village that were selected as participants. However, the key informants were herbal medicine users.

3.4 Sampling Procedure

Given that the population of study area was greater than 10,000 the Fisher et al. (1998) formula was applied to determine the sample size.

\[ N = \frac{z^2pq}{d^2} \]

Where, \( N \) = desired sample size (Population > 10,000).
\( z \) = Standard normal deviation (1.96) which corresponds to 95% confidence interval.
\( P \) = Proportion of target population estimated to have particular characteristics.
(i.e. 0.5)
\( q = 1-p \) (Thus, 1-0.5) = 0.5
\( d \) = degree of accuracy or required precision = 0.05
\( D \) = design effect, in this case 1

Thus \( N = (1.96)^2(0.5)(0.5)/(0.05)^2 \Omega 400 = 244 \)

Probability proportional to size sampling design was used to calculate total number of respondents from each of the villages all totaling to 244. Table 3.1 shows the number of respondents sampled per village.
Table 3.1 Respondents sampled per village

<table>
<thead>
<tr>
<th>Village name</th>
<th>Number of respondents</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kisar</td>
<td>68</td>
<td>27.8</td>
</tr>
<tr>
<td>Imbaya</td>
<td>62</td>
<td>25.4</td>
</tr>
<tr>
<td>Gombe</td>
<td>50</td>
<td>20.5</td>
</tr>
<tr>
<td>Uruadhi</td>
<td>64</td>
<td>26.2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>244</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

3.4.2 Inclusion criteria

The study recruited heads of households and members of households who had lived in the area for at least one year and who consented to the subject. In order to consent, respondents were required to have attained the age of 18 years and above.

3.4.3 Exclusion criteria

Those who had not lived in the area for more than one year and who were not at least 18 years did not qualify for inclusion in the survey. Likewise, those who did not consent to the interview were left out.

3.5 Data sources and instruments

Primary data was collected through questionnaires, while secondary data was collected through reviewing records of the study relevant to the subject. Primary data was collected from Boro Division, Siaya County. Since the study focused on utilization of
herbal medicines for malaria, the household was chosen as the unit of analysis. Households have been shown to be the key unit in prevention, treatment and management of malaria in case of an illness.

Data for both the quantitative and qualitative parts of the study were collected using structured questionnaire. In the construction of the questionnaires expert views and suggestions of the supervisors were initially incorporated in the questionnaires. The questionnaires were then pretested on 11 respondents to ascertain the thinking behind the answers so that the researcher could accurately assess whether the questionnaire would be filled out properly, whether the questions would be actually understood by respondents, and whether the questions ask what the researchers intended. Pre-testing was conducted in circumstances that were similar as possible to actual data collection and on population members as similar as possible to those that were finally sampled. As a result of the pilot test, changes in word selection and instructions were made to the research instrument.

3.6 Validity and reliability

Table 3.2 below indicates the test of validity and reliability of the study questionnaire using Cronbach's $\alpha$ (alpha) coefficient. Fifteen (15) respondents were used as a sample. The alpha coefficient for the 15 questionnaires that were distributed to the respondents was 0.856, or 85% suggesting that the study instrument (Questionnaire) have a relatively high internal consistency.
Table 3.2 Test of validity and reliability of the questionnaire

<table>
<thead>
<tr>
<th>Cronbach’s Alpha</th>
<th>Cronbach’s Alpha Based on Standardized Items</th>
<th>N of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>.856</td>
<td>0.796</td>
<td>15</td>
</tr>
</tbody>
</table>

3.7 Data collection procedure

Prior informed Consent (PIC) to participate in the study was sought from all respondents before research instruments were administered. All respondents were assured of total confidentiality and were informed orally in the local language (Dholuo) of relevant information required in the study. The researcher administered questionnaires contained closed and open ended questions with the aim of collecting the views of the sample respondents on the utilization of herbal medicines for malaria. The questionnaires were attached with a cover letter from the researcher explaining the purpose of the study. The questionnaires were issued by both the researcher and research assistants and later collected upon filling by the respondents. This method created provision for personal contacts between the researcher and the respondents.

3.8 Ethical Consideration

Prior Informed Consent (PIC) to participate in the study was sought from all respondents before administering research instruments. All respondents were assured of total
confidentiality and were informed of the purpose of the study and the relevant information required in the study.

3.9 Data presentation and analysis

The collected data were analyzed both quantitatively and qualitatively so as to ensure that all the collected data were effectively presented. Plants used in treatment of malaria were taken to East African Herbarium which is part of the National Museums of Kenya for analysis to determine their botanical names. Quantitative data collected by use of the questionnaire were thoroughly edited and checked for completeness and comprehensibility; summarized; coded for easy classification and tabulated. The tabulated data were then analyzed by calculating various percentages where possible. Descriptive and inferential statistics especially percentages, frequencies, correlation and regression was used to help establish patterns, trends and relationships and to make it easier for the researcher to understand and interpret implications of the study. Qualitative data which were collected by use of open ended questions was coded and organized into themes and concepts that address the research questions and analysed using content analysis. Presentation of data was in form of tables, pie-charts and bar graphs only where it provides successful interpretation of the findings. Descriptive data were provided in form of explanatory notes.
CHAPTER FOUR: RESULTS

4.1 Introduction

This chapter presents the analysis of study findings on the plant sources of anti malarial natural substance based on the specific objectives on the community knowledge and attitude on malaria treatment and control, prevalence of malaria infection, factors affecting influencing the use of herbs, the health seeking behavior and identification / documentation of herbal plants used to treat malaria. This chapter analyses the variables involved in the study based on the model presented in the previous chapter.

4.2 Response rate

Table 4.1 below, shows the total number of the respondents who responded. The total questionnaires that were distributed to the field were 244 and out of these questionnaires, 221 questionnaires were returned fully answered which represent 90.5 % of the total questionnaires.

Table 4.1 Response Rate

<table>
<thead>
<tr>
<th>Response Rate</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responded</td>
<td>221</td>
<td>90.5</td>
</tr>
<tr>
<td>Non-respondent</td>
<td>23</td>
<td>9.4</td>
</tr>
<tr>
<td>Total</td>
<td>244</td>
<td>100%</td>
</tr>
</tbody>
</table>
4.2 Demographic factors

Majority of the respondents were male (51.6), aged 31-40 (42.1), christens (71.5%), married (78.7), monogamous (62.4) and had primary education (57.4). This can be evidenced by the results on table 4.2 below

Table 4.2 Demographic factors

<table>
<thead>
<tr>
<th>Demographic factors</th>
<th>Categories</th>
<th>Frequency</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male</td>
<td>112</td>
<td>51.6</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>109</td>
<td>49.4</td>
</tr>
<tr>
<td>Age bracket</td>
<td>20-30</td>
<td>48</td>
<td>21.7</td>
</tr>
<tr>
<td></td>
<td>31-40</td>
<td>93</td>
<td>42.1</td>
</tr>
<tr>
<td></td>
<td>41-50</td>
<td>51</td>
<td>23.1</td>
</tr>
<tr>
<td></td>
<td>51 and above</td>
<td>29</td>
<td>13.1</td>
</tr>
<tr>
<td>Religion</td>
<td>Christian</td>
<td>158</td>
<td>71.5</td>
</tr>
<tr>
<td></td>
<td>Muslim</td>
<td>18</td>
<td>8.1</td>
</tr>
<tr>
<td></td>
<td>Traditional</td>
<td>45</td>
<td>20.4</td>
</tr>
<tr>
<td>Marital Status</td>
<td>Single</td>
<td>33</td>
<td>14.9</td>
</tr>
<tr>
<td></td>
<td>Married</td>
<td>174</td>
<td>78.7</td>
</tr>
<tr>
<td></td>
<td>Divorced</td>
<td>80</td>
<td>3.6</td>
</tr>
<tr>
<td></td>
<td>Separated</td>
<td>4</td>
<td>1.8</td>
</tr>
<tr>
<td></td>
<td>Widowed</td>
<td>2</td>
<td>1.0</td>
</tr>
<tr>
<td>Marriage Category</td>
<td>Monogamous</td>
<td>138</td>
<td>62.4</td>
</tr>
<tr>
<td></td>
<td>Polygamous</td>
<td>83</td>
<td>37.6</td>
</tr>
<tr>
<td>Level of education</td>
<td>Tertiary</td>
<td>24</td>
<td>10.9</td>
</tr>
<tr>
<td></td>
<td>Primary</td>
<td>127</td>
<td>57.4</td>
</tr>
<tr>
<td></td>
<td>Secondary</td>
<td>70</td>
<td>31.7</td>
</tr>
</tbody>
</table>
### 4.3 Socioeconomic factors

Table 4.3 represents the socioeconomic factors of the respondents. 31.7%, 37.6%, 41.6% and 32.1% were peasants, housewives, has 4-6 children and a monthly income of 4001-6000 KSHS and support 7-10 dependents respectively.

#### Table 4.3 Socioeconomic factors

<table>
<thead>
<tr>
<th>Socioeconomic Factors</th>
<th>Categories</th>
<th>Frequency</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupation</td>
<td>Peasants</td>
<td>70</td>
<td>31.7</td>
</tr>
<tr>
<td></td>
<td>Teachers</td>
<td>58</td>
<td>26.2</td>
</tr>
<tr>
<td></td>
<td>Traders</td>
<td>53</td>
<td>24.0</td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>40</td>
<td>18.1</td>
</tr>
<tr>
<td>Occupation of spouses</td>
<td>Teachers</td>
<td>83</td>
<td>37.6</td>
</tr>
<tr>
<td></td>
<td>Nurses</td>
<td>32</td>
<td>14.5</td>
</tr>
<tr>
<td></td>
<td>Housewives</td>
<td>106</td>
<td>48.0</td>
</tr>
<tr>
<td>Number of children</td>
<td>Between 1-3</td>
<td>56</td>
<td>25.3</td>
</tr>
<tr>
<td></td>
<td>Between 4-6</td>
<td>92</td>
<td>41.6</td>
</tr>
<tr>
<td></td>
<td>Between 7-9</td>
<td>44</td>
<td>19.9</td>
</tr>
<tr>
<td></td>
<td>10 and above</td>
<td>29</td>
<td>13.1</td>
</tr>
<tr>
<td>Monthly Income</td>
<td>100-2000</td>
<td>10</td>
<td>3.6</td>
</tr>
<tr>
<td></td>
<td>2001-4000</td>
<td>58</td>
<td>26.2</td>
</tr>
<tr>
<td></td>
<td>4001-6000</td>
<td>71</td>
<td>32.1</td>
</tr>
<tr>
<td></td>
<td>6001-8000</td>
<td>48</td>
<td>21.8</td>
</tr>
<tr>
<td></td>
<td>8001-10000</td>
<td>13</td>
<td>5.9</td>
</tr>
<tr>
<td></td>
<td>Over 10000</td>
<td>9</td>
<td>4.1</td>
</tr>
<tr>
<td>Financial dependents</td>
<td>Between 1-2</td>
<td>47</td>
<td>21.3</td>
</tr>
<tr>
<td></td>
<td>Between 3-6</td>
<td>69</td>
<td>31.3</td>
</tr>
<tr>
<td></td>
<td>Between 7-10</td>
<td>90</td>
<td>40.7</td>
</tr>
<tr>
<td></td>
<td>Over 11</td>
<td>15</td>
<td>6.0</td>
</tr>
</tbody>
</table>
4.3.1 Correlations between age, marital status, occupation, dependants and religion

Table 4.4 Correlations between Age, Marital Status, Occupation, Dependents and Religion

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>df1</th>
<th>df2</th>
<th>Sig. F Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.410a</td>
<td>.681</td>
<td>5</td>
<td>139</td>
<td>.842</td>
</tr>
</tbody>
</table>

b. Dependent Variable: Use of herbs for treatment of malaria

The study used the significance level of alpha =0.05. (95%), Degrees of freedom (df) of 5, and two-tailed test. Based on the study, correlation coefficient (r) was .410 and the coefficient of determination (r2) was 0.681 which means that 68% of use of herbs can be associated to age, marital status, occupation, dependants and religion of the inhabitants of Boro division Siaya County.
4.3.2 Cross tabulation between age, marital status, occupation, dependants and religion and the use of herbs

Table 4.5 Chi-Square Test Model summary on the cross tabulation between Age, Marital Status, Occupation, Dependants and Religion and the use of Herbs

<table>
<thead>
<tr>
<th>Model</th>
<th>Change Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Value</td>
</tr>
<tr>
<td>Age</td>
<td>1.079</td>
</tr>
<tr>
<td>Marital Status</td>
<td>2.726</td>
</tr>
<tr>
<td>Occupation</td>
<td>.008</td>
</tr>
<tr>
<td>Dependents</td>
<td>1.605</td>
</tr>
<tr>
<td>Religion</td>
<td>2.607</td>
</tr>
</tbody>
</table>

Significant level at 0.05 (2-tailed)

Results shown on table 4.5 above indicate the relationship between age, marital status, occupation, dependants, religion and the use of herbs. Based on the study, the Pearson Chi-Square value for the various independent variables are as follows: age (1.079), marital status (2.726), occupation (0.008), dependants (1.605) and religion (2.605); while the $P$-values are: age (0.029), marital status (0.036), occupation (0.013), dependants (0.004) and religion (0.012). This computed $P$-values were all less than $\alpha=0.05$, which means the difference is statistically significant for each of the variables. Hence from the study it can be inferred that there is positive significant relationship between age, marital status, occupation, dependants and religion and the use of herbs.
### 4.3.3 Knowledge on malaria

**Table 4.6 Response on knowledge of malaria**

<table>
<thead>
<tr>
<th>Categories</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exposure To Cold</td>
<td>8.1</td>
</tr>
<tr>
<td>Mosquito Bite</td>
<td>88.3</td>
</tr>
<tr>
<td>Person To Person Contact</td>
<td>1.8</td>
</tr>
<tr>
<td>Unhygienic Conditions</td>
<td>0.9</td>
</tr>
<tr>
<td>Other Causes</td>
<td>0.9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Eight point one percent (81%) of the total respondents indicated that malaria is caused by exposure to cold, 88.7% indicated that malaria is caused by mosquito bite, 1.8% indicated person to person contact, 0.9% indicated unhygienic conditions, while 0.9% of the total respondents indicated other causes. From Table 4.6, it can be inferred that malaria is caused by mosquito bite.

### 4.3.4 Malaria attack

**Table 4.7 Response on cause of malaria**

<table>
<thead>
<tr>
<th>Categories</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>88.7</td>
</tr>
<tr>
<td>No</td>
<td>11.3</td>
</tr>
</tbody>
</table>

Based on the findings, majority (88.7%) of the total respondents indicated that they have had an attack of malaria (Table 4.7).
4.3.5 Population at risk of malaria attack

Table 4.8 Response on malaria attack in the past three months

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children Under 5 Years</td>
<td>56.6</td>
</tr>
<tr>
<td>Children From Ages Of 6-15</td>
<td>9.5</td>
</tr>
<tr>
<td>Adults</td>
<td>1.4</td>
</tr>
<tr>
<td>Pregnant Mothers</td>
<td>32.6</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

Fifty six point six percent (56.6%) of the total respondents indicated that children under 5 years, 9.5% of the total respondents indicated children from the ages of 6-15, 1.4% indicated adults, while 32.6% of the total respondents indicated pregnant mothers (Table 4.8).

4.4 Malaria Prevalence

4.4.1 Hospitalized due to malaria

Table 4.9 Response on who is at risk of malaria

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>81.9</td>
</tr>
<tr>
<td>No</td>
<td>18.1</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>
According to the study 81.9% of the total respondents acknowledged that a family member had ever been admitted to hospital due to malaria (Table 4.9).

### 4.4.2 Malaria attributed death

#### Table 4.10 Response on cases of hospitalization due to malaria

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>52.4</td>
</tr>
<tr>
<td>No</td>
<td>47.5</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

Majority (52.5%) of the total respondents indicated that someone they knew had died of malaria. From Table 4.10, it can be deduced that most of the respondents knew someone who had died of Malaria.
4.4.3 Malaria reported in household

Table 4.11 Response on death as a result of malaria

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less Than One Month</td>
<td>53.9</td>
</tr>
<tr>
<td>More Than One Month</td>
<td>26.7</td>
</tr>
<tr>
<td>More Than Six Months</td>
<td>18.1</td>
</tr>
<tr>
<td>Could Not Remember</td>
<td>1.4</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

As indicated in Table 4.11, 53.9% of the total respondents indicated that a member of the household had suffered from malaria in the last less than one month; 26.7% of the total respondents indicated more than one month; 18.1% indicated more than six months, while 1.4% pointed out that they could not remember. These results indicated that majority of the respondents had a member of the household who had suffered from malaria in the last one month period.

4.4.3 Symptoms of malaria

Table 4.12 Response on symptoms of malaria

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fever Plus Another Sign</td>
<td>85.1</td>
</tr>
<tr>
<td>Fever Alone</td>
<td>14.0</td>
</tr>
<tr>
<td>Any One Sign Apart From Fever</td>
<td>0.9</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>
According to findings, 85.1% of the total respondents indicated that the signs associated with malaria consist of fever plus another sign, 14.0% of the total respondents acknowledged that malaria indicative signs include fever alone; while 0.9% indicated any one sign apart from fever (Table 4.12). From the findings, it can be deduced that the signs that make one to realize that one has malaria consists of fever and another sign.

4.4.4 Health problem in the community

Table 4.13 Response on whether malaria is a health problem in their community

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>91.9</td>
</tr>
<tr>
<td>No</td>
<td>8.1</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

Majority (91.9%) of the total respondents indicated that they appreciate malaria as a health problem; while 8.1% of the total respondents indicated that they do not appreciate malaria as a health problem in this community (Table 4.29). Qualitatively, most of the respondents indicated that loss of appetite is the main symptom associated with malaria in children. Retarded growth, crying throughout, being absent from school, general weaknesses and convulsions were the other problems associated with malaria in children.
4.5 Health Seeking Behaviors

4.5.1 Frequency of the use of herbs for treatment

Table 4.14 How frequent is the use of herbs for treatment

<table>
<thead>
<tr>
<th>Categories</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very prevalent</td>
<td>63.3</td>
</tr>
<tr>
<td>Prevalent</td>
<td>35.7</td>
</tr>
<tr>
<td>Not prevalent</td>
<td>0.9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

From the study, 63.3% of the total respondents indicated that the use of herbal medicine for treatment of malaria is very prevalent, 35.7% indicated that use of herbal medicine for treatment of malaria is prevalent, while, 0.9%, indicated that use of herbal medicine for treatment of malaria is not prevalent. From these data, it can be deduced that use of herbal medicine for treatment of malaria is very frequent (Table 4.14).

4.5.2 Source of treatment

Table 4.15 response on where they go for treatment

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Herbalist</td>
<td>38.9</td>
</tr>
<tr>
<td>Health Facility</td>
<td>36.6</td>
</tr>
</tbody>
</table>
The study shows the views of the respondents on where they go for treatment. Based on the findings, 38.9% of the total respondents indicated that they go to the herbalist for treatment, 36.6% of the total respondents indicated that they go to the health facility for malaria treatment, 13.1% of the total respondents indicated they buy medicine from the local shop, while 11.3% of the total respondents indicated they get prescriptions from pharmacist (Table 4.15).

4.5.3 Preference to treat malaria

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Herbal Medicine</td>
<td>49.3</td>
</tr>
<tr>
<td>Conventional Medicine</td>
<td>19.1</td>
</tr>
<tr>
<td>Both Herbal And Conventional Medicine</td>
<td>30.8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

As indicated in Table 4.16 above, 49.3% of the total respondents acknowledged that they prefer Herbal medicine for treatment of malaria, 19.1%, conventional medicine and 30.8% preferred both herbal and conventional medicine. From the findings it can be inferred that majority of the respondents prefer herbal medicine.
4.5.4 Reasons for Preference of herbal medicine

Table 4.17 Response on reasons for preference of herbal treatment

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relatively Cheap</td>
<td>38.9</td>
</tr>
<tr>
<td>Readily Available</td>
<td>23.1</td>
</tr>
<tr>
<td>Effectiveness</td>
<td>36.7</td>
</tr>
<tr>
<td>Other</td>
<td>1.4</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

Thirty eight point nine percent (38.9%) of the total respondents pointed out that the reason for preferring herbal medicine is due to the fact that it is relatively cheap, 23.1% of the total respondents indicated that the reason for preferring herbal medicine is due to the fact that its readily available, 36.7% of the total respondents indicated the reason for their preference of herbal medicine as its effectiveness, while 1.4% of the total respondents indicated others. From the study, it can be deduced that major reasons for the respondents’ preference of herbal medicine are due to the fact that it is cheap and effective; however, the other factors also contribute to the choice of herbal medicine for treatment of malaria.
4.5.5 Relationship between factors that influence preference and the prevalence of use of herbal medicine

Table 4.18 Relationship between factors that lead to preference and the prevalence of use of herbal medicine

<table>
<thead>
<tr>
<th>Model</th>
<th>Change Statistics</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Value</td>
<td>df</td>
<td>Asymp. Sig. (2-sided)</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td>1.079a</td>
<td>1</td>
<td>.029</td>
</tr>
<tr>
<td>Marital Status</td>
<td></td>
<td>2.726a</td>
<td>2</td>
<td>.036</td>
</tr>
<tr>
<td>Occupation</td>
<td></td>
<td>.008a</td>
<td>1</td>
<td>.013</td>
</tr>
<tr>
<td>Dependants</td>
<td></td>
<td>1.605</td>
<td>1</td>
<td>.004</td>
</tr>
<tr>
<td>Religion</td>
<td></td>
<td>2.607a</td>
<td>4</td>
<td>.012</td>
</tr>
</tbody>
</table>

*. Significant level at 0.05 (2-tailed)

The computed P-value of 0.003 is less than $\alpha=0.05$, which means the difference is statistically significant, hence there is a significant relationship between the factors that influence preference and the prevalence of use of herbal medicine for the treatment of Malaria.
4.5.6 Provision of herbal medicine

Table 4.19 Response on who provides herbal medicine

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Herbalist</td>
<td>45.6</td>
</tr>
<tr>
<td>Self</td>
<td>35.9</td>
</tr>
<tr>
<td>Others</td>
<td>16.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Most (45.6%) of the respondents to get medicine from the herbalist; 35.9% pointed out that they look for herbs on their own; while 16.5% of the total respondents indicated they obtain medicine from other sources (Table. 4.19). From the study it can be inferred that the herbalists provides herbal medicine in most incidences but it is important to note that a growing number of those who use herbal medicine look for them themselves.

4.5.7 Form in which herbal medicine is sold

Table 4.20 Response on which form is herbal medicine sold

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infusion</td>
<td>8.6</td>
</tr>
<tr>
<td>Crude Liquid Extracts</td>
<td>24.4</td>
</tr>
<tr>
<td>Green Herbs</td>
<td>26.2</td>
</tr>
<tr>
<td>Powder</td>
<td>39.4</td>
</tr>
<tr>
<td>Other</td>
<td>1.4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
Majority (8.6%) of the respondents indicated that herbal medicine is sold in form of infusion; 24.4% of the total respondents pointed out that herbal medicine are sold in crude liquid extracts; 26.2% and 39.4% of the total respondents indicated that herbal medicine is sold as green herbs and powder respectively, while 1.4% indicated others. From the study it can be deduced that herbal medicine is sold mostly in powder form (Table 4.20).

4.5.8 Dosages of herbal medicine

Table 4.21 Response on measure used to administer herbal medicine

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>94.1</td>
</tr>
<tr>
<td>No</td>
<td>5.9</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

The study shows the views of the respondents on whether the traditional healer uses a measure when administering herbal medicine. Based on the study 94.1% of the total respondents indicated that the traditional healer uses a measure when administering herbal medicine, while 5.9% of the total respondents indicated that the traditional healer does not use a measure when administering herbal medicine. From Table 4.21 it can be deduced that the traditional healer uses a measure when administering herbal medicine.
4.5.9 Measures used

Table 4.22 Response on the measured the herbalist

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cow Horn</td>
<td>10.8</td>
</tr>
<tr>
<td>Spoon</td>
<td>24.8</td>
</tr>
<tr>
<td>Cup</td>
<td>30.7</td>
</tr>
<tr>
<td>Hand</td>
<td>20.8</td>
</tr>
<tr>
<td>Pinch</td>
<td>12.6</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

As reported in Table 4.22, 10.8% of the total respondents acknowledged that the herbalist uses cow horn; 24.8% of the total respondents indicated that the herbalist uses a spoon; 30.7% and 20.8% of the total respondents pointed out that the herbalist uses a cup and a hand respectively to measure doses of herbal medicine, while 12.6 % of the total respondents indicated that the herbalist uses a pinch. From the findings, it can be deduced that the herbalist in most cases use a cup to measure herbal medicine.
4.5.10 Distance from herbalist vs. health clinic

Table 4.23 Response on distance of user from the herbalist

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less Than 1 Kilometer</td>
<td>43.4</td>
</tr>
<tr>
<td>1 And 5 Kilometer</td>
<td>42.0</td>
</tr>
<tr>
<td>5 And 10 Kilometers</td>
<td>14.5</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 4.26 shows that, 43.4% of the total respondents indicated that the herbalist is approximately less than 1 kilometer from their households; 42.0% of the total respondents stated that the herbalist is approximately between 1 and 5 kilometer from their households; while 14.5% indicated that the herbalist is approximately between 5 and 10 kilometers from their households strongly. From the study it can be deduced that in majority of the cases the herbalist is approximately less than 1 kilometer from their households.
4.5.11 Meeting expenses of consulting herbalist

Table 4.24 Response on how they meet expenses of consulting a herbalist

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash Payment</td>
<td>21.7</td>
</tr>
<tr>
<td>Barter Trade</td>
<td>30.3</td>
</tr>
<tr>
<td>Debt</td>
<td>24.4</td>
</tr>
<tr>
<td>Other</td>
<td>23.6</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

Twenty one point seven (21.7 %) of the total respondents pointed out that they make cash payment in meeting the expenses of consulting the herbalist; 30.3% of the total respondents indicated that they carry out barter trade in meeting the expenses of consulting the herbalist; while 24.4% and 23.6% of the total respondents stated that the herbalist accepts debt which is settled on agreed time frame, and other arrangements respectively in meeting the expenses of consulting the herbalist. From the study it can be deduced that in most cases barter trade arrangement(commodities such as cereals and legumes, chickens and other farm products) is used in meeting the expenses of consulting the herbalist. However accepting debt and other forms of payment are also important.

Identification/ documentation of herbal plants used to treat malaria
4.5.12 Identification/documentation of herbal plants used to treat malaria

Table 4.25 Which plants are most popular to use

<table>
<thead>
<tr>
<th>Local Name</th>
<th>Scientific Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aketch</td>
<td><em>Tithonia diversifolia</em></td>
</tr>
<tr>
<td>Achak</td>
<td><em>Ozovoa insignis</em></td>
</tr>
<tr>
<td>Achak</td>
<td><em>Sapium ellipticum</em></td>
</tr>
<tr>
<td>Akado marachar</td>
<td><em>Boscia salicifolia</em></td>
</tr>
<tr>
<td>Akado marateng</td>
<td><em>Cadaba farinosia</em></td>
</tr>
<tr>
<td>Akado</td>
<td><em>Boscia salicifolia</em></td>
</tr>
<tr>
<td>Aremo</td>
<td><em>Harungana madascariensis</em></td>
</tr>
<tr>
<td>Abuno</td>
<td><em>Saba comorensis</em></td>
</tr>
<tr>
<td>Dwele</td>
<td><em>Melia azaderach</em></td>
</tr>
<tr>
<td>Mirembe</td>
<td><em>Erythrina abyssinica</em></td>
</tr>
<tr>
<td>Nyakisumu</td>
<td><em>Schuria Pinnata</em></td>
</tr>
<tr>
<td>Aber</td>
<td><em>Albizia coriaria</em></td>
</tr>
<tr>
<td>Ogombo</td>
<td><em>Mucuria gigentea</em></td>
</tr>
<tr>
<td>Okita</td>
<td><em>Plectranthus barbatus</em></td>
</tr>
<tr>
<td>Orembe</td>
<td><em>Albizia gummifora</em></td>
</tr>
<tr>
<td>Yath Winyo</td>
<td><em>Cucumi aculeatus</em></td>
</tr>
<tr>
<td>Olulusia</td>
<td><em>Vernonia amygdalina</em></td>
</tr>
<tr>
<td>Rabongo</td>
<td><em>Rhoicissus revoillii</em></td>
</tr>
<tr>
<td>Sangla</td>
<td><em>Rhus vulgaris</em></td>
</tr>
<tr>
<td>Sangla</td>
<td><em>Rhus natalensis</em></td>
</tr>
<tr>
<td>Owino winy</td>
<td><em>Senna didymobotrya</em></td>
</tr>
<tr>
<td>Ombili</td>
<td><em>Abrus precatorius</em></td>
</tr>
<tr>
<td>Ogaka</td>
<td><em>Aloe latevitia</em></td>
</tr>
<tr>
<td>Nyabende winy</td>
<td><em>Psiada Arabica</em></td>
</tr>
</tbody>
</table>
4.5.13 Most mentioned herbal medicine

Table 4.26. Frequently used herbal medicine for treatment of malaria

<table>
<thead>
<tr>
<th>Herb</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ogaka</td>
<td>61</td>
<td>27.6</td>
</tr>
<tr>
<td>Owino winy</td>
<td>43</td>
<td>19.4</td>
</tr>
<tr>
<td>Ogombo</td>
<td>29</td>
<td>13.1</td>
</tr>
<tr>
<td>Yath Winyo</td>
<td>25</td>
<td>11.3</td>
</tr>
<tr>
<td>Nyakismumu</td>
<td>23</td>
<td>10.4</td>
</tr>
<tr>
<td>Melia azaderach</td>
<td>40</td>
<td>18.0</td>
</tr>
<tr>
<td>Total</td>
<td>221</td>
<td>100.0</td>
</tr>
</tbody>
</table>

From Table 4.26, majority (27.6%) of the total respondents indicated that they frequently use Ogaka (*Aloe latevitia*), 19.4% indicated that they prefer using owino winy (*Cassia didymbotyra*); 13.1% of the total respondents indicated that they frequently use Ogombo (*Mucuria gigantea*); while, 11.3%, 10.4% and 18.0% indicated that they frequently use Yath Winyo (*Cucumi aculeatus*); Nyakismumu (*Schkuria pinnata*) and *Melia azaderach* respectively (Table 4.14).
Plate 4.0; Aloe species in a banana plantation

Plate 4.1 Albizia gummifora
4.5.14 Cross tabulation between the method of meeting the expenses of consulting herbalist and the prevalence of herbal medicine

Table 4.27 Chi-Square Test- Methods of meeting the expenses of Consulting Herbalist

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>df</th>
<th>Asymp. Sig. (2-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>5.067a</td>
<td>5</td>
<td>.035</td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>4.961</td>
<td>5</td>
<td>.049</td>
</tr>
<tr>
<td>N of Valid Cases</td>
<td>173</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The study examines the relationship between the method of meeting the expenses of consulting herbalist and frequency of herbal medicine use. The Pearson Chi-Square value is 5.067 with df = 5 and the P-value is 0.035. The P-value computed is less than $\alpha=0.05$, which means the difference is statistically significant. Hence there is a significant relationship between the method of meeting the expenses of consulting herbalist and the frequency of herbal medicine use for the treatment of malaria.
4.6 Effectiveness of herbal medicine in the treatment of Malaria

4.6.1 Effects of using herbal medicine

Table 4.28 Response on whether after using herbal medicine they are healed

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>95.1</td>
</tr>
<tr>
<td>No</td>
<td>4.9</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

According to Table 4.28, 95.1% of the total respondents agreed that after using herbal medicine they felt healed, while 4.9% of the total respondents indicated that after using herbal medicine they do not feel healed. From the study it can be inferred that majority of the respondents may feel fine after using herbal medicine.
4.6.2 Side effects of anti-malarial

Table 4.29 Response on whether there any side effects attributed to herbal anti-malarial

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>61.1</td>
</tr>
<tr>
<td>No</td>
<td>38.9</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

Sixty one percent (61.1%) of the total respondents reported acknowledgement that there are no side effects attributed to herbal anti-malarial medicine, while 38.9% indicated there are side effects attributed to herbal medicine. From the study it can be deduced that in majority of the cases there may be no side effects attributed to herbal anti-malarial medicine. Qualitatively most respondents indicated that the side effects resulting from use of traditional medicine are feeling like vomiting, drowsiness, itchy skin, profuse sweating, dizziness, fatigue, sour mouth, body weakness, severe stomachache, diarrhea, loss of appetite and looking gloomy.

4.6.3 Malaria control

A variety of herbal strategies are employed by respondents to stop mosquito bites. These included the burning of logs and plants such as *Albizia coriaria* with cow dung to generate smoke; filling up pits in the compound or removing materials likely to promote the breeding of mosquitoes; and closing windows and doors before nightfall.
Respondents also claimed that they destroy bushes from around the homestead and also use mosquito nets and mosquito repellants like such as mosquito coils.

4.7.1 Time of year when they take malaria control action

Table 4.30 Response on the time of year when they take malaria control action

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>January and April</td>
<td>39.8</td>
</tr>
<tr>
<td>May and August</td>
<td>42.5</td>
</tr>
<tr>
<td>September and December</td>
<td>17.7</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 4.30 indicate that 39.8% of the total respondents indicated that they take the action to control malaria between the months of January and April; 42.5% of the total respondents pointed out that they take action to control malaria between the months of May and August; while 17.7% of the total respondents indicated that they take action to control malaria between the months of September and December. From the study it can be deduced that for many respondents they take the action to control malaria between the months of May and August.
4.2.8 Malaria Prevention

Table 4.31 Response on whether malaria can be prevented

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>91.9</td>
</tr>
<tr>
<td>No</td>
<td>8.1</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

Ninety point five (91.9%) of the total respondents strongly agreed that malaria can be prevented; while 8.1% of the total respondents indicated that malaria can not be prevented. From the study it can be inferred that malaria can be prevented.

4.7.2 Use of repellants, mosquito nets and insecticides

Table 4.32 Response on whether they use repellants, mosquito nets and insecticides

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>85.0</td>
</tr>
<tr>
<td>No</td>
<td>15.0</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>
Table 4.33 shows that 85% of the total respondents agreed that they use repellants, mosquito nets and insecticides; while 15%, of the total respondents indicated that they do not use repellants, mosquito nets or insecticides. From the study findings, it can be deduced that repellants, mosquito nets and insecticides are mostly used in control of malaria.

4.7.3 Form of plant repellants

Table 4.34 Response on which form the plant repellants are used

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green Form</td>
<td>46.2</td>
</tr>
<tr>
<td>Dried Plant</td>
<td>24.0</td>
</tr>
<tr>
<td>Smoked Plant</td>
<td>19.5</td>
</tr>
<tr>
<td>Liquid Extracts</td>
<td>10.4</td>
</tr>
<tr>
<td>Total</td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Table 4.34, indicate that 46.2% of the total respondents indicated that they use green form of plant as repellants (planted next to windows or stalks of plants placed at vent areas); 24.0% of the total respondents pointed out that they use dried plant (leaves of *Artemisia annua* dried and placed at vent areas), while 19.5% and 10.4% indicated that they use smoked plant (placed on jikos or fire places and left to smolder overnight),
liquid extracts and plant repellants respectively. From the study it can be deduced that most of the respondents use green form of plant repellants.

Plate 4.3 Burning plant leaves to produce smoke as a mosquito repellant

4.7.4 Placement of plant repellants

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ventilated Areas</td>
<td>37.6</td>
</tr>
<tr>
<td>Inside The House</td>
<td>52.1</td>
</tr>
<tr>
<td>Outside The House</td>
<td>10.4</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>
Table 4.3 shows the views of the respondents on where they place plant repellents to prevent mosquito entry. Based on the findings, 37.6% of the total respondents indicated that they place plant repellents in ventilated areas and any crevices in a house to prevent mosquito entry, 52.1% of the total respondents pointed out that they place plant repellents inside the house to prevent mosquito entry, while 10.4% of the total respondents indicated that they place or plant repellents outside the house (planted repellants or cut plants forming a fence less than a meter from the house) to prevent mosquito entry. From the study it can be deduced that most of the respondents place plant repellents inside the house to prevent mosquito entry.

4.7.5 Effect of plant repellants

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>82.8</td>
</tr>
<tr>
<td>No</td>
<td>17.2</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 4.35 below shows the views of the respondents on whether plant repellents prevent mosquito nuisance. Results indicate that majority (82.8%) of the total respondents agreed that plant repellents prevent mosquito nuisance, while 17.2% of the total respondents indicated that plant repellents do not prevent mosquito nuisance.
4.7.6 Conservation status of medicinal plants

Table 4.37 Response on whether traditional medicine is endangered

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>63.4</td>
</tr>
<tr>
<td>No</td>
<td>36.6</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

Based on the findings, 63.4% of the total respondents indicated that medicinal plants are endangered, while 36.6% of the total respondents indicated that medicinal plants are not endangered (Table 4.36).

4.7.7 Use of herbs in Boro division

Table 4.37 Response on whether communities in Boro use herbs

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>90.5</td>
</tr>
<tr>
<td>No</td>
<td>9.5</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 4.37 shows the views of the respondents on whether communities living in Boro division use herbs. Based on the findings, 90.5% of the total respondents indicated that communities living in Boro division use herbs, while 9.5% of the total respondents indicated that communities living in Boro division do not use herbs.
4.8 Relationship Analysis

4.8.1 Relationship between Socio-economic factors and the use of herbal medicine

Table 4.38 Correlations between socio-economic factors and the use of Herbs

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>$R^2$</th>
<th>df1</th>
<th>df2</th>
<th>sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.542</td>
<td>.294</td>
<td>9</td>
<td>13</td>
<td>.034</td>
</tr>
</tbody>
</table>

b. Dependent Variable: use of herbs for treatment of malaria

The study findings indicated that there was a positive relationship between socio-economic factors and the use of herbal medicine evidenced by a positive coefficient correlation (r) of .542 and coefficient determination of ($r^2$) of .294.

4.8.2 Chi-square test on whether Religion influence the use of herbs for treatment of malaria

Table 4.39 Chi-Square Test-Religion

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>df</th>
<th>Asymp. Sig. (2-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>2.607</td>
<td>4</td>
<td>.012</td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>3.117</td>
<td>4</td>
<td>.538</td>
</tr>
<tr>
<td>N of Valid Cases</td>
<td>221</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Study results indicated that there is a positive relationship between the household’s number of children and the use of herbal medicine for the treatment of malaria (Chi-Square = 2.607, P-value =0.012)

4.8.3 Chi-square test on whether marriage categories’ influence the use of herbs for treatment of malaria

Table 4.40 Chi-Square Test-Marriage Category

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>df</th>
<th>Asymp. Sig. (2-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>2.726*</td>
<td>2</td>
<td>.036</td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>1.036</td>
<td>2</td>
<td>.596</td>
</tr>
<tr>
<td>N of Valid Cases</td>
<td>207</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The study findings showed that was a positive significant relationship between the existing marriage categories and the use of herbal medicine for the treatment of malaria (Chi-Square = 2.726; p-value =0.036).

4.8.4 Chi-square test on whether the number of children influences the use of herbs for treatment of malaria

Table 4.41 Chi-Square Tests-Number of Children

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>df</th>
<th>Asymp. Sig. (2-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>7.062*</td>
<td>3</td>
<td>.031</td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>6.968</td>
<td>3</td>
<td>.032</td>
</tr>
<tr>
<td>N of Valid Cases</td>
<td>197</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Results of the study indicated that there was a positive significant relationship between the number of children and the use of herbs for treatment of malaria. (Chi-Square = 7.062; P-value = 0.031).

4.8.5 Chi-square test on whether the Education Level influences the use of herbs for treatment of malaria.

Table 4.42 Chi-Square Test-Education Level

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>df</th>
<th>Asymp. Sig. (2-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>5.668a</td>
<td>2</td>
<td>.043</td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>4.527</td>
<td>2</td>
<td>.039</td>
</tr>
<tr>
<td>N of Valid Cases</td>
<td>212</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The study findings indicated there was a positive relationship between the education level and the use of herbal medicine for the treatment of malaria (Chi-Square = 5.668; P-value = 0.043).

4.8.6 Chi-square test on whether monthly income influences the use of herbs for treatment of malaria

Table 4.43 Chi-Square Test-monthly income

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>df</th>
<th>Asymp. Sig. (2-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>9.911a</td>
<td>3</td>
<td>.048</td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>11.129</td>
<td>3</td>
<td>.034</td>
</tr>
<tr>
<td>N of Valid Cases</td>
<td>212</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The study results indicated that there was a positive relationship between the monthly income and the use of herbal medicine for the treatment of malaria. (Chi-Square = 9.9911; P-value = 0.048).

4.8.7 Chi-square test on whether the number of dependants influences the use of herbs for treatment of malaria

Table 4.44 Chi-Square Tests- Dependents

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>df</th>
<th>Asymp. Sig. (2-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>11.108a</td>
<td>4</td>
<td>.035</td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>11.620</td>
<td>4</td>
<td>.021</td>
</tr>
<tr>
<td>N of Valid Cases</td>
<td>218</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The study findings indicated that there was a positive relationship between the number of dependants and the use of herbal medicine for the treatment of malaria (Chi-Square = 11.108; P-value = 0.035).

4.9 Hypotheses Testing

4.9.1 Community knowledge on malaria treatment and control in Boro Division

Table 4.45 Chi-Square Tests- Communities Use Herbal Medicine

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>df</th>
<th>Asymp. Sig. (2-sided)</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>13.347a</td>
<td>5</td>
<td>.03</td>
<td>.023b</td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>9.320</td>
<td>5</td>
<td>.01</td>
<td>.002b</td>
</tr>
<tr>
<td>N of Valid Cases</td>
<td>218</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Results of the study indicate that there is positive statistically significant relationship between communities living in Boro Siaya division and the use herbs for malaria treatment. (Chi-Square =13.347; p-value = 0.023). Hence we reject the null hypothesis of the community knowledge on malaria treatment and control is low in Boro Division and accepts the alternate hypothesis that the community knowledge on malaria treatment and control is high in Boro Division.

### 4.9.2 Malaria prevalence rate in Boro Division

<table>
<thead>
<tr>
<th>Table 4.4 Chi-Square Tests- Communities Use Herbal Medicine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
</tr>
<tr>
<td>Pearson Chi-Square</td>
</tr>
<tr>
<td>Likelihood Ratio</td>
</tr>
<tr>
<td>N of Valid Cases</td>
</tr>
</tbody>
</table>

Results of the study indicate that there is positive statistically significant relationship between communities living in Boro Siaya division and the use herbs for malaria treatment. (Chi-Square =9.016; p-value = .008). Hence we reject the null hypothesis of
malaria prevalence rate in Boro Division is low and accept the alternate hypothesis that malaria prevalence rate in Boro Division is high

### 4.9.3 The level of herbal usage in Boro Division


<table>
<thead>
<tr>
<th>Table 4.47 Chi-Square Tests- Communities Use Herbal Medicine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communities Use Herbal Medicine</td>
</tr>
<tr>
<td>Value</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>Pearson Chi-Square</td>
</tr>
<tr>
<td>Likelihood Ratio</td>
</tr>
<tr>
<td>N of Valid Cases</td>
</tr>
</tbody>
</table>

Results of the study indicate that there is positive statistically significant relationship between communities living in Boro Siaya division and the use herbs for malaria treatment.(Chi-Square =19.739;p-value = 0.04). Hence we reject the null hypothesis of Communities living in Boro Siaya division do not use herbs for malaria treatment and accept the alternate hypothesis that communities living in Boro Siaya division use herbs for malaria treatment.
4.9.4 Influence of Socio-economical

Table 4.48 Correlations between socio-economic factors and the use of Herbs

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R²</th>
<th>df1</th>
<th>df2</th>
<th>sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.542</td>
<td>.294</td>
<td>9</td>
<td>13</td>
<td>.034</td>
</tr>
</tbody>
</table>

b. Dependent Variable: use of herbs for treatment of malaria

Table 4.49 Regression between socio-economic factors and the use of Herbs

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>T</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Constant)</td>
<td>1.105</td>
<td>.280</td>
<td>3.946</td>
</tr>
<tr>
<td>Occupation</td>
<td>.109</td>
<td>.046</td>
<td>.020</td>
<td>.2.369</td>
</tr>
<tr>
<td>No of children</td>
<td>.141</td>
<td>.063</td>
<td>.018</td>
<td>2.238</td>
</tr>
<tr>
<td>Level of education</td>
<td>.199</td>
<td>.080</td>
<td>.126</td>
<td>2.488</td>
</tr>
<tr>
<td>monthly income</td>
<td>.111</td>
<td>.054</td>
<td>.022</td>
<td>2.056</td>
</tr>
<tr>
<td>Financial dependants</td>
<td>.152</td>
<td>.064</td>
<td>.107</td>
<td>2.375</td>
</tr>
<tr>
<td>Religion</td>
<td>.105</td>
<td>.046</td>
<td>.009</td>
<td>2.283</td>
</tr>
<tr>
<td>Marital Status</td>
<td>.128</td>
<td>.063</td>
<td>.016</td>
<td>2.031</td>
</tr>
<tr>
<td>Marital Category</td>
<td>.113</td>
<td>.052</td>
<td>.006</td>
<td>2.173</td>
</tr>
<tr>
<td>Gender</td>
<td>.120</td>
<td>.049</td>
<td>.018</td>
<td>2.449</td>
</tr>
</tbody>
</table>

a. Dependent Variable: Use of herbs for treatment of Malaria
Results of the study shows: correlation coefficient (r) of .542 and the coefficient of determination ($r^2$) of .294 indicating a strong relationship between socio-economic factors and use of herbs. Since the correlation of .542 is positive it can be concluded that the correlation is statistically significant, hence there is a positive relationship between socio-economic factors and use of herbs for treatment of malaria.

The results indicate that the computed t-values and p-values of occupation ($t=2.369; p=.042$); No of children ($t=2.238; p=.009$); level of education ($t=2.488; p=.016$); monthly income ($t=2.056; p=.037$); financial dependants ($t=2.375; p=.002$); religion ($t=2.283; p=.019$); marital status ($t=2.031; p=.006$); marital category ($t=2.173; p=.004$) and gender ($t=2.449; p=.034$) are smaller than the critical t-value and level of significance of ($t=2.571; p=.05$). This shows that there is a significant relationship between socio-economic factors and use of herbs for treatment of malaria.

4.9.5 Effectiveness of herbal medicine in the treatment of malaria in Boro Division

Table 4.50 Chi-Square Tests- Communities Use of Herbal Medicine

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>df</th>
<th>Asymp. Sig. (2-sided)</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>11.873a</td>
<td>6</td>
<td>.003</td>
<td>.010b</td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>8.320</td>
<td>6</td>
<td>.009</td>
<td>.004b</td>
</tr>
<tr>
<td>N of Valid Cases</td>
<td>218</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Results of the study indicate that there is positive statistically significant relationship between communities living in Boro Siaya division and the use herbs for malaria treatment. (Chi-Square =11.873; p-value = 0.010). Hence we reject the null hypothesis that use of herbal medicine in the treatment of malaria in Boro Division is not effective and accept the alternate hypothesis that use of herbal medicine in the treatment of malaria in Boro Division is effective.

### 4.9.6 Use of herbal plants to control malaria in Boro Division

#### Table 4.5 Chi-Square Tests- Communities Use Herbal Medicine

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>df</th>
<th>Asymp. Sig. (2-sided)</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>17.115</td>
<td>3</td>
<td>.004</td>
<td>.002</td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>9.039</td>
<td>3</td>
<td>.001</td>
<td>.004</td>
</tr>
<tr>
<td>N of Valid Cases</td>
<td>218</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Results of the study indicate that there is positive statistically significant relationship between communities living in Boro Siaya division and the use herbs for malaria treatment. (Chi-Square =19.739; p-value = 0.002). Hence we reject the null hypothesis that the community does not use herbal medicine to control malaria and accept the alternate hypothesis that community use herbal medicine to control malaria.
CHAPTER FIVE: DISCUSSION

5.1 Introduction

The purpose of this chapter was to discuss the findings of the main objective of the study which was to identify plants that are used as herbs for treatment of malaria and the factors influencing their use in Boro Division, Siaya County; and answers to research questionnaires pertaining to whether people living in Boro Division, Siaya District use herbs to treat malaria and the socio economic factors compelling people living in Boro Division, Siaya County to use herbs for treatment of malaria.

5.2 Knowledge of Malaria

It was also established that the community demonstrated a better understanding of malaria causes, symptoms, treatment and, preventive measures and indicated that herbs are used to treat malaria. These findings are in line with those of Clarke and Svenningsen, (2003) and De Savigny et al (2004) which reported similar results from different parts of the world. The results further confirm the findings by UNEP (1995) which established that many African communities use plants for management of most diseases. The study established that plants are used as traditional medicine, which is in line with the views of Ogol et al, (2002) who indicated that most communities use herbs as medicine.

5.3 Malaria prevalence

The study established that malaria prevalence in the area is high as most family members had suffered from malaria in the last less than one month; family members had been
admitted to hospital due to malaria and that some community members had died of malaria. This support the government of Kenya (2011) findings that each year, an estimated 6000 pregnant women suffer from malaria-associated anemia and 34000 children below the age of five years die from malaria and that poor populations particularly in rural setups bear the brunt of this disease burden.

5.4 Health seeking behaviors

The study findings established that the use of herbal medicine for treatment of malaria is very prevalent and that they go to the herbalist for treatment, the other major reasons for the respondents’ preference of herbal medicine are due to the fact that they are cheap and effective; increased accessibility/availability, low cost of traditional medicine, negotiable prices and payment modes. These findings are consistent with the findings of a number of authors for instance: Adera, (2003) who indicated that greater accessibility of traditional medicine was the most important reason for use of herbs in Ethiopia; while Baume et al.(2000), Miguel et al. (1999) Okrah et al. (2002) and Utarini et al. (2003) indicated that in many areas, distance to the health center is the limiting factor and finally Bugmann (2000) and Traore et al. (1993) noted that transport costs are usually cheaper when consulting a healer, as there is less distance to travel and that healers can often be paid in kind rather than in currency according to the patient’s means rather than a fixed charge. in Uganda, perceived absence of drugs at health centers is an important reason why patients do not attend the clinics for treatment against malaria as established by Ndyomugyeniyi et al.(1998) and Helitzer-Allen et al,(1993) in Malawi
The other major factor for communities’ use of herbal medicine was found to be lack of money or poverty. This was a vindication of the findings of Richardson (1990) and Foster (1995) who noted that even drugs provided at very low cost can be unaffordable to the very poor in rural Malawi and in Madagascar, some health professionals refuse to see patients in their private clinics unless they can pay; while government hospitals may be too far therefore, many poor patients have given up going to modern health facilities.

The results of the study established that the herbalist provides herbal medicine while other users of herbal medicine looked for herbs on their own hence do not consult herbalist for the treatment of malaria because they know how to prepare the necessary herbal medicines themselves. The findings concur with the views of Geissler et al. (1995) and Leon (2002) that in many societies, knowledge of herbal remedies is not confined to traditional healers.

5.5 Identification/documentation of herbal plants used to treat malaria

The study found out that most of the respondents frequently use ogaka (*aloe latevitia*). This complements the research done by Ogol *et al.* (2002) that established that over 88 compounds that are active on malaria parasites have been isolated from plants. Plants are used as traditional medicine, food, shelter, dyes, oils, intoxicants, fuel, beverages, tools, for rituals, religious, ceremonial purposes and even as a source of cash income.
5.6 Socio economic factors that compel people living in Boro Division, Siaya District to use herbs for treatment of malaria

The study established that the community’s social situation influenced their use of herbal and this was in concurrence with the views expressed by Bartolome and Vosti, (1995) and De Francisco et al. (1994) that a similar proportion of patients consulted traditional healers regardless of whether primary health facilities were available. The authors speculated that this may be due to the prevalence of traditional concepts of health and disease, as well as the direct accountability of traditional healers to their communities. This is further confirmed by a study done by Abyan and Osman (1993) who found that cost was the reason for only 50%, whereas lack of faith in doctors was the reason in the other 50%. While Randrianarivelojosia et al. (2003) acknowledged that the use of plants for medicinal care reflects the attachment of a people to their culture.

The research study established that religion, marital category, educational level, number of children and number of financial dependants affect the use of herbal medicine in the treatment of malaria. Based on the correlation analysis of the relationship between socio-economic factors and the prevalence of use of herbal medicine, it was established that 34% of the prevalence of use of herbal medicine can be predicted by socio-economic factors. Hence we reject the null hypothesis that socio-economical factors do not influence the use of herbs for treatment of malaria in the study area and a conclusion is made that socio-economical factors influence the use of herbs for treatment of malaria in the study area.
The findings of this study are consistent with those of Kelley et al. (2001) who found that those in the poorest economic quintile were significantly more likely to seek care from traditional providers than other quintiles and to use hospitals less frequently than other quintiles. In contrast Mugisha et al. (2002) found that people in urban areas and those with high incomes were more likely to seek care (for any illness) from health facilities (compared a traditional healer). While Fawole and Onadeko (2001) found that educated mothers were more likely to choose a formal health facility as their first port of call, but only slightly less likely to consult a traditional healer first. Elzubier et al. (1997) found that education was positively associated with knowledge of herbal medicines for malaria.

The study established that educational level was correlated to use of herbal medicine, this was in line with the findings of Alilio et al. (1998) who concurred but acknowledged that the differences are not very great, and a substantial proportion of educated people still choose to use traditional medicines for malaria. For example, in a survey in Zanzibar, 52% of people with no formal education used herbal remedies for malaria, compared to 42% of those with at least primary education. Even those who were educated consulted their grandparents, which may have led to high levels of use of traditional medicines. While, Fawole and Onadeko (2001) found that educated mothers were more likely to choose a formal health facility as their first port of call, but only slightly less likely to consult a traditional healer first. It further confirms the survey found by Elzubier et al. (1997) which established that education was positively associated with knowledge of
herbal medicines for malaria: in an urban secondary school in Sudan, 42% of teachers, compared to 20% of students, believed that malaria could be treated with herbal medicine.

The results of the study established that the use of herbal medicine by communities may be attributed to the high cost of conventional medicine care. This is in line with the findings of WHO (2000) which was derived from community survey done in Boa, Zaire, which indicated 56% of households reported that the price of treatment was the greatest obstacle to them concerning medical care. Relevance of herbal drugs to provision of health care was investigated in a study carried out in Ghana using the criteria of availability, accessibility, utilization and patient satisfaction. Availability of herbal drugs in the city was found to be low due to depletion of original vegetation and scarcity of commercial outlets and herbalists. Drugs were found to be quite accessible both financially and geographically.

The study also established that communities living in urban and rural centres use herbal medicine. This was in line with the findings of Amanda and Wondergem (1990) who established that the acceptability of herbal drugs was found to be related to popular concepts of health, disease and healing for utilization while vast differences were observed between rural and urban areas. In both rural and urban locations, it was noted that about half of all self-care treatments involve herbal medicine. Satisfaction was higher in patients treated by herbalists Likewise, another survey carried out in Nigeria among 500 residents to determine their use of medicinal plants in treatment of malaria as
home remedy showed a significant segment (40.3%) of the population use medicinal plants.

5.7 Effectiveness of herbal medicine in the treatment of Malaria

The study also established that after using herbal medicine the respondents feel well implying that the medicine may be effective. This finding is consistent with the results established by Nuwaha (2002) who indicated that in the Mbarara region of Uganda, people continue to treat themselves with traditional medicine despite the availability of cheap modern anti-malarials. Traditional medicines are perceived to be effective for malaria (Bugmann, 2000). Different tribes in the same country may have different traditional medicinal systems, with different perceived efficacy for the treatment of malaria (Matthies, 1998). The results of the study further confirm the study by Nyamongo (2002) which indicated that the perceived efficacy of herbal medicines is spurious and related to concomitant treatment with over-the-counter pharmaceuticals.

5.7 Malaria control

The study found out that a variety of herbal strategies are employed by respondents to stop mosquito bites. These included the burning of logs and plants such as *albizia coriaria* or cow dung to generate smoke; filling up pits in the compound or removing materials likely to promote the breeding of mosquitoes; and closing windows and doors before nightfall. The study also established that respondents take the action to control malaria between the months of January and April and that they use green form of plant as repellants, place plant repellents inside the house to prevent mosquito entry and that plant
repellents are effective in preventing mosquito nuisance. This is in line with the views expressed by Warrel (1997) that plant repellents have long been used as protection against biting insects primarily to reduce nuisance biting among different cultures and communities in Africa and beyond.
CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

a) There is continuous usage of herbs implying that the community has good knowledge about malaria and can readily distinguish it from other fever types on the basis of signs and symptoms. These include raised body temperature (hot skin), feeling chill, joint pains, weakness, headache, lethargy, sneezing, loss of appetite, coughing, flu like symptoms and vomiting, general weaknesses and convulsions were the other problems associated with malaria in children. The community also knows that malaria is caused by mosquitoes, and that mosquitoes favor bush and stagnant water.

b) Malaria prevalence is common in the area as most family members have suffered from malaria, others have been admitted to hospital due to malaria, and even members of some households have died of malaria.

c) The health seeking behavior of the local community is characterized by going to the herbalist for treatment and getting medicine from the herbalist. Herbal medicine is sold as green herbs, liquid extracts and powder form respectively, traditional healer uses a measure when administering herbal medicine.

d) Preference of herbal medicine is based on socio-economic factors such as religion, marital category, and educational level, number of children, monthly income and number of financial dependants. Other factors contributing to preference include
increased accessibility/availability, low cost of traditional medicine, negotiable prices and payment format.

e) There is need to encourage the use of Aketch (*Tithonia Diversifolia*), Achak (*Ozovoa insignis*), Achak (*Sapium ellipticum*), Akado marachar (*Boschia salicifolia*) Akado marateng (*Cadaba farinosia*), Akado (*Boschia salicifolia*) Akado (*Euclia dirinorum*), Aremo (*Harungana madascariensis*), Abuno (*Saba comorensis*), Dwele (*Melia azedarach*), Mireme (*Erythrina abyssinica*), Aber (*Albizia coriaria*), Ogombo (*Mondia whytei*), Okita (*Plectranthus barbatus*), Olulusia (*Vernonia amygdalina*), Rabongo (*Rhoicissus revoilii*), Sangla (*Clerodendrum myricoides*), Sangla (*Rhus natalensis*), Owino winy (*Senna didymobotrya*), Ombili (*Abrus precatorius*), Owino (*Cassia didymobotrya*), Siala and (*Markhamia platica*). However the most frequently used herb for treatment is Ogaka (*aloe latevitia*).

f) The local community prevent/control malaria by reducing mosquitoes through burning of logs and plants such as *albizia coriaria* and use of green form of plant as repellants which are placed inside the house to prevent mosquito entry and nuisance.

### 6.2 Recommendations

a) There is need to increase awareness about malaria and the choices of medicine. Special attention should be given to illiterate community members. There is also need for health professionals to improve availability of information on herbal medicine for malaria treatment through rural dispensaries and primary healthcare centers.
b) Encourage use of herbal medicine through proper research on already known plants, improve on modes of delivery and promote their uses.

c) There is continuous use of herbs in the treatment malaria by local people. The trend can be encouraged in other communities through identification and further improvement on the mode of delivery.

6.3 Suggestion for further research

The limited attention of this study has been focused on these aspects hence further studies on effect of socio-economic impact of the community on the uptake of herbal medicine in the treatment and control of malaria, likewise there is need for socio economic impact studies of the use of herbal medicine for treatment of malaria on the community.

History of prolonged safe and apparently successful use of traditional herbal medicines provides the initial critical information to the health practitioners and policy makers to subject the identified herbal medicine to phyto chemical analysis and clinical trials to confirm further their efficacy and safety, and also to determine recommended doses thus laying the ground work for wider acceptance.
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APPENDICES

APPENDIX I

CROSS SECTIONAL SURVEY QUESTIONNAIRE

(i) General Instructions for the Interviewer

The interviewer will carefully read each of the following questions and fill in the appropriate response. He/she should note that:

- Interview is carried out only on selected households.
- All answers are ticked or written in the provided spaces.
- Answers are filled in using a pencil.

(ii) Introduction

My name is Christine Olala and I am carrying out a health research in this community. I would like to find out about the herbal medicines that are used to treat malaria within this setting. I am glad that you have taken this moment to talk with me. May I ask you a few questions about malaria.

Name of the interviewer: ___________________________________________

Community Name: __________________________________________________

Location/Sublocation:________________________________________________

Household Number: __________________________________________________

Date of Interview: ___________________________________________________

Code Number: ______________________________________________________
A. Socio-Economic and Demographic Data

1. Sex:
   Male ( )
   Female ( )

2. What is your name? ________________________________

3. How old are you? ________________________________

4. What is your religion? ________________________________
   Christian ( )
   Muslim ( )
   Non-traditional ( )

5. What is your mother tongue? ________________________________

6. (a) What is your marital status?
   Single ( )
   Married ( )
   Divorced ( )
   Separated ( )
   Widowed ( )

   (b) (For those who are married) what marriage category are you in?
   Monogamous ( )
   Polygamous ( )

7. (a) What is your occupation? ________________________________

   (b) What is the occupation of your spouse? ________________________________

      (Do not ask the question if he/she is single)
8. Do you have children?
   Yes (  )
   No (  )
   If yes, how many children do you have? ___________________________

9. (a) Are you educated?
   Yes (  )
   No (  )

   (b) If yes, what level of education have you achieved?
       Adult Education (  )
       Primary Education (  )
       Secondary Education (  )
       Tertiary Education (  )

10. (a) Do you have a source of income?
    Yes (  )
    No (  )

    (b) If you do then, what is your approximate monthly income in Kshs.
        0-2000 (  )
        2001-4000 (  )
        4001-6000 (  )
        6001-8000 (  )
        8001-10000 (  )
        Over 10000 (  )
(c) Over what period do you earn that amount____________________

(d) Calculate the total amount of money per year over a period of 12 months.

Source | Amount Earned | Period of Time the Amount is Earned | Total Amount Earned in One Year

<table>
<thead>
<tr>
<th>Source</th>
<th>Amount Earned</th>
<th>Period of Time the Amount is Earned</th>
<th>Total Amount Earned in One Year</th>
</tr>
</thead>
</table>

Total Earnings Per Year from all Sources of Income (Kshs)

11. How many people financially depend on you including yourself?

____________________________________________________________________________________

B. Community Knowledge of Malaria (Level of awareness)

I am going to ask you some questions about malaria.

12. Do you know of a disease called malaria?

   Yes ( )

   No ( )

13. How do you call malaria in the local language?

   ________________________________________________________________

14. What causes malaria?

   Exposure to cold ( )
15. What signs make you realize that one has malaria? (One mentioning fever plus two signs: headache, vomiting, joint pains or general malaise).

- Fever plus another sign (High knowledge) ( )
- Fever alone, (Fair knowledge) ( )
- Any one sign (Low knowledge) ( )
- No sign (No knowledge) ( )

C. Malaria Prevalence

16. Have you or any member of your household had an attack of malaria in the last one year?

- Yes ( )
- No ( )

17. Who is at risk for malaria?

- Children under 5 years ( )
- Children from 6-15 years ( )
- Adults ( )
Pregnant mothers

18. Have any of the following ever happened in your household?

(a) Someone admitted to hospital due to malaria?
   Yes ( )
   No ( )
   Don’t know ( )

(b) Someone born alive and died due to malaria?
   Yes ( )
   No ( )
   Don’t know ( )

19. When did you or any member of your household suffer from Malaria last?
   Less than one month ( )
   More than one month ( )
   More than six months ( )
   Can’t remember ( )

20 Is malaria a health problem in this community?
   Yes ( )
   No ( )

   (i) If yes, what problems do you as an adult got from malaria?
   ______________________________________________________________
   ______________________________________________________________
   ______________________________________________________________
(ii) What problems do children get from malaria?

D. Health Seeking Behaviour (Level of Usage)

21. Where do you go for treatment in case you or any member of your household becomes sick with malaria?
   
   Traditional Healer
   Health Facility
   Local Shop
   Pharmacy

22. In your own opinion which is your choice of preference to treat malaria?
   Herbal Medicine
   Conventional Medicine
   Both
   Other

23. If herbal, what makes you prefer traditional medicine?
Is it cheap ( )
Readily Available ( )
More Effective ( )
Other ( )
Specify________________________________________

24. Who provides you with herbal medicine?
Herbalist ( )
Mganga ( )
Self ( )
Other ( )

25. In which form is herbal medicine administered to you?
Infusion ( )
Crude liquid extracts ( )
Green herbs ( )
Powder form ( )
Other ( )
(Specify) ________________________________

26. (a) Does the traditional healer use a measure when administering herbal medicine?

(b) If yes, what measure does he/she use?
Cow horn ( )
Spoon ( )
Cup ( )
Handful ( )
Pinch ( )

27. How far is the herbalist from the household?

Less than 1 km ( )
1-5 km ( )
5-10 kms ( )

28. How do you meet the expenses of consulting an herbalist?

Cash payment ( )
Barter trade ( )
Can accept debt ( )
Other ( )
Specify: ________________________________

E. Plants that are used for treatment

29. Please name some of the herbal medicines used in this community to treat malaria?

__________________________________  __________________
__________________________________  __________________
__________________________________  __________________
__________________________________  __________________
__________________________________  __________________
F. Effectiveness of the herbal medicine

30. Which of the herbs indicate above (29) is the most effective in treating malaria?

______________________________________________________

______________________________________________________

______________________________________________________

30. After using herbal medicine do you feel fine?

Yes  (  )

No   (  )

31. Are there any side effects attributed to herbal anti-malarial that you have used?

Yes  (  )

No   (  )

32. If yes, can you please tell me some of the side effects you have felt?

______________________________________________________

______________________________________________________

______________________________________________________

______________________________________________________

______________________________________________________

G. Use of herbal medicine in the control of malaria

33. (Ask those who mention at least one problem in question (i) and (ii) above).
What action do you take to solve mosquito problems you have mentioned above?
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

34. What time of year do you take this action (write either in months or by events mentioned by respondent).

January ( )
February ( )
March ( )
April ( )
May ( )
June ( )
July ( )
August ( )
September ( )
October ( )
November ( )
December ( )

Period by Events:
(i) Can malaria be prevented?
Yes ( )
No ( )

(ii) If yes, do you use the following to prevent mosquitoes?

Repellent plants:
Yes ( )
No ( )

Mosquito Net:
Yes ( )
No ( )

Insecticides:
Yes ( )
No ( )

36. In which form is the plant repellants used?

Green plant form ( )
Dried plant form ( )
Smoked plant form ( )
Liquid extract from plant ( )
Other ( )
Specify: _____________________________________

37. Where do you place plant repellents to prevent mosquito entry into the house?
Ventilation area ( )
Inside the house ( )
Outside the house ( )

38. Do plant repellents prevent mosquito nuisance?
Yes ( )
No ( )

39. Can you please mention some of the plant repellents found in this community?
__________________________________
__________________________________
__________________________________
__________________________________
__________________________________

40. What other methods do you use to prevent malaria?
____________________________________________________________
____________________________________________________________
____________________________________________________________
____________________________________________________________
____________________________________________________________

41. In your own view, do you think traditional medicine is endangered?
42. If yes, why do you think that traditional medicine is endangered in your own opinion?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

THANK YOU