# EXPLORATION OF MEDICINAL PLANTS USED BY TRADITIONAL MEDICINE PRACTITIONERS IN THE MANAGEMENT OF ALCOHOL-RELATED DISORDERS IN SOUTHWESTERN UGANDA

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## Declaration of authorship

The work presented in this thesis is the result of my original research work. Where I have used the works of other people, due acknowledgments are clearly stated. No portion of this work has been submitted in support of an application for a degree or qualification to any other university or institute of higher learning. I present it without any reservations for examination.

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## Approval

The research work culminating in this thesis was conducted under my guidance and supervision.

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## List of abbreviations

AUD: Alcohol Use Disorder

FRC: Faculty Research Committee

MRRH: Mbarara Regional Referral Hospital

MUST-REC: Mbarara University of Science and Technology Research Ethics Committee

SD: *Sprague-Dawley* rats

TMP: Traditional Medicine Practitioner

v/v: Volume per Volume

## Operational definitions

**Alcoholic beverage:** Any drink containing ethanol, including beer, wine, spirits, and locally brewed beverages, consumed for recreational, social, or cultural purposes.

**Alcohol-Related Disorders:** A pattern of alcohol consumption that is uncontrollable and has led to physical, social, and psychological complications.

**Alcohol-related harm:** Any negative outcome directly or indirectly resulting from alcohol use, including accidents, injuries, violence, poverty, and chronic health conditions.

**Alcohol Use Disorder:** A clinical condition characterized by impaired control over drinking, social or occupational impairment, and physiological symptoms such as tolerance or withdrawal, as defined by DSM-5 TR.

**Alcohol use:** is the consumption of any alcoholic beverage, regardless of frequency, quantity, or pattern**Ethanol:** is the primary psychoactive substance in alcoholic drinks, responsible for intoxication, acts as a central nervous system depressant, and is typically quantified in grams or standard drinks.

**Ethnopharmacology:** The study of the actions and properties of medicinal agents often derived from plants, indigenous to populations or ethnic groups (U.S. National Library of Medicine)

**Harmful alcohol use:** A pattern of drinking that results in physical, psychological, or social harm to the individual or others, as defined by the World Health Organisation in ICD 11.

**Herbs:** Include crude plant material such as leaves, flowers, fruits, seeds, stems, wood, bark, roots, rhizomes, or other plant parts, which may be entire, fragmented, or powdered.

**Medicinal plants:** Plants used for maintaining health and/or treating specific ailments.

Ethnobotany: The scientific study of the relationships between people and plants. It aims to document, describe, and explain complex relationships between cultures and plants, focusing primarily on how plants are used, managed, and perceived across human societies.

**Traditional Medicine:** is the sum total of the knowledge, skills, and practices based on the theories, beliefs, and experiences indigenous to different cultures, whether explicable or not, used in the maintenance of health as well as in the prevention, diagnosis, improvement, or treatment of physical and mental illness.

**Traditional Medicine Practitioner:** A person who is recognized by the community in which they live as being knowledgeable in traditional medicine and is responsible for providing health care through the use of plant, animal, and mineral-based medicines, spiritual therapies, manual techniques, and exercises, applied singularly or in combination to treat, diagnose, and prevent illnesses or to maintain well-being.

## Abstract

**Background:** Harmful alcohol use is a major public health concern in Uganda, with limited access to effective and culturally acceptable treatments. Traditional medicine is widely used in Africa including Uganda, yet little is known about its role in managing alcohol-related problems. This study aimed to: (1) document treatment outcomes among individuals treated by traditional medicine practitioners (TMPs) using plant remedies; (2) identify and prioritize the plant species used; and (3) evaluate the effectiveness of *Dracaena fragrans*, the most frequently cited plant, in reducing alcohol consumption using an experimental rat model.

**Methods**: The study used a mixed-methods design to address three objectives. For Objective One, a cross-sectional qualitative study involved in-depth interviews with 44 adults treated by TMPs for alcohol-related problems. Data were collected using semi-structured questionnaires, audio-recorded, and thematically analyzed. Objective Two involved an ethnopharmacological survey among 50 TMPs in Bushenyi District using key informant interviews. Identified plants were classified scientifically at Mbarara University, and ethnobotanical indices (Frequency of Citation, Relative Frequency of Citation, Informant Consensus Factor) were calculated. In Objective three, *Dracaena fragrans* was tested in *Sprague-Dawley* rats across five groups (9 rats per group) using a two-bottle choice test. Alcohol intake and preference were analyzed using t-tests at 95% confidence intervals.

**Results:** In objective one, 82.5% of participants reported sustained alcohol abstinence, with additional positive outcomes including reduced cravings, better sleep, less aggression, and improved social functioning. Objective two documented 25 medicinal plant species from 20 families, with *Dracaena fragrans* being the most frequently cited (Relative Frequency of Citation=0.44), with a high informant consensus factor (ICF=0.67). In Objective three, low and

high doses of *Dracaena fragrans* significantly reduced alcohol intake in rats compared to controls (p-values 0.016 and 0.036, respectively). No significant changes in alcohol-to-water preference were observed.

**Conclusions and recommendations:** This study provides consistent evidence from patient reports, ethnobotanical data, and experimental findings supporting the use of *Dracaena fragrans* in managing alcohol-related disorders. Reported patient improvements were mirrored by significant reductions in alcohol intake in the animal model. Future work should involve controlled clinical trials to evaluate the efficacy and safety of *Dracaena fragrans* in human populations. Further research should isolate and characterize the active compounds, examine their mechanisms of action, and optimize dosage.

# 1 CHAPTER ONE: INTRODUCTION

## 1.1 Background

The World Health Organization's Global Status Reports on Alcohol and Health from 2011, 2014, 2018, and 2024 consistently highlight alcohol as a significant contributor to the global burden of disease and a leading cause of mortality, morbidity, and premature death [1-5]. Heavy and binge drinking are consistently linked to a high risk of all-cause, cardiovascular, and cancer-specific mortality [6-8]. Alcohol contributed to 3 million deaths and 131 million disability-adjusted life-years (DALYs) globally in 2016, accounting for 3.2% of all deaths worldwide [4, 5, 9]. Alcohol-attributable deaths and DALYs are notably higher among men and younger populations, especially those aged 15-49 years [7, 9]. Alcohol's impact extends beyond health, negatively affecting economic productivity, social relationships, crime rates, legal issues, education, and community resources [10-13]. The global economic costs of alcohol consumption are substantial, ranging from 0.01% to 2.6% of Gross Domestic Product (GDP) depending on the country [11]. High-income settings experience an exceptionally high burden, while low-income countries also incur significant costs, which are often underestimated due to inconsistencies in methodology [12, 14].

Alcohol consumption exerts a disproportionate burden on low- and middle-income countries (LMICs), where its impacts are both widespread and severe [15]. In many LMICs, particularly in Sub-Saharan Africa, alcohol use is notably higher among lower socioeconomic groups, exacerbating economic strain by diverting funds from essential household expenditures like food, housing, and education [16]. Moreover, the substantial economic burden of alcohol is often underestimated in global GDP assessments [12]. The harmful effects of alcohol are further

compounded by the prevalence of alcohol-related diseases and disabilities, which disproportionately affect people in these regions [17]. The use of alcohol also contributes to a high incidence of non-communicable diseases and poses significant challenges among young adolescents [17]. In Uganda, Alcohol consumption contributes significantly to the growing burden of non-communicable diseases such as hypertension, obesity, and related metabolic disorders [18-20]

Alcohol consumption in sub-Saharan Africa (SSA) poses a significant and growing public health concern, characterized by high rates of heavy episodic drinking and increasing alcohol-related harms [9, 21]. Alcohol use is a significant risk factor for various diseases and injuries, disproportionately affecting least-income countries and young people. Alcohol is deeply embedded in social and cultural activities in Africa, which contributes to its high consumption and associated disease burden [22]. Social factors, including the drinking behaviors of family and friends, significantly impact alcohol consumption. In Africa, men are more likely to experience alcohol use disorders than women, while women with alcoholic partners are more prone to intimate partner violence [22-24]. Additionally, high rates of alcohol consumption during pregnancy lead to adverse effects on both mother and fetus, exacerbated by factors such as depression and unplanned pregnancy [25]. Research in Uganda highlights alcohol use during pregnancy as a significant public health concern, especially among women living with HIV [26-29].

Alcohol consumption in Uganda is alarmingly high, exhibiting marked variations by gender, age, occupation, and region [30-34]. With alcohol per capita (15+ years) consumption of a whopping 12.2 liters of pure alcohol, alcohol consumption in Uganda is nearly that of the rest of the African region, which is 15.5 liters [4]. The country ranks among the highest in sub-Saharan

Africa for alcohol use, with 45% of individuals in the Rakai region and 26.8% of adults nationwide reporting current use [30]. Men in Uganda are more prone to both alcohol consumption and high-risk drinking behaviors than women, and older adults, mainly those aged 30-69 years, are more likely to engage in medium- to high-level alcohol use [30, 31]. Occupations such as fishing and bar/restaurant work are linked to elevated alcohol consumption, with central and western regions of Uganda showing higher prevalence than the east [31]. Among youth in Kampala's slums, 31% reported alcohol use in the past year, and nearly half qualify as problem drinkers, while 16.1% of adolescents in urban slums are identified as high-risk users[35-37]. The prevalence of alcohol use disorders (AUD) is notably high, affecting 9.8% of adults, with rural areas like Kamuli reporting 4.1% to 5.8% of men screening positive [38]. Alcohol use is associated with significant health risks, including sexually transmitted infections (STIs) and risky sexual behaviors, particularly among young people in fishing communities [39]. Sub-Saharan Africa including Uganda is particularly burdened by liver cirrhosis, cancers, and road traffic injuries related to alcohol [1, 40, 41]. In Southwestern Uganda, alcohol consumption in the general population and among pregnant women is high [26, 42, 43]. Furthermore, alcohol is linked to high HIV risk behavior in the Southwestern region [44-46].

Traditional medicine is crucial in global healthcare, particularly in regions with limited access to modern medical resources. It remains a primary source of healthcare for many Africans, valued for its cultural relevance and accessibility [47, 48]. It includes diverse practices, such as herbalism, spiritualism, and divination, all tailored to various communities' cultural and religious contexts [49]. In many African countries, including Uganda, traditional medicine practitioners are integral to the healthcare system, deeply rooted in cultural and spiritual beliefs, and essential to the health and well-being of their communities[47]. Traditional medicine is widely used in

Uganda, especially in rural areas, often as the first line of treatment due to accessibility and cultural acceptance [50-52]. TMPs are particularly significant in managing chronic diseases such as cancer and HIV/AIDS, as well as mental health and substance abuse disorders [53-55]. They are frequently consulted for mental health issues and alcohol use disorders, with many patients reporting positive outcomes from treatments using plant derivatives[56, 57] . Despite their importance, there is potential for better collaboration between TMPs and biomedical health systems to enhance mental health services, though mutual mistrust and competition often hinder such efforts [47]. TMPs possess extensive, though often undocumented, knowledge of medicinal plants, which is crucial for treating various ailments but their knowledge is at risk of being lost. In Western Uganda, local communities use 67 plant species to treat "African" diseases, with a high degree of consensus on their efficacy [58]. Integrating traditional and western medicine could improve treatment outcomes and patient satisfaction and provide culturally sensitive care.

Ethnopharmacological surveys are invaluable for documenting and preserving traditional medicinal knowledge and crucial for drug discovery and the development of new therapeutic agents [59]. By gathering information on the local and traditional uses of plants and natural substances, these surveys help identify a wide range of medicinal plants that indigenous populations use to treat various health conditions [60]. This knowledge preserves cultural heritage and guides the identification of bioactive compounds that can be further studied, developed and intergrated into clinical practice. Ethnopharmacological surveys also help establish correlations between traditional and conventional medical terms, which is essential for understanding the bioactive properties of traditional remedies [61]. Overall, these surveys provide a crucial link between traditional and western medicine, contributing to the discovery of new treatments while ensuring the ethical and sustainable use of natural resources.

Treatment for alcohol addiction has the following methods: pharmacological, psychological, and social approaches, and a combination of those approaches. However, the mainstay treatments currently employed are psychosocial. The psychosocial approaches, though useful, do not adequately address the physical effects of alcohol addiction, such as craving, tolerance, withdrawal, and other toxic effects. Psychosocial alcohol treatments have, therefore, not been beneficial to a large proportion of patients, resulting in high rates of relapse[62]. The currently available pharmacological approaches are not used regularly due to their side effects, non-availability in the developing world, and questionable efficacy. Disulfiram, naltrexone, and acamprosate, three main medications for alcohol, are hampered by side effects.

Ethnopharmacological surveys play an important role in identifying plant species that can be researched further for developing novel medicines. The development of an effective, available, safe, and locally acceptable medication for alcohol treatment is therefore necessary for better patient outcomes. Plant-based remedies, in particular, are increasingly being investigated for their potential to reduce alcohol consumption[63, 64]. Preclinical research has demonstrated that herbal compounds can significantly reduce alcohol intake and prevent relapse-like behaviors in animal models. For instance, ibogaine, a psychoactive alkaloid derived from the African plant *Tabernanthe iboga*, has shown promise in reducing alcohol consumption in rats and mice[65]. Similarly, Kudzu (*Pueraria lobata*) has been found to reduce alcohol consumption in both animal models and human clinical trials[66]. St. John's Wort (*Hypericum perforatum*) has also effectively reduced alcohol intake in a rat model[67]. Research on plants used to treat alcohol problems in the African and Ugandan settings is sparse. Utilizing an Ethnopharmacological survey, this study documented plants used by communities in rural Southwestern Uganda to manage alcohol-related problems.

## 1.2 Problem statement

Harmful alcohol use is a major contributor to death and disability worldwide and is ranked as the number seven leading risk factor for both deaths and disability adjusted life years [68]. The World Health Organization [1] in its Global Status Report on Alcohol and Health reports that globally 2.3 billion people are current drinkers. The same report shows that alcohol consumption is linked to 200 disease and injury conditions and 3.3 million people die of alcohol related causes annually. Alcohol is responsible for 5% of the global of disease burden [1], and affects 13 of 17 sustainable development goals [69] and SDG 3.5 aims to strengthen prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol. Uganda's alcohol per capita (15+) consumption of pure alcohol is 61.1 liters of pure alcohol [1]. This is much higher than the 6.3 liters reported for the rest of the African region.

The prevalence of alcohol use in Uganda is high, with national surveys showing that approximately 27% of adults are current alcohol users and nearly 10% meet the criteria for an alcohol use disorder[70]. Men and older adults are particularly at heightened risk, reflecting concerning patterns of consumption and associated harm within these demographic groups[71].

In Uganda alcohol consumption is associated with acute and chronic adverse health outcomes including psychiatric conditions like depression, suicide, and anxiety [45, 72, 73]. It is also linked to the risk of non-communicable diseases including cardiovascular disease burden [70, 74, 75] and injuries, commonly road traffic accidents [76, 77]. In addition, alcohol consumption in Uganda has been shown to be a risk factor for cancers [78, 79] as well as sexually transmitted infections, including HIV [80-82].

Available pharmacological treatments have limited utility due to poor compliance and acceptability among patients and families [83]. Besides, the clinical efficacy of the currently available medications for alcohol abuse, such as disulfiram, remains modest [84]. There is also a very low rate of prescription of Antabuse medications by physicians [85].

Traditional medicines are widely used in African communities and are an essential contribution to indigenous healthcare systems in Uganda. There is ample research evidence showing that the majority of Ugandan local communities use herbal medicines for a wide range of ailments [86-91]. In its strategy, the Government of Uganda has put efforts to scale up the use of herbal medicine and ultimately integrate it into the healthcare system in the country [92, 93]. The majority of research on herbal medicinal plant use in Uganda has been on infections such as malaria [94], HIV and its opportunistic infections [89], Tuberculosis [95] and fungal infections; on use in pregnancy and birth [90, 96] and treatment of cancer. There are hardly any reported studies on mental health disorders, including addiction to alcohol in Uganda. This research proposed to document the medicinal plants used by the TMPs to treat alcohol-related problems in Southwestern Uganda. The plant with the highest Informant Consensus Factor was tested using a rat model to determine its effect on the amount of alcohol consumed and on relapse.

## 1.3 Research questions

1. What are the perceived treatment outcomes among individuals who have received care for alcohol-related problems from Traditional Medicine Practitioners using plant-based remedies in Southwestern Uganda?

2. Which medicinal plants are used by Traditional Medicine Practitioners in Southwestern Uganda to manage alcohol-related problems, and what practices guide their therapeutic use

3. Is there a significant difference in alcohol consumption between rats administered *Dracaena fragrans* extract and those receiving either a solvent or disulfiram?

## 1.4 Study objectives

### 1.4.1 General Objective

To explore the medicinal plants and practices used by Traditional Medicine Practitioners in the management of alcohol-related disorders in Southwestern Uganda

### 1.4.2 Specific objectives

1. To document the treatment outcomes of people treated for alcohol-related problems by TMPs using plant derivatives in Southwestern Uganda

2. To document medicinal plants used in managing alcohol-related problems by Traditional Medicine Practitioners in Southwestern Uganda.

3. To determine the effect of small, medium, and high doses of *Dracaena fragrans* plant extract on the amount of alcohol consumed by Sprague-Dawley rats compared to the negative and positive controls.

## 1.5 Null Hypotheses

1. There is no statistically significant difference in the amount of alcohol consumed between adult male Sprague-Dawley rats administered *Dracaena fragrans* extract and those administered a solvent.

2. There is no statistically significant difference in the amount of alcohol consumed between adult male Sprague-Dawley rats administered *Dracaena fragrans* extract and those administered disulfiram.

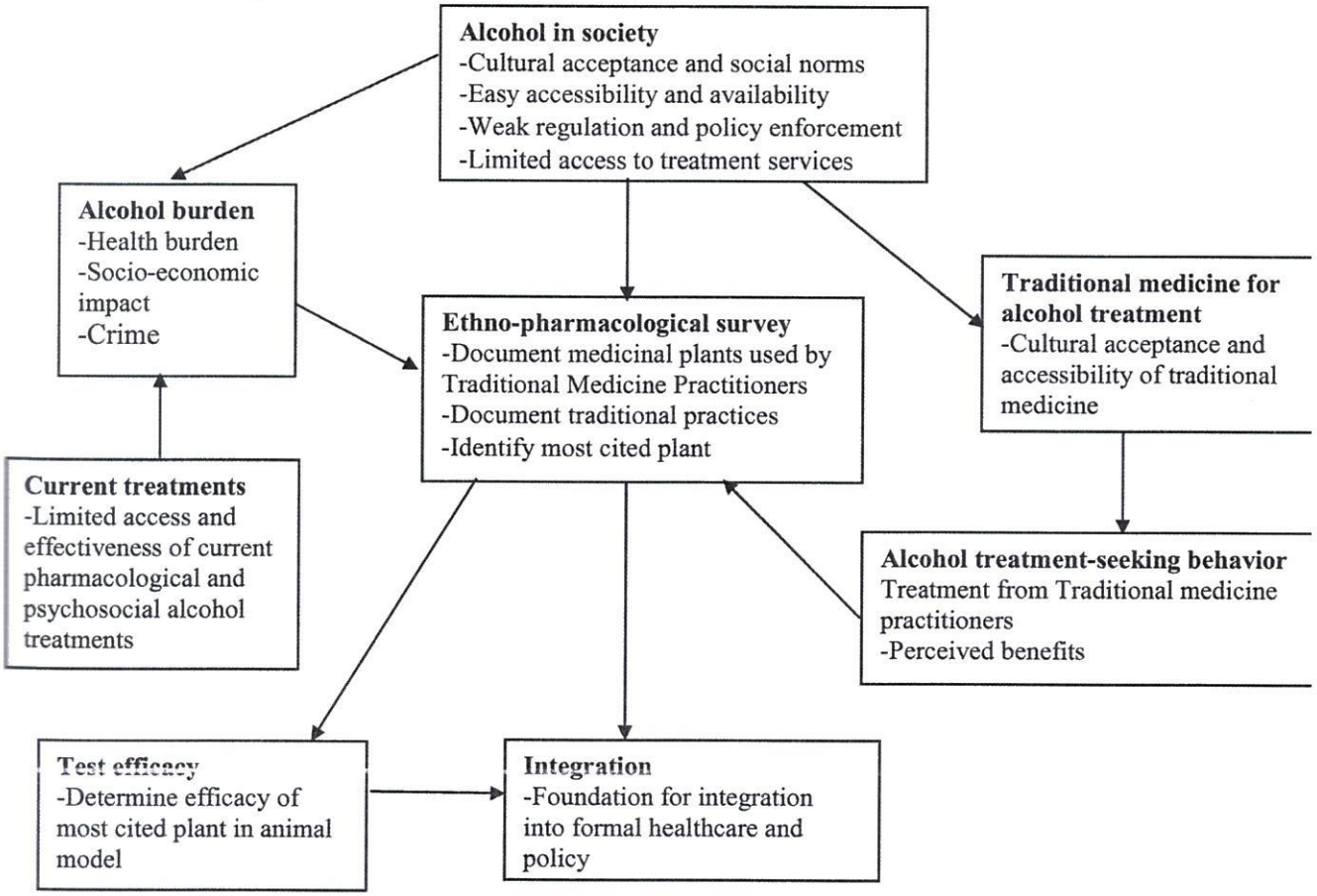
## 1.6 Justification and significance

This study was justified by the need for alternative therapies for treating alcohol-related disorders that are both effective and acceptable within local, cultural and health system contexts. Although pharmacological treatments such as disulfiram, acamprosate, and naltrexone exist, their clinical efficacy, availability, and use remain modest. In many low- and middle-income countries, these are underutilized due to poor patient adherence and low cultural acceptability. In Uganda, access to formal alcohol treatment services, including pharmacotherapies, is further hindered by structural, economic, and social barriers, particularly in rural and underserved areas. As a result, the management of alcohol-related disorders depends mainly on psychosocial interventions, which, on their own, have shown limited success in reducing relapse rates and sustaining abstinence among individuals with alcohol dependence. These treatment gaps necessitated the search for alternative, contextually appropriate pharmacological therapies. One promising avenue is herbal medicine, which has remained a central component of indigenous healthcare in many African societies. Traditional medicine is widely used in many developing countries, with prevalence often exceeding 50% among both general and patient populations [97]. It remains a vital component of healthcare in many settings, with 68% of the population in Uganda relying on it to meet their health needs[98]. Cultural beliefs, economic constraints, and limited access to formal healthcare largely shape its widespread use. Traditional remedies are often used in conjunction with western medical treatments, reflecting a complementary approach to health and healing.

Uganda, in particular, has a rich ethnobotanical diversity, with extensive community use of medicinal plants for various conditions, including malaria, infections, and reproductive health issues [99, 100]. However, there is limited research on the application of these traditional remedies in the management of mental health disorders and substance use problems, such as alcohol-related disorders. While herbal treatments have been studied in other regions, particularly in Asia, results are inconsistent, with some formulations showing limited efficacy or even toxicity in clinical trials. Moreover, many of these studies involved plants that were not endemic or culturally relevant to African settings. This further emphasized the need for locally grounded ethnopharmacological research that explored indigenous treatments.

This study is significant in several respects. It potentially lays the groundwork for future clinical trials and community-based treatment programs. This could ultimately improve treatment outcomes, reduce relapse rates, and offer a sustainable and accessible approach to addressing Uganda's heavy alcohol burden. Furthermore, the findings could inform national policy on integrating herbal medicine into formal healthcare systems, in line with the WHO Traditional Medicine Strategy (2014–2023) [101] and Uganda's health sector development goals[102]. Additionally, this research is well aligned with Uganda's Fourth National Development Plan (NDP IV)[103], which prioritizes innovation and research in traditional medicine and its integration into healthcare[102]. It advances a collaborative agenda led by the Ministry of Health, involving research institutions, academia, and the private sector.

## 1.7 Conceptual Framework




**Conceptual framework narrative**

This conceptual framework illustrates the link between alcohol-related disorders, the role of Traditional Medicine Practitioners, and the development of plant-based treatments. The framework begins with the burden of harmful alcohol consumption, which has significant health, social, and economic consequences. Limited effectiveness and accessibility of current pharmacological and psychosocial interventions create a treatment gap. In this context, Traditional Medicine Practitioners play a crucial role, using culturally accepted medicinal plants to manage alcohol-related problems. An ethnopharmacological survey identifies the most cited

plant. This leads to preclinical testing in a rat model to evaluate its effect on alcohol consumption. The results inform potential integration of effective plant-based interventions into formal healthcare systems. Ultimately, this framework aims to guide future clinical trials, improve treatment options, and reduce the burden of alcohol-related disorders.

# 2 CHAPTER TWO: LITERATURE REVIEW

## 2.1 Burden

### 2.1.1 Global burden

Alcohol, together with its related complications, has been part of man's social life since ancient times. Today, alcohol drinking is a public health problem that causes poor health, poverty, crime, social strife and requires a priority response. Globally about 2 billion people are estimated to be current drinkers and therefore at risk of alcohol related complications [1] with reported 100.4 million cases in 2016. Overall, alcohol contributes to 4% of the global burden of disease [2]. Alcohol is also responsible for 1.8 million deaths annually, representing 3.2% of all deaths worldwide [1, 104]. Sustainable Development Goal 3, Target 3.5 aims at 'strengthening the prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol' [69]. This calls for action to control alcohol-related problems by 2030.

### 2.1.2 Regional burden

Sub-Saharan Africa is grappling with a growing burden of harmful alcohol abuse characterized by high prevalence and volumes of consumption and resultant disastrous consequences [1, 105, 106]. Alcohol consumption per capita in Africa shows wide variation across countries. Some North African and predominantly Muslim nations report less than 1 liter of pure alcohol per capita annually, while others exceed 9–10 liters, ranking among the highest globally[107-109]. Harmful alcohol use among youth in Africa is a significant and growing public health burden. A recent systematic review showed that about 36% report alcohol use in the past year, with 7–8% meeting criteria for alcohol use disorder within that period[105]. Alcohol remains the most commonly used substance among young people, with a higher prevalence among males[110]. It

is linked to numerous adverse outcomes, including interpersonal violence, risky sexual behavior, and poor academic performance[111].

Alcohol use plays a significant role in fueling the HIV epidemic in Africa, especially in sub-Saharan regions where alcohol drinking and HIV rates are both alarmingly high[112]. Studies have consistently demonstrated that individuals who consume alcohol are up to twice as likely to contract HIV compared to those who do not drink[113, 114]. The risk is even greater among individuals with problematic drinking patterns compared to moderate users[115]. Alcohol is a major contributor to the growing burden of non-communicable diseases in Africa, which now accounts for a significant share of illness and death across the continent[116, 117]. Harmful alcohol use is linked to rising rates of hypertension, stroke, liver cirrhosis, and certain cancers, placing immense pressure on already stretched health systems[116].

### 2.1.3 Local burden

In Uganda, alcohol is a major contributor to the national burden of disease, poverty, and psychosocial problems. Uganda was reported to have the highest alcohol consumption per capita in East Africa, estimated at 23.7 liters of pure alcohol [104]. In a countrywide Non-Communicable Diseases (NCD) survey, Guwatudde [75], [118] and Kabwama [70]found alcohol as a major risk factor for NCD in Uganda. Alcohol has also been shown to be a risk factor for infections, especially HIV/AIDs, syphilis, and tuberculosis in Uganda. In Southwestern Uganda, for example, Mbulaiteye [119] and others found that HIV prevalence was twice as high in those who had ever drunk alcohol compared with those who had not. Other studies in Uganda have shown alcohol as a risk factor for HIV infection [44, 81, 82, 119]. Alcohol is also linked to the risk of cancer in Ugandan studies [78, 79, 120]. Research in Uganda has associated alcohol to gender based and intimate partner violence [121]. Alcohol is also a major contributor to road

traffic accidents in Uganda [76, 122]. Mental health problems including suicide are more proportionally higher in people with problem drinking in Uganda [45, 123, 124].

## 2.2 Traditional medicine in Uganda

Research done in Uganda shows that communities commonly use traditional medicine for a wide range of ailments. In Southwestern Uganda, rural communities have used traditional medicine for treatment of diabetes [125], HIV/AIDS [89, 126, 127], for malaria [128-130] and for child birth [90]. There is evidence that modern health practitioners can collaborate with Traditional Medicine Practitioners in Uganda [131, 132]. Research on herbal remedies for alcohol treatment are sparse in Uganda, a gap that this research aims to fill.

## 2.3 Pharmacotherapies for Alcohol Use Disorder

Pharmacotherapy plays a role in the treatment of alcohol-related disorders. Several medications are currently being used to treat alcohol-related disorders, with ongoing research exploring new and combination therapies. Disulfiram, acamprosate, and naltrexone are the most commonly used pharmacotherapies for AUD treatment[133-135]. Disulfiram works through an aversive mechanism, while naltrexone and acamprosate block the rewards of alcohol or stabilize systems dysregulated by chronic alcohol intake.

These medications help reduce alcohol consumption and promote abstinence, although their effectiveness can vary among individuals. Pharmacotherapies for alcoholism show promise in treating withdrawal, reducing cravings, addressing psychiatric issues, and treating concurrent drug abuse[135]. The efficacy of these medications is modest and often limited by patient nonadherence and disease heterogeneity. Pharmacotherapies for alcohol use disorder have specific side effects[136]. Disulfiram can cause peripheral neuropathy and has not consistently

improved long-term abstinence rates. Naltrexone commonly leads to nausea and is more effective in active drinkers due to its aversive effects during alcohol consumption. Acamprosate is generally well-tolerated, with diarrhea being the most frequent adverse effect.

## 2.4 Herbal remedies for alcohol

Herbal remedies have been investigated as potential treatments for alcohol addiction and its related complications, including alcoholic liver disease. These natural therapies are often favored for their lower toxicity and their ability to target multiple pathways involved in alcohol dependence and liver damage. In Central Uganda, young people believed that herbs could deter alcohol dependence, indicating a cultural acceptance and perceived efficacy of herbal treatments [137]. In China, the use of plant extracts for managing alcohol is reported to have been around for over the last 200 years [138]. Traditional medicine is essential to health care in Low and Middle-Income countries because it is affordable and culturally acceptable to the poor population (Sato, 2012). Herbal medicine, a component of traditional medicine, has wide usage in the African setting [139]. In Central Uganda, young people believed that herbs could deter alcohol dependence, indicating a cultural acceptance and perceived efficacy of herbal treatments. Ibogaine is a naturally occurring alkaloid extracted from Tabernanthe Iboga, a shrub found in West Africa. It has been researched in an animal model to explore its anti-addictive effects, including alcohol, with a major focus on its ability to reduce craving and relapse both in humans and in rats. Rezvani and others [140] demonstrated that an intraperitoneal injection of 60 mg/kg of ibogaine significantly reduced the amount of alcohol drunk by three strains of alcohol-preferring rats. In a follow-up study, Rezvani and his team tested the effect of three doses (5, 20 and 40 mg/kg) of Ibogaine analogue on ethanol intake by alcohol-preferring rats [141]. Using a two-bottle choice method, He and others [142]provided evidence of ibogaine in reducing the

amount of ethanol self-administered by rodents. Clinical studies on Ibogaine have however been made difficult by its toxic side effects at high doses [143, 144].

Kudzu, a perennial climbing vine native to Asia, is another plant shown to reduce alcohol intake in a rodent model. Kudzu root is rich in isoflavones, particularly daidzin, daidzein, and puerarin, which contribute to its pharmacological effects, including the suppression of alcohol intake in a rat model[145, 146]. Benlhabib and others found that o.5mg/KG of Kudzu root extract suppressed ethanol drinking in Alcohol Preferring rats by 50-60% [147]. Puerarin, a component of Kudzu roots, has also been found to lower alcohol intake and withdrawal symptoms in P-rats having unlimited access to ethanol, water, and food [148]. Clinical trials indicate that kudzu extract, significantly its isoflavones such as puerarin and daidzin, can effectively reduce alcohol consumption and modify drinking behaviors in heavy drinkers[149, 150]. However, its effects on alcohol cravings and long-term sobriety remain unclear[151]. Despite this, kudzu shows promise as a safe adjunctive treatment for reducing alcohol intake, with minimal side effects.

St John's Wort (Hypericum perforatum) has been widely studied as a potential herbal medicine for alcohol addiction. It is native to Europe and Asia and has spread to North America. There is strong evidence from animal studies that St John's Wort (SJW) suppresses ethanol drinking in animal models. A chronic administration of SJW significantly reduced alcohol intake in mice, with a reported decrease of 78.6% in ethanol consumption[152]. An intragastric administration of Hypericum perforatum extract to Alcohol preferring rats induced a 30-40% reduction of the amount of 10% ethanol drunk by the rats [153]. In addition, St. John's Wort significantly reduced alcohol intake in High Alcohol Drinking and Fawn-Hooded rats in two separate researches [140, 154].

Another plant product that has benefits in alcohol dependence is Ginseng. The extracts of Ginseng have been found to be protective against liver and gastric complications in alcohol dependents [155-158]. Ginseng has also been found to be beneficial in alleviating alcohol intoxication and withdrawal in rodents and rabbit models [159]. Dracaena, commonly known as dragon trees or corn plants, is a genus of over 120 species of trees and succulent shrubs recognized for their striking foliage and adaptability[160]. Several Dracaena species have demonstrated pharmacological potential in traditional medicine[161]. For instance, an experimental study on *Dracaena terniflora* Roxb. showed that its root extracts possessed significant hepatoprotective activity in Wistar albino rats subjected to ethanol-induced liver injury[162]. However, despite such promising evidence related to organ protection, there is limited research on the ability of Dracaena species to reduce alcohol intake or craving.

Medicinal plants are often found in diverse habitats essential for their growth and sustainability. They thrive in various environments, including streams and riverbanks, cultivated lands, bushlands, forested areas and their margins, woodlands, grasslands, and home gardens[163]. Home gardens, especially within indigenous and rural communities, are crucial for these plants, providing easy access and supporting their conservation through human management. Many medicinal plants are also harvested from wild habitats such as forests, bushlands, and grasslands, which are vital for preserving biodiversity[50]. However, these habitats face significant threats from habitat destruction, urbanization, agricultural expansion, investment, road construction, and deforestation, leading to the decline and loss of medicinal plant species.

Traditional medicine practitioners (TMPs) across various cultures commonly use different parts of plants to treat a wide range of ailments, including AUDs. In traditional medicine across Africa and Asia, leaves and roots are the most frequently utilized plant parts[58, 164-166]. This is likely

due to their abundance, accessibility, and ease of preparation. Additionally, the bark, flowers, seeds, and whole plants are also employed, though to a lesser extent[165].

Traditional medicine practitioners (TMPs) use various methods to prepare medicinal plants. The most commonly employed techniques are decoction and infusion, which involve boiling plant parts in water or steeping them in hot water[164, 167]. Some practitioners use fresh plant parts directly or pound them into a paste for application or consumption[168]. Additionally, other methods, such as squeezing, drying, and concocting various plant parts, are also used to prepare medicinal remedies[168].

## 2.5 Rat models in alcohol research

Animal models are fundamental in addiction research, offering a controlled and ethical means to investigate the behavioral, neurobiological, and pharmacological mechanisms underlying substance use disorders[169, 170]. These models allow replication of features of human addiction, such as drug-seeking behavior, escalation of use, tolerance, withdrawal, and relapse, under standardized experimental conditions[170, 171]. Rodents, particularly rats and mice, are preferred due to their well-characterized behavioral profiles, genetic homogeneity, and responsiveness to pharmacological manipulations[172]. Sprague-Dawley (SD) rats are widely utilized among rat strains because of their docile temperament, consistent physiological development, and proven reliability in behavioral and pharmacokinetic studies[173]. Through the use of these models, researchers can examine addiction-related phenomena that are not feasible or ethical to study in human populations, such as the effects of chronic substance exposure or targeted neurochemical interventions.

Alcohol addiction has been extensively modeled using both voluntary intake methods and pharmacologically induced dependence[174, 175]. One of the most widely adopted behavioral models is the two-bottle choice model, in which animals are given continuous or intermittent access to two drinking bottles, one containing water and the other an ethanol solution[176, 177]. This setup enables researchers to measure alcohol preference and consumption patterns over time, closely mimicking voluntary drinking behavior in humans. Importantly, these models also serve as valuable platforms for testing the efficacy of pharmacological and plant-based interventions aimed at reducing alcohol intake or preventing relapse[169, 178]. They allow for the controlled evaluation of dose-dependent effects, behavioral changes, and treatment outcomes over time[179]. In the context of growing interest in traditional and herbal medicine, animal models have become especially relevant for preclinical studies seeking to validate the use of ethnobotanical remedies in the management of alcohol use disorders.

This study employed a rat model rather than human participants to ensure controlled, ethical, and reproducible investigation of alcohol use disorder and potential interventions. Using rats allowed precise control over the environment and alcohol exposure, thereby minimizing confounding variables and enabling standardized experimental conditions. Only male rats were used in the study to avoid the hormonal variations associated with the estrous cycle in females, which can influence alcohol metabolism and behavior, thereby ensuring consistency and reliability of results.

# 3 CHAPTER THREE: MATERIALS AND METHODS

## 3.1 Materials and methods study objective 1

In this objective, the study documented the treatment outcomes of people treated by TMPs using plant derivatives in Southwestern Uganda.

### 3.1.1 Research Design

This was a cross-sectional, semi-structured qualitative study that used in-depth interviews.

### 3.1.2 Study Population

The study population was individuals who had sought treatment for alcohol drinking problems from traditional medicine practitioners (TMPs) and were treated using plant derivatives.

### 3.1.3 Study site

The study was conducted in rural communities of Bushenyi District in southwestern Uganda.

### 3.1.4 Sample size and sampling procedures

A sample size of 50 participants was used, guided by a similar previous study in Uganda (Adia et al., 2014a) and sample size estimation for qualitative studies as described by Morse (Morse, 2015a). Traditional medicine practitioners who treat alcohol drinking problems using plant derivatives were asked to identify the clients they had previously treated. These individuals were then contacted and traced for participation in the study.

### 3.1.5 Eligibility criteria

Eligibility for inclusion in the study required that participants be reachable for a face-to-face, in-depth interview and reside within Bushenyi District.

### 3.1.6 The data collection and tools

Data were collected through face-to-face, in-depth interviews using a semi-structured interview guide. This guide was designed to elicit information on participants' socio-demographic characteristics, history of alcohol use, motivations for seeking treatment, treatment outcomes, and perceived benefits following abstinence. Interviews were conducted by three trained research assistants fluent in English and the local language (Runyankore-Rukiga), who had prior experience in research involving traditional medicine practitioners in southwestern Uganda. Two of the assistants had backgrounds in mental health, and one in public health. All interviews were conducted in Runyankore-Rukiga and audio-recorded with participants' consent. Field notes were taken to complement the recordings. One assistant facilitated the interview during each session while the other managed audio recording and note-taking. Each interview lasted approximately 60 minutes. Details of the interview guide are shown in Table 1 below.

**Table 1: Interview guide for In-depth interviews**

| Interview area | Guiding Questions |
|---|---|
| Socio-demographic characteristics | Age, gender, main occupation, other occupations, marital status, and education level |
| Drinking history | Please share the types of alcohol that you drank or were drinking before you went to the traditional healer for treatment.<br>(Probe: both locally brewed/home-made and factory manufactured) |
| Reasons for drinking | Please share what made you drink alcohol excessively.<br>(Probe: perceived beneficial effects, external influence) |
| Duration of alcohol drinking before seeking treatment | How long had you been drinking alcohol before you went to see the traditional medicine practitioner? |
| Reasons for seeking treatment | Please share the problems related to your drinking of alcohol that made you visit the traditional medicine practitioner seeking treatment. |
| Alcohol use disorder treatment outcome | Did you get healed from your drinking after treatment by a traditional medicine practitioner?<br>(Probe: Stopped completely, continued to drink like before, drunk even more) |
| Perceived benefits following treatment for alcohol use disorder | Please share the benefits you observed in yourself after you were treated for your drinking problem by a traditional medicine practitioner. (Probe specific benefits) |

### 3.1.7 Quality control

The research assistants were trained on study protocol, informed consent, and data collection procedures. The in-depth interview guide was pretested among clients of a traditional healer in a suburb of Mbarara city. Debriefing meetings were held at the end of each data collection day to check for the data's completeness. The principal investigator provided oversight during the debriefing and attended some of the interviews to ensure that interviews were conducted properly according to the study protocol.

### 3.1.8 Data management and analysis

Audio-recorded interviews conducted in Runyankore-Rukiga were directly transcribed into English by a research assistant familiar with the local dialect and English. An independent research assistant cross-checked the transcripts for accuracy and completeness, listening to the recordings while reviewing them. The data analysis was guided by Braun and Clarke's thematic analysis model[180], using a deductive approach in which patterns were identified, analyzed, and interpreted based on a priori themes.

Two researchers independently conducted open coding on the English transcripts, identifying segments of text related to the a priori themes such as participants' motivations for seeking traditional treatment, descriptions of treatment practices, or reported changes in health or social behavior following treatment. After initial coding, the researchers reviewed and discussed their respective code lists to consolidate overlapping codes and ensure consistent definitions. Any disagreement between the coders was resolved by discussion and consensus. In addition to qualitative coding, demographic and categorical data on drinking history and treatment outcomes were entered into Microsoft Excel 2019 and analyzed using simple descriptive statistics.

## 3.2 Materials and methods study objective 2

In this objective, the study documented the medicinal plants used in managing alcohol drinking problems by Traditional Medicine Practitioners in Southwestern Uganda.

### 3.2.1 Research Design

The study was an ethno-pharmacological survey.

### 3.2.2 Study Population

The study population was Traditional Medicine Practitioners (TMPs) with experience in treating people with alcohol drinking problems using medicinal plants.

### 3.2.3 Study site

The study was conducted in Bushenyi District, southwestern Uganda. According to the Uganda Population and Housing Census 2024 Final Report, Bushenyi District has a population of 283,392 people [187], with the majority (73.8%) residing in rural areas. The majority of people (87%) in the district are engaged in subsistence agriculture, while others are involved in commercial cultivation of tea, coffee, and bananas. Other economic activities in the district include fishing, stone quarrying, sand and mineral mining, tourism, and lumbering. Bushenyi district covers an area of 841 square kilometers and is home to two natural forests, Kalinzu and Imaragambo, that together cover 84 square kilometers [181]. The main tribes are the Banyankole, who are the majority, Bakiga, Baganda, and Bakonjo, and the main spoken local language is Runyanore-Rukiga. Bushenyi district has nine sub-counties, 64 parishes, and 565 villages. The district lies 0.4871° S, 30.2051° E, has low-lying plateaus interfaced with hilly terrain, and gets 1500-2000 mm of rainfall annually.

The Bushenyi Medical and Traditional Healers Association (BUMETHA) [132] was founded in 1988 and currently has a membership of 75 traditional healers. BUMETHA operates within Rukararwe Partnership Workshop for Rural Development (RPWRD) and is located 4.6 km from Bushenyi town. The association promotes collaboration with western medicine and participates in research, some of which have been published [132].

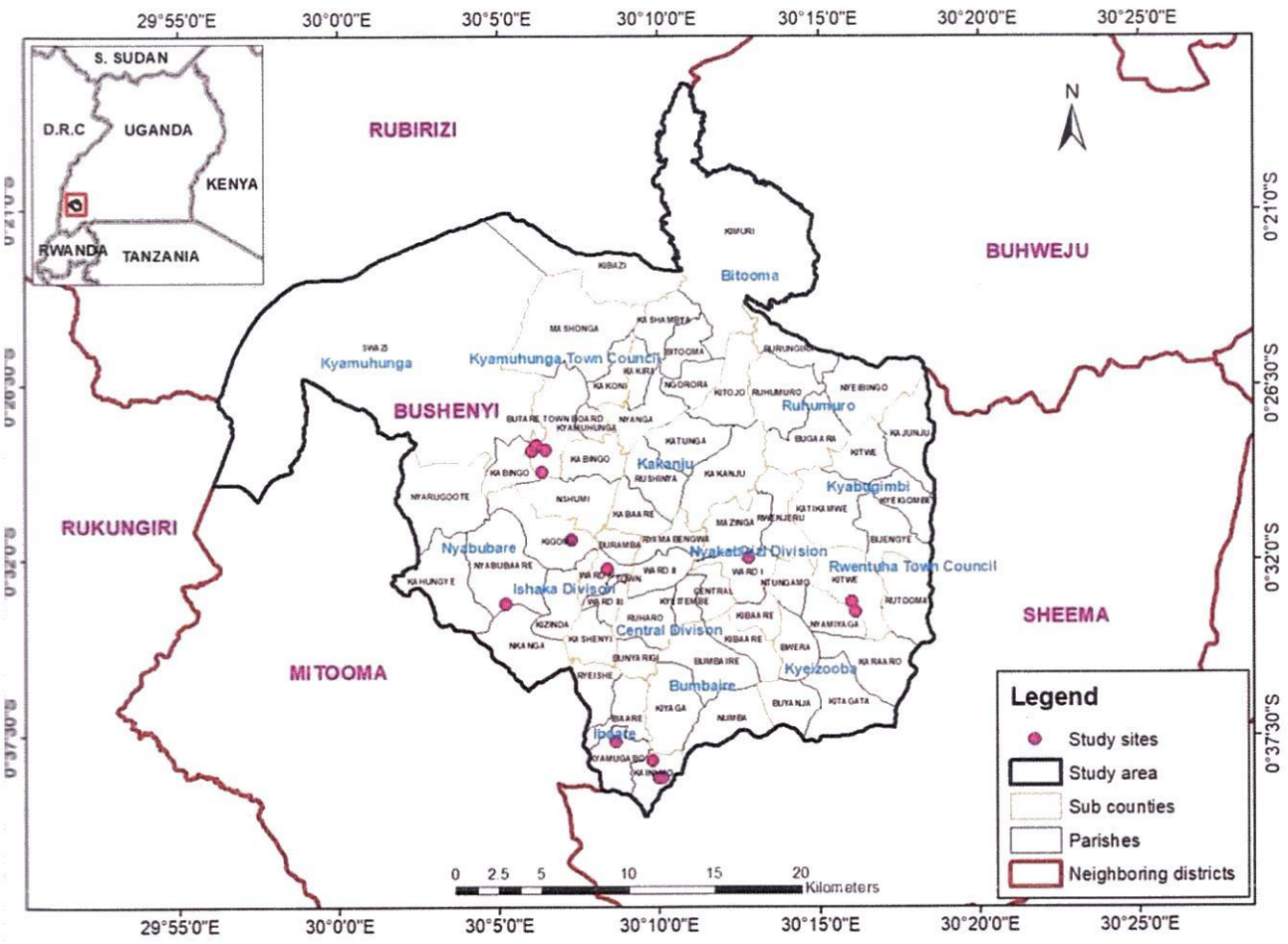



**Figure 1: Map of Bushenyi District with inset showing location in Uganda**

(Map was created using ArcGIS version 10: 18/11/2023)

### 3.2.4 Sampling Procedure

A snowballing technique, as described by Parker and others [182], was used to identify Traditional Medical Practitioners with experience and who were active in managing alcohol-related problems using herbal medications. The sampling process commenced with the chairman of the TMPs association in Bushenyi, who provided the initial referrals and contacts. Subsequently, each interviewed TMP was asked to nominate other practitioners known to offer herbal treatment for alcohol use problems, thereby facilitating the identification of additional eligible participants.

### 3.2.5 Sample size

The sample size was determined a priori at 50 TMPs, guided by methodological recommendations for qualitative research and precedent from similar studies. Specifically, Morse (2015) recommends a sample size of 30 to 60 participants for qualitative ethnographic studies[183]. This guidance, along with a comparable study conducted in Uganda by Adia et al. [184], informed the decision to target 50 participants as sufficient to achieve data saturation and thematic depth.

### 3.2.6 Survey pre-test

The questionnaire was pre-tested with four TMPs in Nyakayozo sub-county, Mbarara District, in southwestern Uganda. This pre-test aimed to assess the tool's clarity, cultural relevance, and appropriateness prior to full-scale data collection.

### 3.2.7 Eligibility criteria

Inclusion in the study required that Traditional Medicine Practitioners (TMPs) be residents of the study area and have experience managing alcohol-related problems using medicinal plants. Practitioners unwilling to disclose the specific plants used in treatment were excluded from participation.

### 3.2.8 The data collection

Data was collected using the key Informant technique and a semi-structured questionnaire. Interviews were conducted by a team of three research assistants who were fluent in Runyankore-Rukiga and familiar with the local cultural context. All research assistants had experience in research involving traditional healers in Southwestern Uganda. In addition, all had a health background, two in nursing and mental health, and the other in public health and research ethics.

### 3.2.9 Data collection tools

A semi-structured questionnaire containing both open- and closed-ended questions (see Table 2 below) was used to collect detailed information on the medicinal plants employed in the treatment of alcohol-related problems. Topics included plant identification, collection methods, parts used, preparation techniques, storage, routes of administration, and dosing. In addition, the questionnaire captured data on the sociodemographic characteristics of the TMPs.

**Table 2: Interview guide for Key Informant Interviews**

| Interview area | Guiding questions |
|---|---|
| Socio-demographic characteristics | Age, gender, religion, main occupation, other occupations, marital status, highest education level, duration of practice in traditional medicine, telephone contact |
| Physical address of the traditional medicine practitioner | Please share:<br>Name of the village where you reside<br>Name of your parish<br>Name of your sub-county<br>Name of your district |
| Plant identification | Please share the local name of the plant that you use to treat people with drinking problems<br>*Probe if there are distinguishing aspects of the plant.* |
| Plant parts used and collection | Please share which part or parts of the plant you use<br>*Probe the detailed process step-by-step*<br>*Probe how the parts are collected, season if flowers or seeds* |
| Preparation | Please describe how you prepare the plant material to make the remedy you use to treat people with alcohol problems.<br>*Probe step by step of the detailed process* |
| Administration | Please share how you administer the remedy<br>*Probe how much and how often* |
| Plant collection during the field trip | Date of plant collection<br>Conservation status of the plant: *probe if the plant is common, rare, or scarce*<br>The life form of the plant<br>Village, parish, and sub-county where the plant is located<br>GPS coordinates and altitude where the plant is located |
| Scientific identification at the Herbarium | Voucher number<br>Scientific name<br>Species<br>Family |

### 3.2.10 Plant identification

Field visits by the research team, accompanied by the TMPs, were conducted to where the plants naturally grew. During these visits, the TMPs identified plants used in treating alcohol-related problems by their local names. Voucher specimens of the plants mentioned by the TMPs were then collected using a procedure described by Martins and others [185]. These specimens were submitted to a botanist in the Department of Biology at the Faculty of Science, Mbarara

University of Science and Technology, who assigned voucher numbers and confirmed the scientific names. The scientific names of the plants and species were identified based on the International Plant Names Index [186]. The voucher specimens were preserved at the Department of Biology of the Faculty of Science, Mbarara University.

### 3.2.11 Quantitative ethnobotany

Data obtained from the survey were used to calculate key ethnobotanical indices, including Frequency of Citation (FC)[187, 188], Relative Frequency of Citation (RFC)[187, 188] and the Informant Consensus Factor (ICF)[187, 188]. The indices were calculated as follows [187]:

*Frequency of Citation (FC)*

$$\text{FC}=\frac{(\text{Number of mentions of a particular plant species})}{(\text{Total nuber of mentions of all species})}\times 100$$

*Relative Frequency of Citation (RFC)*

$$\text{The RFC}=\frac{\text{Number of informants who mentioned each plant species}}{\text{Total number of informants in the study}}$$

The RFC index ranged from "0" when nobody referred to a plant as useful to "1" when all informants referred to a plant as useful.

*The Informant Consensus Factor*

The Informant Consensus Factor (ICF) is used in ethnopharmacological studies to quantify the level of agreement among traditional medicine practitioners regarding using specific plants for a particular ailment category. The ICF was calculated in this study using the formula[189]:

ICF = ($N_{ur}$ - $N_t$)/ ($N_{ur}$ -1) where $N_{ur}$ is the number of use reports or mentions and $N_t$ is the number of species used.

### 3.2.12 Data Analysis

Plant-related data, including species, botanical family, life form, collection method, preparation, administration techniques, frequency of mention, and relative frequency of citation, were analyzed using descriptive statistical methods in Microsoft Excel 2019[190]. Results were summarized and presented in frequency tables and graphs to illustrate distribution patterns and usage.

## 3.3 Materials and methods study objective 3

In this objective, the study determined the effect of small, medium, and high doses of *Dracaena fragrans* plant extract on the amount of alcohol consumed by Sprague-Dawley rats compared to the negative or positive controls.

### 3.3.1 Study Design

The study was a confirmatory experiment with five arms, including two control and three experimental groups. The control arms consisted of a negative control (administered water) and the positive control (administered disulfiram at a daily dose of 0.3 mg), derived from a human dose of 500 mg per day for a 70 kg adult, following established guidelines for interspecies dose conversion [191]. The control arms consisted of a negative control (administered water) and a positive control (administered disulfiram at a daily dose of 0.3 mg), derived from a human therapeutic dose of 500 mg/day for a 70 kg adult, following established guidelines for interspecies dose conversion (Nair and Jacob, 2016). The experimental arms received low (200 mg/kg), moderate (400 mg/kg), and high (800 mg/kg) doses of *Dracaena fragrans* extract.

Animals were randomly assigned to the five arms. To minimize bias, the principal investigator was blinded to group allocation. Each adult Sprague-Dawley rat was treated as an independent experimental unit and housed individually.

### 3.3.2 Experimental animals

The study utilized adult male Sprague-Dawley (SD) hybrid albino rats, approximately 60 days old at the initiation of the study. The SD rats are an outbred multipurpose breed of albino rats widely used in medical research, including alcohol experiments. Sprague-Dawley rats are an outbred, multipurpose strain of albino rats that have been extensively employed in biomedical research, including alcohol-related studies. Their use in Uganda has been documented at the Mbarara University research facility [192, 193]. This outbred strain was selected over inbred alcohol-preferring strains to enhance the generalizability of findings, as it more closely represents the genetic diversity found among alcohol-consuming human populations. The SD rats are noted for their calm temperament and ease of handling. This strain was originally developed by Sprague Dawley Farms in Madison, Wisconsin, USA. Adult males typically weigh between 450 and 520 grams, while adult females range between 250 and 300 grams.

### 3.3.3 Research site

The study was conducted at the animal research facility of Mbarara University of Science and Technology (MUST), a facility established in 1994 to support research and training. The facility serves as a key resource for undergraduate and postgraduate students and faculty-led investigations. It comprises several specialized rooms, including one designated for housing wooden cages with non-study rats, with provisions for food and water. An experimental room is used to conduct research procedures, while a separate holding area accommodates animals

currently enrolled in studies or awaiting experimental sessions. The facility can house approximately 300 small laboratory animals, predominantly rats, the primary species used for experimental research. Additional resources include digital weighing scales suitable for small animals, two air conditioning units, and continuous electricity and running water access. In addition to supporting research, the facility contributes to the practical training of undergraduate students enrolled in Pharmacy and Pharmaceutical Sciences programs.

### 3.3.4 Study variables

The primary independent variable in this study was the dosage of the *Dracaena fragrans* extract, which was categorized into three levels: low, medium, and high. These dosage categories represented the varying concentrations of the plant extract administered to the experimental groups. The primary dependent variable was the quantity of alcohol consumed by the Sprague-Dawley (SD) rats. This was measured in grams per kilogram of body weight and was computed by multiplying the volume of 10% v/v ethanol solution consumed (in milliliters) by 0.7893 (the density of ethanol), and dividing the result by the individual rat's body weight (in kilograms). A secondary dependent variable was the alcohol-to-water preference ratio, calculated by dividing the volume of alcohol consumed by the total volume of fluid (alcohol plus water) consumed. The result was then expressed as a percentage by multiplying by 100, following the method described by Rezvani and Grady (1994) [194].

### 3.3.5 Housing and husbandry

All Sprague-Dawley rats were individually housed in standardized polypropylene rat cages (Figure 2 below), each measuring 410 x 282 x 153 mm (length, width, and height) and providing a floor space of 1,156 $cm^2$. These cages were equipped with holders for two water bottles and

feed pellets to ensure uniform housing conditions across experimental units. A 12/12-hour natural light-dark cycle was maintained. The rats were given one week for acclimatization prior to the onset of the experiment. Wood shavings served as bedding material, which was replaced twice weekly (every Monday and Thursday morning), concurrently with cage cleaning to maintain hygienic conditions. The composition of the feed included maize bran, soya, silverfish, and vitamin and mineral supplements, and the pellets were procured from licensed commercial animal feed suppliers. The animals were maintained under ambient room temperature typical of Mbarara, Uganda, with diurnal temperature variations ranging from 25–28 °C during the day to 14–16 °C at night [195]. Tap water was made available ad libitum, and all rats were provided with standard rodent feed in pellet form. All experimental procedures were reviewed and approved by the Mbarara University of Science and Technology Research and Ethics Committee and the Uganda National Council for Science and Technology. The study also complied with the Uganda Animals Prevention of Cruelty Act [196] and the Uganda National Guidelines for Use of Animals in Research and Teaching[197]. A veterinary doctor and faculty member from the Department of Anatomy was responsible for overseeing the health of the experimental animals. This veterinarian performed pre-experimental health assessments, conducted weekly health checks, and remained available on call throughout the duration of the study.



**Figure 2: Rat cage**

### 3.3.6 Sample size

The sample size was determined using the formula for continuous variables in animal studies [198]:

$n= 1+2C(s/d)^2$

n = sample size

d = effect size to be detected

s = standard deviation

C = constant

**This study's significance level (α) was** set at 0.05 and the power (1-β) **at 90%. For values of** $\alpha =$ 0.05 and $1-\beta = 0.9$**, C is equal to 10.51 and hence** $2C = 21$.

The effect size and population standard deviation in this study are guided by findings from a previous meta-analysis study [199]and are s= 2.3, d=3.6.

Therefore:

$n = 1+ 21\ (2.3/3.6)^2$ giving a sample size of 9 rats per group.

Objective 3 had three experimental groups and two control groups, so the total number of animals required was 45.

Baseline characteristics: The male SD rats were alcohol and test naïve before the experiment and were acclimatized to cage conditions for at least one week.

### 3.3.7 Allocation and randomization

The experimental animals were allocated to the five groups using a simple randomization procedure. The five groups were: (i) negative control receiving water, (ii) a positive control group administered disulfiram, and three treatment groups that received (iii) a low, (iv) a medium, and (v) a high dose of *Dracaena fragrans* extract. Each group comprised nine adult male Sprague-Dawley rats, ensuring equal group sizes for comparison. The 45 cages housing the experimental rats were labeled sequentially from C1 to C45. To facilitate random allocation, 45 identically sized and colored pieces of paper, each bearing one of the cage numbers (C1–C45), were prepared. These papers were folded uniformly and placed in a box, which was thoroughly shaken to ensure random mixing. An independent individual, not affiliated with the research team, was invited to draw the papers one at a time. The first paper drawn was assigned to the negative control group, the second to the positive control group, the third to the low-dose treatment group, the fourth to the medium-dose treatment group, and the fifth to the high-dose treatment group. This process was repeated until all 45 cages were assigned to one of the five study groups.

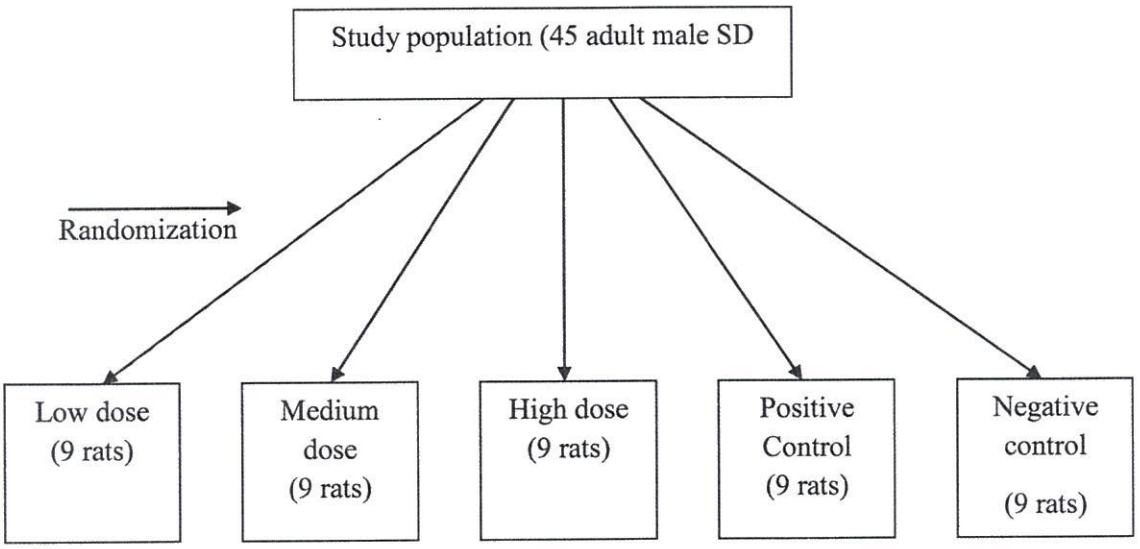



**Figure 3: Randomization of experimental animals**

### 3.3.8 Pilot study

A pilot study was conducted using four Sprague-Dawley rats to assess the feasibility of the study procedures and train the research team in the experimental protocols. This preliminary phase allowed the research assistants to become proficient in key techniques, including reading volume measurements from Richter drinking bottles, weighing animals and food accurately, administering the study questionnaire, humanely handling animals, and performing routine cage cleaning.

Additionally, the pilot study was used to assess the acute toxicity of the *Dracaena fragrans* extract in rats using the "up-and-down" procedure outlined in the OECD Guidelines for the Testing of Chemicals [200]. This toxicity assessment enabled the determination of the dosage range to be used in the main experiment. The highest dose that was found to be safe in the

toxicity test was designated as the maximum dose. The medium dose was calculated as one-tenth of the maximum dose, while the minimum dose was determined by dividing the maximum dose by one hundred. These dosing levels informed the stratification of treatment groups in the main experimental study.

### 3.3.9 Experiment procedure

**Free-choice bottle model**

The free-choice bottle model [201, 202] was employed in this study. This self-administration approach allows experimental animals to voluntarily consume alcohol orally, making it particularly appropriate for alcohol addiction research. The model is non-invasive and mirrors the natural route of alcohol intake in humans. In this method, animals are presented with one or more bottles containing ethanol and water, enabling researchers to assess voluntary and spontaneous alcohol consumption without compulsion. Specifically, Sprague-Dawley rats in this study were offered two bottles: one containing 10% v/v diluted ethanol and the other containing water. This setup provided the rats with a free choice between alcohol and water. Standard food pellets were made continuously available within the cages throughout the experiment. A 10% v/v alcohol solution was prepared by measuring 10 milliliters of absolute (100%) ethanol and adding distilled water gradually until the total volume reached 100 milliliters. This ensured that ethanol constituted 10% of the final solution by volume. Care was taken to mix thoroughly and measure accurately using a graduated cylinder.

**Acclimation Phase:** To facilitate adaptation to the drinking apparatus, the animals first received free access to water via drinking bottles for one day. This was followed by three consecutive days of free access to a 10% (v/v) ethanol solution. A 10% alcohol concentration is commonly

used in animal studies to balance palatability, voluntary intake, and translational relevance to human alcohol consumption. A 10% ethanol solution is generally well-tolerated and palatable for rodents, encouraging voluntary drinking without causing aversion[203]. Lower concentrations may not produce sufficient intake or blood alcohol levels, while higher concentrations can reduce consumption due to taste aversion or toxicity. This concentration allows animals to achieve blood ethanol concentrations that are comparable to those seen in human mild to moderate alcohol use, supporting the face and construct validity of animal models for alcohol use disorder[204]. Using a standard concentration like 10% enables reproducibility and comparability across studies, facilitating the evaluation of interventions and the understanding of neurobiological mechanisms underlying excessive alcohol consumption[205].

**Choice period:** During the choice phase, each rat was given free access to two drinking bottles: one containing water and the other containing a 10% (v/v) ethanol solution. This phase lasted for 35 consecutive days. The rationale for employing a 35-day choice period was based on several considerations. The extended choice period allowed modeling chronic exposure, enabling observation of the development and maintenance of alcohol preference and consumption patterns over time, which reflects the chronic nature of alcohol use disorder in humans. The longer duration also ensured stabilization of the rats' drinking behavior, allowing transient fluctuations in intake to subside, thereby providing a more accurate measure of stable, voluntary alcohol consumption and preference. A prolonged access period improved the translational relevance of the experiment by mimicking the extended access and choice humans have with alcohol, thereby enhancing the validity of the findings for human applications.

To eliminate potential side bias in consumption patterns, the positions of the alcohol and water bottles were alternated daily. On day one, alcohol was placed on the right and water on the left,

while the positions were reversed on day two. This alternating pattern was maintained throughout the study period. Each rat was weighed every Monday, Wednesday, and Friday between 8:00 and 9:00 a.m., and cage cleaning occurred concurrently. Throughout the experiment, food pellets were provided ad libitum.

### 3.3.10 Plant material, extraction and administration

*Dracaena fragrans* specimens were collected from Bushenyi District, located approximately 70 kilometers from Mbarara University of Science and Technology, the study site. The botanical identity of the species had been confirmed during a preceding ethnopharmacological survey using the International Plant Names Index [206], where it registered the highest frequency of citation among reported plants.

**Extract preparation:** The extract was prepared at the Mbarara University Pharmaceutical Sciences Laboratory, which is equipped for such procedures. Seeds of *Dracaena fragrans* were oven-dried at 50°C for 48 hours and then pulverized mechanically into a fine powder. Approximately 500 grams of the powder were macerated in 5000 mL of 70% ethanol for 72 hours. The macerate was filtered, and the filtrate was concentrated under reduced pressure at 35°C using a rotary evaporator. The resulting concentrate was lyophilized into a stable powder, which was stored in amber bottles to protect against light and preserve integrity for subsequent use.

**Administration of the extract**

The rats in the experimental arm were administered respective doses of the plant extract between 9:00 and 10:00 am during the 35 days of the choice period. Control group animals received the vehicle solution and disulfiram following the same schedule. Dosing was performed via oral

gavage using specialized ball-tipped 16-gauge gavage needles. This technique has been previously utilized in similar studies [154, 207, 208]. The ball-tipped needles are designed for use in experimental rats and mice. The procedures were carried out by trained personnel to ensure safe and accurate delivery of the substances without harm to the animals' gastrointestinal tissues.

### 3.3.11 Measurements

**Weights:** Each rat was weighed on Mondays, Wednesdays, and Fridays between 9 and 10 am using a digital small animal weighing scale. Weights were recorded in grams and rounded to one decimal point.

**Daily alcohol and water intake:**

Fluid intake was measured at 6 and 24 hours after the extract or vehicle was administered. Consumption was calculated by subtracting the volume remaining in the graduated Richter tubes from the previously recorded volume.

**Daily food intake**

The quantity of food consumed was measured 24 hours after the administration of extract or vehicle, with all measurements recorded accordingly.

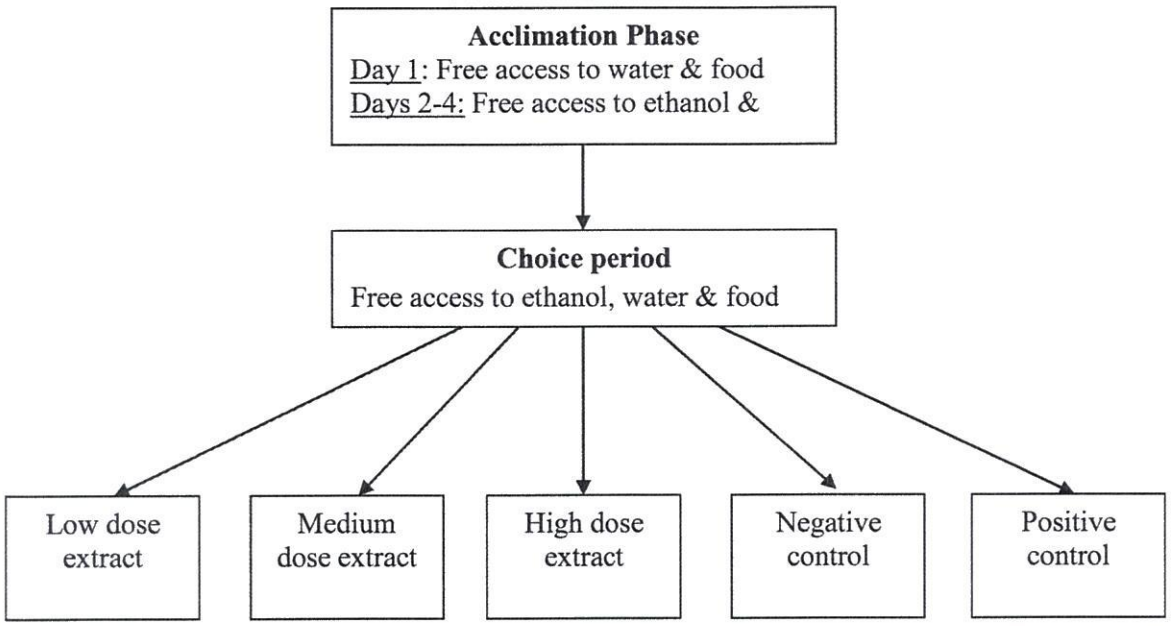



**Figure 4: Experiment procedure**

### 3.3.12 Data analysis

To examine the effects of the plant extract on the amount of alcohol drunk by the rats and alcohol preference to water, the repeated measures analysis of variance (RM-ANOVA) was conducted to determine if the mean differences between dependent variables exist between the experimental and control groups. The repeated measures analysis of variance is an appropriate statistical analysis in this study as it involved the comparison of group means that were generated from continuous variables repeatedly over time. For this research, the continuous dependent variables are the amount of alcohol drunk by the rat and the alcohol to water preference; the independent variables were the low, medium and high dosages of the plant extract.

## 3.4 Tiangulation

Methodological triangulation was employed to enhance the validity and reliability of the study findings. Three complementary approaches were used. First, an ethnopharmacological survey was conducted with Traditional Medicine Practitioners (TMPs) to document medicinal plants and practices used in the management of alcohol-related disorders. Second, in-depth interviews were conducted with individuals who had received plant-based treatments from TMPs to capture their self-reported treatment outcomes and experiences. Third, an experimental rat model was used to evaluate the effects of the most cited plant species (*Dracaena fragrans*) extract on alcohol consumption, providing objective preclinical evidence of efficacy. Data source triangulation was achieved by drawing information from practitioners, treated clients, and laboratory experiments. Investigator triangulation was incorporated by involving multiple trained research assistants in data collection, transcription, and analysis. This multi-pronged approach enabled convergence of evidence from qualitative, quantitative, and experimental perspectives, thereby strengthening the credibility and depth of the study's conclusions. Triangulation was particularly important in this ethnopharmacological context, as it bridged traditional knowledge with scientific validation, ensuring that findings were both culturally grounded and empirically robust. Triangulation of the results was conducted by integrating findings from the ethnopharmacological survey, in-depth interviews, and experimental rat model. Convergence was observed, where the most frequently cited plant by Traditional Medicine Practitioners, *Dracaena fragrans*, was also associated with measurable reductions in alcohol consumption in the laboratory model.

## 3.5 Ethical Considerations

This study adhered to established ethical guidelines throughout its implementation. All participants provided individual written informed consent before participating. To enhance comprehension, the consent form was translated into Runyankore-Rukiga. The consent form was read aloud verbatim for participants who were not formally educated and unable to read or write, and those who agreed to participate indicated consent by affixing a thumbprint. Ethical approval was obtained from the Mbarara University Research Ethics Committee (MUST-REC), approval number #39/02-20, and the study was registered with the Uganda National Council for Science and Technology (UNCST), registration number #HS981ES.

*Ethics in the Ethnobotanical Survey:* Each Traditional Medicine Practitioner involved in the study provided written informed consent, using forms translated into Runyankore-Rukiga. Access to TMPs was granted following formal permission from the Bushenyi district authorities and the leadership of the Bushenyi Medical and Traditional Healers Association. The research team respected the cultural context and ensured that no plants were collected from sites of spiritual significance. The study prioritized equitable benefit-sharing. If any medicinal material proves marketable, the local communities from which the plants were obtained will be involved in benefit-sharing arrangements in collaboration with Mbarara University. Participating TMPs will also be provided with any developed herbal remedy free of charge for a mutually agreed period. If collected plants are to be used beyond the scope of this research, additional consent from the TMPs was obtained.

The TMPs were formally acknowledged in the research report and related scientific publications. Plant collection was conducted with conservation in mind, avoiding depletion of local plant

populations. Specific permissions were secured for collecting cultivated or managed plants. TMPs received modest compensation for their time, and any patients who had not benefited from traditional treatment were referred to the Mbarara University Alcohol Treatment Service. The principal investigator and research assistants also provided brief intervention therapy during recruitment.

Ethics in the Use of Experimental Animals: The study complied with the "3Rs" principles (Replacement, Reduction, Refinement) outlined in the Uganda National Council for Science and Technology guidelines[197]. Replacement: Sprague-Dawley rats were chosen as the most ethically suitable model due to their capacity to mimic complex human alcohol-related behaviors, such as craving, binge drinking, withdrawal, and relapse, which cannot be modeled using invertebrates. Reduction: The sample size was scientifically calculated to ensure the smallest number of animals necessary to achieve statistical validity, avoiding wasteful use. Refinement: All experimental procedures were designed to minimize animal pain and distress. Personnel handling the animals were trained in humane handling and restraint techniques and were instructed to recognize signs of distress or illness. The principal investigator completed a National Institutes of Health (NIH) training course on research involving animal subjects (certificate attached as Appendix 11). To prevent direct contact with animal excreta or fur, animal handlers were provided with protective equipment, including gloves, aprons, and facemasks. In case of allergic reactions or other health issues, personnel were referred for medical attention at Mbarara Regional Referral Hospital. The animals were housed in a clean, hygienic environment with regular cleaning and bedding changes, following a defined routine. Ethical oversight of the animal component of the study was provided by MUST-REC, which

retained the right to inspect the animal facility with or without prior notice. Experimental animals were closely monitored for any adverse reactions throughout the study.

At the end of the experiment, all animals were handled following established ethical guidelines for the care and use of laboratory animals. They were humanely euthanized using methods approved by the Mbarara University Research and Ethics Committee to minimize pain and distress. This procedure ensured compliance with relevant animal welfare regulations and allowed for the safe collection of tissues for subsequent analyses.

# 4 CHAPTER FOUR: RESULTS

## 4.1 Results Objective 1

The study enrolled a total of 44 participants. The mean age was 47 years, with the youngest person treated being 23 years old and the oldest being 80 years old. The majority of the participants (70.5%, 31/44) were male. The details are in Table 3 below.

**Table 3: Socio-demographics and treatment outcomes of patients treated by traditional medicine practitioners using plant derivatives in southwestern Uganda**

| Socio-demographic characteristic | Frequency | % |
|---|---|---|
| **Sex** | | |
| Male | 31 | 70.5 |
| Female | 13 | 29.5 |
| **Main Occupation** | | |
| Formally employed | 16 | 36.4 |
| Farmer | 17 | 38.6 |
| Business | 7 | 15.9 |
| Retired | 1 | 2.3 |
| Other | 3 | 6.8 |
| **Education** | | |
| No formal education | 11 | 25.0 |
| Primary | 16 | 36.4 |
| Secondary | 10 | 22.7 |
| Tertiary | 7 | 15.9 |
| **Marital status** | | |
| Married | 30 | 68.2 |
| Single | 8 | 18.2 |
| Widowed | 6 | 13.6 |
| **Religious affiliation** | | |
| Catholic | 15 | 34.1 |
| Protestant | 21 | 47.7 |
| Pentecostal | 5 | 11.4 |
| Moslem | 2 | 4.5 |
| Seventh Day Adventist | 1 | 2.3 |
| **Treatment outcomes** | | |
| Stopped alcohol drinking | 41 | 93.2 |
| Continued to drink alcohol | 3 | 6.8 |

### History of alcohol drinking

Types of alcohol drunk by the participants before seeking treatment from the Traditional medicine practitioners: The study found out that most participants drank more than one type of alcohol, often mixing locally brewed and factory-manufactured alcohol. The most typical kind of alcohol consumed was spirits (both factory-made and home-made), which was drunk by 86.2% (38/44) of the participants. Other forms of alcohol drunk were tonto and kwete (locally brewed alcoholic beverages), used by 65.8% (27/41) of participants, while only a few drank beers. About half of the participants regularly drank more than one type of alcohol.

Duration of alcohol drinking before seeking treatment: In this study, it was found that many of the participants had been drinking alcohol for many years before seeking treatment from the traditional healers. The majority of the participants (84.1%, 37/44) had been drinking for 5 or more years before seeking treatment for alcohol related problems from the TMP. The participants had a mean of 14 years' duration of alcohol drinking before being treated with the shortest duration of 1 year and the longest 46 years.

### Reasons for seeking treatment

Participants in the in-depth interviews were asked to share the reasons why they sought treatment from the TMPs. The analysis, guided by a set of a priori themes, revealed participants' reasons for seeking treatment. Under **health-related concerns**, participants described seeking treatment from Traditional Medicine Practitioners due to recurrent illnesses, alcohol-related accidents, loss of consciousness, and fears of contracting HIV through risky sexual behavior while intoxicated. **Economic consequences** were evident in narratives of job loss, misused income, and the inability to meet basic needs. Within the theme of **family problems**, participants spoke of strained relationships, domestic violence, neglect of family responsibilities, and a fear of losing

their partners or children. Finally, the theme of **social shame and community stigma** captured feelings of embarrassment and disgrace while drunk. This was particularly pronounced among Muslim participants, who expressed deep concern about violating religious norms.

**Health-related concerns:**

Numerous participants sought treatment from the TMPs following involvement in accidents while drunk, some had repeated hospitalizations, loss of consciousness arising from excessive alcohol intake and suffered physical illnesses related to alcohol. Others were involved in risky sexual behaviors while drunk and feared they would contract HIV. One participant narrated:

> *'I got in an accident and lost teeth while drunk, I was also sleeping on an empty stomach because whenever I would drink, I would lose my appetite for food, I had lost weight.'* P21.

> *'I had several warnings from my boss at work because of being a drunkard, I was even scared that I could be HIV positive because I would sleep with different women whenever I would get drunk, I almost lost my marriage so I decided to ask my friends to refer to any healer and they referred me to a man who healed me'* P16.

**Economic consequences**

Many of the participants also reported having sought care from the TMPs due to alcohol related wastage of money, loss of jobs and income following excessive alcohol drinking. One participant had this to say: *'...they stole my money like I told you. But what hurts me most when I recall is the way I lost my job in Mbarara and I left without being paid my salary'* P23.

**Family problems**

Many of the participants decided to see traditional medicine practitioners for treatment due to repeated family problems arising from drinking behavior, predominantly violence towards the spouse and children. One participant said:

> *'I realized that my family was falling apart because I was not caring for my wife and children. My wife was ever complaining and she would have left be by now'* P12

**Social shame and community stigma**

Several participants went to see the TMPs for alcohol treatment after having been feeling they were a shame and nuisance in the community. Some had been spending nights outside in the cold after failing to reach home while drunk, been a nuisance in the community by displaying shamming behavior while drunk, while others thought they were a shaming fellow Muslims who are not expected to drink alcohol. A female participant reported:

> *'...there is a problem, they do not respect anybody who takes alcohol. And if you are a Moslem and you take alcohol, the community see you as a shame because they know that Moslems are not supposed to take alcohol'* P22.

**Treatment outcomes**

Abstinence from alcohol following treatment by the TMP: The majority of the participants (93.3%, 41/44) abstained from drinking after treatment by the TMPs using plant derivatives, with only 6.7% (3/44) of those treated continuing to drink but of less amounts. The longest reported duration of abstinence from alcohol after treatment for drinking by a TMP was 46 years, while the shortest was 1 year.

**Perceived benefits following alcohol abstinence**

In addition to abstinence from drinking alcohol, the participants described improvement in their lives. The theme of **improved health** was common, with many participants reporting better sleep, youthful appearance, relief from recurrent illnesses, and, for some men, the return of sexual vitality. Under **better family function**, participants described restored relationships and maintaining a more stable and harmonious home environment. **Improved productivity** was also widely reported, with participants describing their ability to save money, stop selling household items, return to work or school, and invest in income-generating activities. Finally, participants spoke of **an improved image in the community**, noting that they were now seen as responsible, respected, and trustworthy individuals.

**Improved health**

Most participants described improvement in physical health following stopping alcohol drinking. They reported better sleep, looking healthier and younger and no longer suffering from repeated common ailments while some of the men reported they had regained their 'manhood'.

One participant said:

> *'I got healthier and stronger to do my work after stopping alcohol, I got more committed to my family, I get good sleep and even now I look younger'* P11

**Better family function**

Most participants interviewed reported improved family function following abstinence from alcohol after being treated by the TMPs. They reported partners and children feeling happy, some were reunited with their spouses whom they had separated with due to problem alcohol

drinking, others got married and having a stable family was cited by many participants as a benefit. A participant in an in-depth interview said:

> *'My home is now clean because I have the time to make it neat, I take care of my grandchildren and my husband very well. Even I look healthy I never used to eat because all the time I would be thinking of going to look for alcohol'* P17.

**Improved productivity**

Majority of the participants reported that they became productive and improved their lives. Some participants cited going back to school, retaining jobs, stopped selling household property, several reported saving money and building better houses for their families.

One participant had this to say when asked about benefits of stopping alcohol drinking following treatment by the healer:

> *'I built a house, I now have goats, I have two boda-bodas' (motorcycle taxis) and generally there is a big change'* P13

**Improved image in the community**

Some of the participants appreciated that their image in the community had been restored following treatment by the TMPs for problem drinking. They reported that they can now be trusted, respected, and were presentable as better dressed, as this participant said:

> *'I started saving my money, I built a permanent house, my children started respecting me as their father. My children have all finished school. I also now have respect from the community'* P40.

## 4.2 Results Objective 2

### Sociodemographic Characteristics of the Traditional Medicine Practitioners

Fifty traditional medicine practitioners were enrolled in the study. The ages of the TMPs ranged from 34 to 98 years, with a mean age of 67. The 25th percentile age was 59 years, indicating that three-quarters of the traditional healers were older than 59 years. The mean experience of the TMPs was 31 years, while the 50$^{th}$ percentile years of experience in traditional healing was 30, indicating that half of the healers had more than 30 years of experience in traditional healing. Approximately two-thirds of the TMPs (33/50, 66%) were female. Most participants (42/50, 84%) either did not receive formal education or had completed only primary education. Nearly all (46/50, 92%) were engaged in additional occupations alongside their traditional medicine practices, primarily in peasant farming and informal businesses. Only four of the participants exclusively practiced traditional medicine without any other occupation. Details of the socio-demographic characteristics are in Table 4 below:

**Table 4: Sociodemographic characteristics of Traditional Medicine Practitioners managing alcohol-related disorders in Bushenyi District**

| Socio-demographic | Frequency (n=50) | % |
|---|---|---|
| **Sex** | | |
| Female | 33 | 66.0 |
| Male | 17 | 34.0 |
| **Education** | | |
| No formal education | 23 | 46.0 |
| Primary | 19 | 38.0 |
| Secondary | 4 | 8.0 |
| Tertiary | 4 | 8.0 |
| **Marital status** | | |
| Married | 28 | 56.0 |
| Widowed | 21 | 42.0 |
| Single | 1 | 2.0 |
| **Religion** | | |
| Protestant | 16 | 32.0 |
| Catholic | 24 | 48.0 |
| Moslem | 8 | 16.0 |
| Born Again | 2 | 4.0 |
| **Other main occupation** | | |
| Farming | 28 | 56.0 |
| Business | 5 | 10.0 |
| Formal employment | 5 | 10.0 |
| Traditional birth attendant | 2 | 4.0 |
| Crafts | 1 | 2.0 |
| Retired | 1 | 2.0 |
| None | 8 | 16.0 |
| **Tribe** | | |
| Munyankole | 40 | 80.0 |
| Muganda | 3 | 6.0 |
| Other tribes | 7 | 10.0 |

**Plant Identification**

The total number of plant species identified were 25 belonging to 20 families (Figure 5 below). Asteraceae was the predominant family.

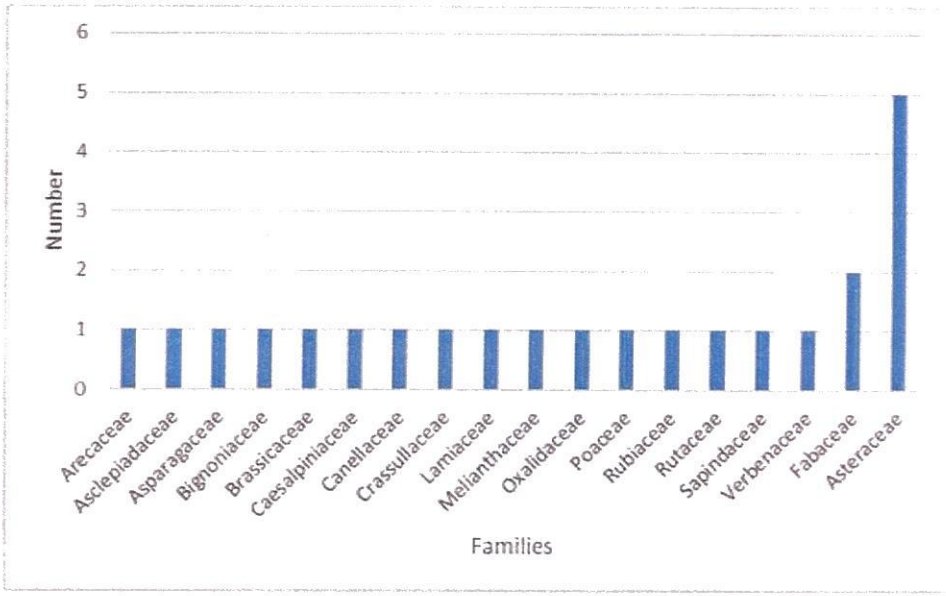



**Figure 5: Families of plants used by Traditional Medicine Practitioners for treating alcohol-related disorders**

The four most commonly used ethnomedicinal plant species were *Dracaena fragrans* (L.) Ker Gawl., *Coffea canephora* Pierre ex A. Froehner, *Saccharum officinarum* L. *and Melanthera scandens* (Schumach. & Thonn.) Brenan (Details in Tables 5a and 5b below).



*Dracaena Fragrans*
Picture taken on 20th December 2021

**Table 5a: Medicinal plant species used by TMPs in treating alcohol-related problems in Bushenyi district**

| Scientific name and Voucher number | Local name (Runyankore) | Family | Life form | Part (s) used | Frequency of Citation (FC) | Conservation status | Relative Frequency citation (RFC) |
|---|---|---|---|---|---|---|---|
| *Dracaena fragrans* (L.) Ker Gawl., SM2 | Omugorora | Asparagaceae | Shrub | Flowers Seeds Leaves | 29.7 | Common | 0.44 |
| *Coffea canephora* Pierre ex A. Froehner, SM1 | Coffee /omubarama/Omwani | Rubiaceae | Tree | Flowers Leaves | 25.7 | Common | 0.38 |
| *Saccharum officinarum* L., SM7 | Sugarcane/Ekikwaijo | Poaceae | Grass | Flowers | 6.8 | Common | 0.10 |
| *Melanthera scandens* (Schumach. & Thonn.) Roberty, SM18 | Ekarwe | Asteraceae | Herb | Leaves | 4.1 | Common | 0.06 |
| *Bersama abyssinica* Fresen., SM4 | Omukaka | Melianthaceae | Herb | Leaves | 2.7 | Common | 0.04 |
| *Erythrina abyssinica* Lam., SM12 | Ekiko | Fabaceae | Shrub | Flowers | 2.7 | Common | 0.04 |
| *Kigelia africana* (Lam.) Benth., SM6 | Omusha/omwisya | Bignoniaceae | Shrub | Leaves Flowers | 2.7 | Rare | 0.04 |
| *Solanecio cydoniifolius* (O.Hoffm.) C.Jeffrey, SM11 | Irarira | Asteraceae | Shrub | Roots | 2.7 | Rare | 0.04 |
| *Solanecio mannii* (Hook. fil.) C.Jeffrey, SM22 | Engango | Asteraceae | Tree | Leaves | 2.7 | Common | 0.04 |
| *Biophytum abyssinicum* Steud. ex A.Rich., SM9 | Irango | Oxalidaceae | Herb | Root | 1.4 | Rare | 0.02 |
| *Brassica oleracea* L. var. *capitata* f. *rubra* DC, SM3 | Purple Cabbage head | Brassicaceae | Herb | Leaves | 1.4 | Common | 0.02 |
| *Clerodendrum myricoides* R.Br., SM8 | Omukuzanyana | Lamiaceae | Shrub | Flowers Fruits | 1.4 | Rare | 0.02 |
| *Dodonaea viscosa* (L.) Jacq., SM25 | Omusambya | Sapindaceae | Herb | Leaves | 1.4 | Common | 0.02 |

**Table 6b: Medicinal plant species used by TMPs in treating alcohol-related problems in Bushenyi district**

| Scientific name and Voucher number | Local name (Runyankore) | Family | Life form | Part (s) used | Frequency of Citation (FC) | Conservation status | Relative Frequency o citation (RFC) |
|---|---|---|---|---|---|---|---|
| *Gomphocarpus physocarpus* E.Mey., SM21 | Kashaho/Kanyamate | Asclepiadaceae | Herb | Leaves | 1.4 | Rare | 0.02 |
| *Kalanchoe pinnata* (Lam.) Pers., SM16 | Ereka | Crassulaceae | Herb | Roots | 1.4 | Common | 0.02 |
| *Lantana trifolia* L., SM15 | Omuhukye | Verbenaceae | Shrub | Leaves | 1.4 | Common | 0.02 |
| *Momordica foetida* Schumach., SM14 | Ebombo | Cucurbitaceae | Vine | Leaves | 1.4 | Common | 0.02 |
| *Phoenix reclinata* Jacq., SM23 | Ekikindo | Arecaceae | Tree | Leaves | 1.4 | Common | 0.02 |
| *Rumex usambarensis* Dammer ex Peter, SM5 | Omuka | Polygonaceae | Shrub | Leaves | 1.4 | Common | 0.02 |
| *Senna didymobotrya* (Fresen.) H.S.Irwin & Barneby, SM17 | Omugabagaba | Caesalpiniaceae | Tree | Leaves | 1.4 | Common | 0.02 |
| *Tephrosia nana* Kotschy ex Schweinf., SM24 | Abati muruku | Fabaceae | Tree | Leaves | 1.4 | Common | 0.02 |
| *Vernonia brachycalyx* O.Hoffm., SM19 | Omuhe | Asteraceae | Herb | Roots | 1.4 | Common | 0.02 |
| *Vernonia lasiopus* O. Hoffm., SM13 | Omujuma | Asteraceae | Herb | Leaves | 1.4 | Common | 0.02 |
| *Warburgia ugandensis* Sprague, SM10 | Omwiha | Canellaceae | Tree | Bark | 1.4 | Rare | 0.02 |
| *Zanthoxylum gilletii* (De Wild.) P.G.Waterman, SM20 | Omuremankobe/Omurema | Rutaceae | Tree | Bark | 1.4 | Rare | 0.02 |

**Life forms of the plants used by Traditional Medicine Practitioners to manage people with alcohol-related disorders**

The most prevalent life form of plants employed was the herbs (36%), while grasses (4%), were the least frequently utilized, as depicted in Figure 6 below.

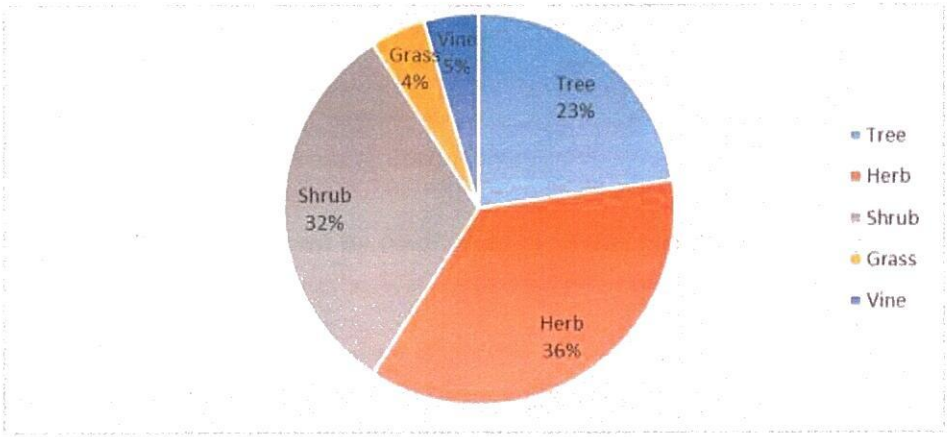



Figure 6: Life forms of plants used by traditional medicine practitioners to treat alcohol-related disorders

**Plant parts used by Traditional Medicine Practitioners in Bushenyi District to manage people with alcohol-related disorders**

Leaves (48%) were the most utilized plant parts, while fruits and seeds were the least used, each contributing only 4%, as depicted in Figure 7 below.

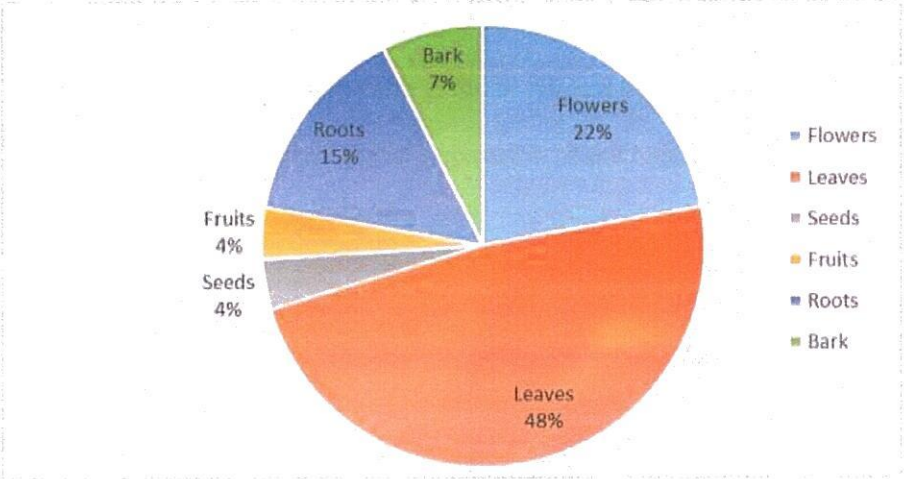



**Figure 7: Plant parts used by traditional medicine practitioners in the treatment of alcohol-related disorders**

**Methods used to prepare and administer plant materials**

Among the 50 Traditional Medicine Practitioners interviewed, 40% exclusively utilized a single plant, 38% combined two plants, and 19% mixed three or four plants to prepare herbal remedies for alcohol. Traditional healers utilize four methods to prepare medicinal plant remedies. The decoction method involved the prolonged boiling of plant parts, such as roots, bark, or seeds, in water to extract medicinal compounds. Tinctures were made by immersing plant parts in alcohol or a mixture of alcohol and water. Additionally, plant materials were dried and processed into powders for application. Finally, certain healers employed the technique of pounding or squeezing fresh plant parts to extract beneficial juices. The most prevalent methods used by the Traditional Medicine Practitioners for preparing medicinal plant remedies were squeezing or pounding plant parts to extract juice, utilized by 41% of the healers, and the least was tincturing, used by only 8% of the healers. In terms of administering the powder or juice, all the TMPs, except one, mix 1-2 spoonfuls with alcohol, which was then given to the patient for

consumption. The sole exception to this practice involved a TMP who combined the powder with a ripe banana, forming a paste given to the patient for ingestion. Figure 8 below shows the methods used by the healers in the preparation of the medicinal plant parts.

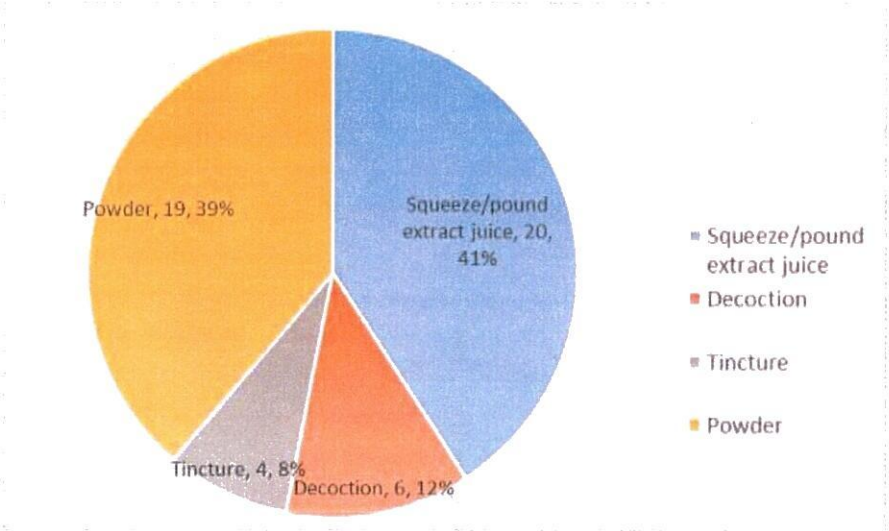



**Figure 8: Methods used by traditional medicine practitioners to prepare medicinal plants for treating alcohol-related disorders**

**Quantitative Ethnobotany**

The Relative Frequency of Citation (RFC) in this survey ranged between 0.02 and 0.44. Based on this RFC data, the four most commonly used ethnomedicinal plant species were *Dracaena fragrans* (0.44), *Coffea canephora* (0.40), *Saccharum officinarum* (0.1) and *Melanthera scandens* (0.06).

The Informant Consensus Factor (ICF) was calculated using the following formula: ICF = ($N_{ur}$ - $N_t$)/ ($N_{ur}$ -1), where $N_{ur}$ is the number of use reports or mentions and $N_t$ is the number of species used. In this study, $N_{ur}$ was 74, and $N_t$ was 25. Therefore ICF = $(74 - 25)/(74 - 1)$ =0.67

## 4.3 Results Objective 3

**Distribution of data:** A Strip chart and a Box and whisker plot were used to compare data distributions across small, medium, and high doses of the *Dracaena fragrans* extract.

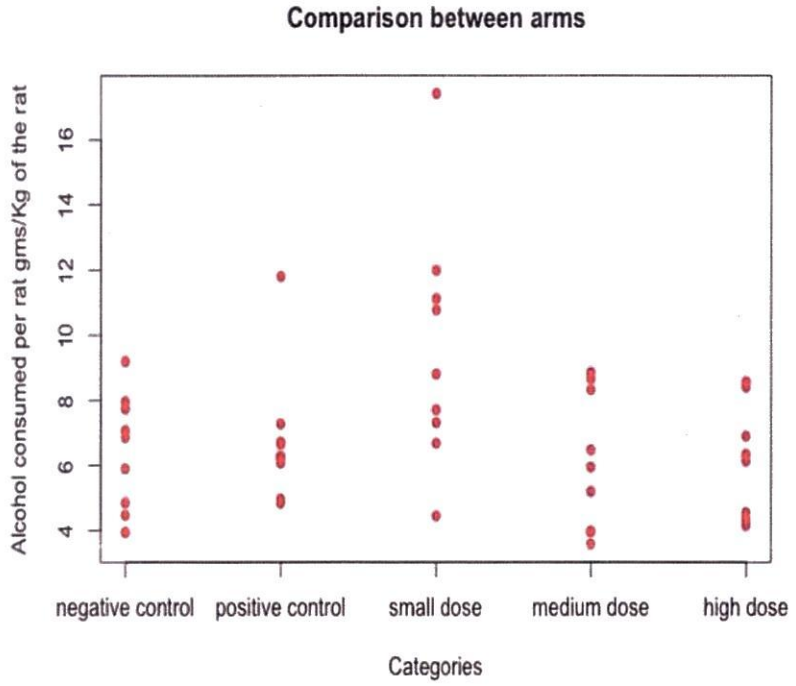



**Figure 9: Strip chart of amounts of alcohol consumed by rats**

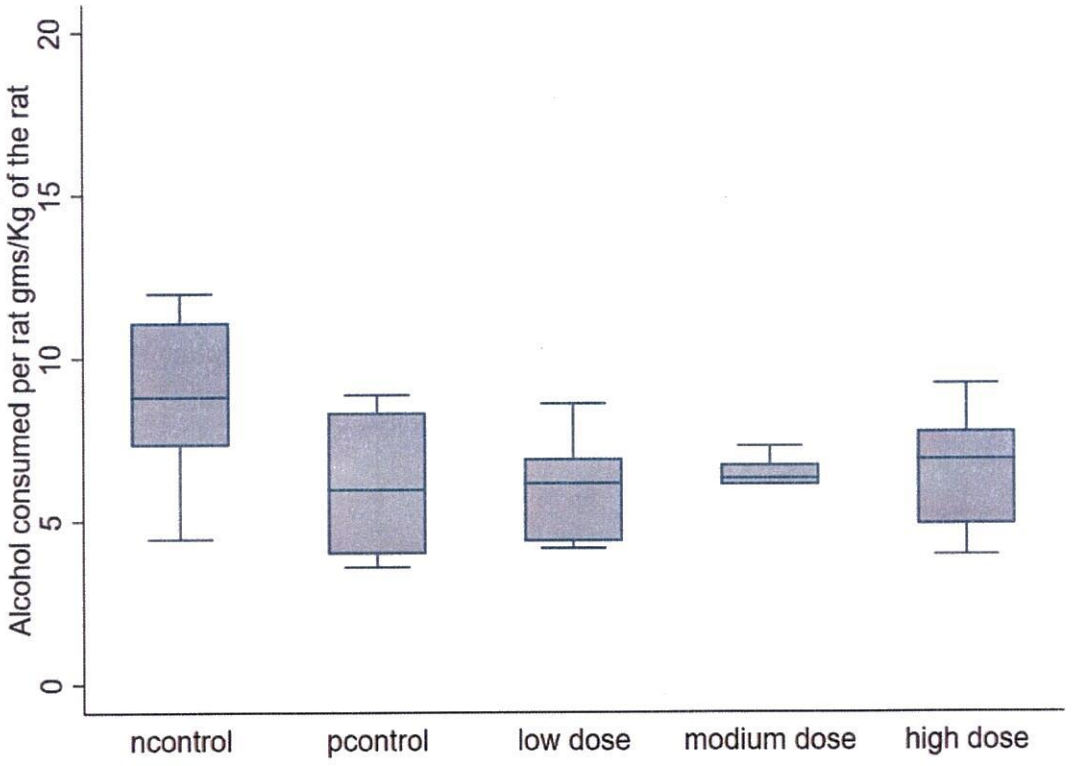



**Figure 10: Box and whisker plot comparison of amounts of alcohol consumed by rats across control and small, medium, and high extract doses.**

The negative and positive control groups show higher consumption variability, while the medium dose group shows the least variability.

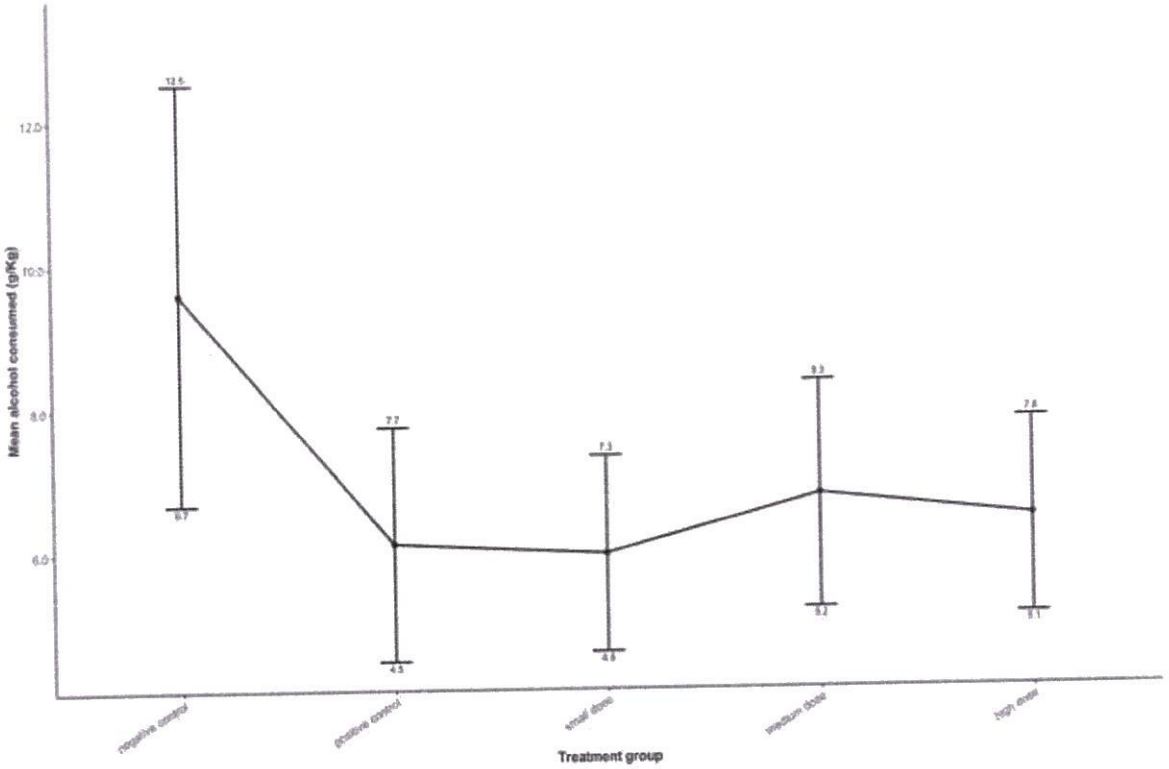



**Figure 11: Plot of means of alcohol consumed by rats with 95% Confidence Intervals**

The mean amounts of alcohol consumed by rats administered small, medium, and high doses are lower than the control. The high and medium doses have slightly higher means than the positive control, while the small dose has a slightly lower mean.

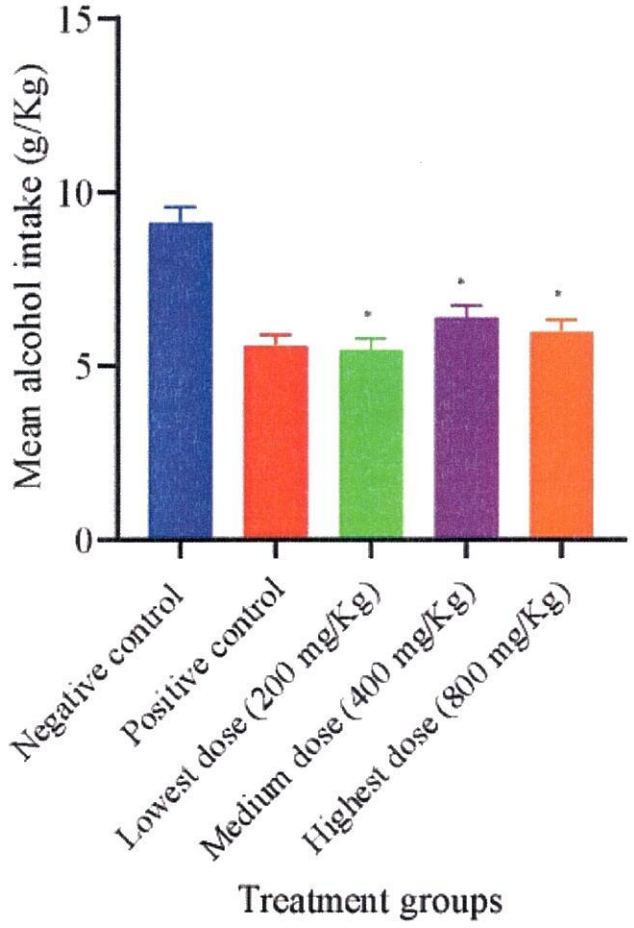



**Figure 12: Mean daily alcohol intake.**

(Data are expressed as Mean ± SEM; n = 9; * - $p < 0.05$ vs negative control group).

**Amount of alcohol drunk/ rat/ kg by dose of medicinal extract compared to the negative control**

The study tested if there was a statistically significant difference in the amounts of alcohol consumed between the adult male Sprague-Dawley rats that were given low, medium, and high doses of *Dracaena fragrans* extract compared to those that received only a solvent (negative control).

**Table 7: Alcohol consumed by *Sprague-Dawley* rats administered doses of *Dracaena fragrans* extract**

| Extract doses | N | Mean (SD) of alcohol drank/ Rat/ Kg | Mean Difference (SE) | t | P value |
|---|---|---|---|---|---|
| Low dose | 9 | 5.45 (1.66) | -3.66 (1.36) | -2.696 | 0.016* |
| Solvent | 9 | 9.11 (3.72) | | | |
| Medium dose | 9 | 6.39 (2.22) | -2.73 (1.45) | -1.885 | 0.078 |
| Solvent | 9 | 9.11 (3.72) | | | |
| High dose | 9 | 5.98 (1.74) | -3.13 (1.37) | -2.284 | 0.036* |
| Solvent | 9 | 9.11 (3.72) | | | |

The null hypotheses that '*there is no statistically significant difference in the amounts of alcohol consumed between the adult male Sprague-Dawley (SD) rats that are given a medicinal extract and those that receive only a solvent (negative control)*' was rejected for low and high doses of the medicinal extract but could not be rejected for medium dose of the medicinal extract. As the dose of the herbal medicinal extract increased from low through medium to high doses, alcohol

consumption by the rats rose from low dose to medium dose and then declined from medium to high dose.

**Alcohol to water preference**

**Table 8: Alcohol to water preference of the *Sprague-Dawley* rats across *Dracaena Fragrans* extract vs negative control**

| Extract doses | N | Mean (SD) of alcohol to water preference | Mean Difference (SE) | t | P value |
|---|---|---|---|---|---|
| Low dose | 9 | 30.25 (5.47) | -5.47 (2.74) | -1.995 | 0.063 |
| Solvent | 9 | 35.72 (6.14) | | | |
| Medium dose | 9 | 36.80 (10.02) | 1.08 (3.92) | 0.275 | 0.787 |
| Solvent | 9 | 35.72 (6.14) | | | |
| High dose | 9 | 31.22 (4.71) | -4.50 (2.58) | -1.744 | 0.100 |
| Solvent | 9 | 35.72 (6.14) | | | |

There was no statistically significant difference in the alcohol to water preference between the Sprague-Dawley rats that were given small, medium, and high doses of the *Dracaena fragrans* extract and those that received a negative control. The null hypothesis could not be rejected for all doses of the medicinal extract. As the dose of the medicinal extract increased from low through medium to high doses, water preference of the rats rose from low dose to medium dose and then declined from medium to high dose.

**Alcohol drunk/rat/kg by dose of medicinal extract compared to a positive control**

The study determined if there was a statistically significant difference in the amounts of alcohol drunk between the adult male Sprague-Dawley rats that were given small, medium, and high doses of *Dracaena fragrans* extract and those that received disulfiram (positive control).

**Table 9: Alcohol amounts consumed by Sprague-Dawley rats administered doses of *Dracaena fragrans* extract vs positive control**

| Extract doses | N | Mean (SD) of alcohol/ Rat/ Kg | Mean Difference (SE) | t | p-value |
|---|---|---|---|---|---|
| Low dose | 9 | 5.45 (1.66) | -0.14 (0.89) | -0.155 | 0.879 |
| Positive Control | 9 | 5.59 (2.09) | | | |
| Medium dose | 9 | 6.39 (2.22) | 0.80 (1.02) | 0.786 | 0.443 |
| Positive Control | 9 | 5.58 (2.09) | | | |
| High dose | 9 | 5.98 (1.74) | 0.40 (0.91) | 0.437 | 0.668 |
| Positive Control | 9 | 5.59 (2.09) | | | |

There was no statistically significant difference in the amount of alcohol drunk between the adult male Sprague-Dawley rats that were given small, medium, and high doses of *Dracaena fragrans* extract and those that received disulfiram.

**Alcohol to water preference of the *Sprague-Dawley* rats across *Dracaena Fragrans* extract vs positive control (Disulfiram)**

The study determined whether there was a statistically significant difference in the alcohol-to-water preference of the adult male Sprague-Dawley rats that were given low, medium, and high

doses of *Dracaena fragrans* extract compared to those that received only a positive control (Disulfirum). Details in Table 9 below:

**Table 10: Alcohol to water preference of the *Sprague-Dawley* rats across *Dracaena Fragrans* extract vs positive control**

| Extract doses | N | Mean (SD) of water preference | Mean Difference (SE) | t | P value |
|---|---|---|---|---|---|
| Low dose | 9 | 30.25 (5.47) | -0.51 (2.77) | -0.185 | 0.856 |
| Positive Control | 9 | 30.76 (6.26) | | | |
| Medium dose | 9 | 36.80 (10.02) | 6.04 (3.94) | 1.534 | 0.145 |
| Positive Control | 9 | 30.76 (6.26) | | | |
| High dose | 9 | 31.22 (4.71) | 0.46 (2.61) | 0.177 | 0.862 |
| Positive Control | 9 | 30.76 (6.26) | | | |

The null hypothesis that '*there is no statistically significant difference in the water preference between the adult male Sprague-Dawley (SD) rats that are given small, medium, and high doses of Dracaena Fragrans and those that receive disulfiram (positive control)*' could not be rejected. As the dose of the herbal medicinal extract increased from low through medium to high doses, the water preference of the adult male Sprague-Dawley rats rose from low dose to medium dose and then declined from medium to high dose.

# 5 CHAPTER FIVE: DISCUSSION

This study provides converging evidence from qualitative findings, ethnopharmacological data, and experimental findings, supporting the potential role of traditional plant-based remedies in managing alcohol-related problems. The use of plant-derived interventions, particularly those recognized and widely used by conventional medicine practitioners, may offer culturally acceptable, accessible, and potentially effective alternatives or complements to pharmacological approaches for alcohol use disorders.

In objective one of this study, we explored alcohol treatment outcomes and secondary benefits of people who were treated for alcohol-related problems by traditional medicine practitioners using plant derivatives in Southwestern Uganda. The participants' alcohol drinking history, abstinence from alcohol consumption following treatment, and the perceived benefits were assessed. Most of the participants interviewed reported having abstained from drinking alcohol following the treatment by the Traditional Medicine Practitioners. All the participants who stopped drinking alcohol enumerated several personal and social benefits. The study found that more males than females sought treatment for their drinking problems. Due to our non-random sampling strategy and small sample size, comparing this finding with those in other studies is not feasible. However, significantly higher alcohol use among men than women has been reported in Uganda and elsewhere [70, 209]. For example, at Butabika Mental Hospital in Uganda, males were the majority of the patients treated for alcohol use disorders[210]. The World Health Organization has also affirmed a similar pattern in that in Africa, females are less often current drinkers than males, and when women drink, they drink less than men[5]. The social, cultural, and religious norms and beliefs help to understand some of the alcohol consumption practices in Uganda.

Alcohol use is part of Ugandan cultural, spiritual, and social practices. Drinking alcohol is widespread in Uganda and is accepted among all socioeconomic groups; it is only seen as a problem if a person makes a nuisance of himself or others[211]. While drinking is socially acceptable for Ugandan men in bars and other public places, women are typically only allowed to drink at home or in their neighborhood, with friends or family, including their spouse or sexual partner[209, 211, 212]. In this study, for the first time in Uganda, to our knowledge, face-to-face, in-depth interviews were to demonstrate favorable treatment outcomes and perceived benefits by people who were treated by traditional healers for drinking problems in Southwestern Uganda.

Participants in this study reported drinking a mix of homemade and factory-brewed alcohol, with the majority drinking spirits. Most had been drinking for prolonged periods before seeking treatment. This pattern of alcohol drinking in Uganda, which is dominated by spirits, has been observed and reported before. The Uganda Youth Development Link organization, in its report on the 'state of alcohol abuse in Uganda,' shows that homemade spirits are the most consumed form of alcohol in Uganda[213]. A similar pattern is described by the Uganda Ministry of Health in the Uganda Alcohol Status Report – 2018[214].

Reasons for seeking help for alcohol drinking problems described by the participants ranged from suffering from medical problems, especially while drunk, social issues in the family, and loss of image in the community. Seeking help for drinking problems is reported to be rare in Uganda, except in emergencies, while experiencing life-threatening situations such as acute intoxication and loss of consciousness or after sustaining severe physical injuries[211]. Participants in our study cited similar reasons. Other findings in agreement with ours have been reported by Zewdu and others in Ethiopia[215]. Studies have also found that family, friends, and

neighbors together constituted the single largest group suggesting care to be sought; this is similar to what was reported by some of our participants[216].

This study found that most of the participants had been abstinent from alcohol for long periods following treatment by the traditional healers. Though abstinence is seen as the strongest evidence of recovery from harmful alcohol drinking, our evidence is not strong in this regard due to the small sample size. Publications on alcohol treatment outcomes by traditional medicine practitioners using plant derivatives are scarce. The data available are related to alcohol treatment outcomes following treatment at health facilities or addiction treatment centers. For instance, Kalema and others in Uganda report a very low abstinence rate of 21% after six months in people seeking care at alcohol treatment centers in Uganda[217]. Kalani and others at Butabika Mental Hospital in Uganda reported a high relapse rate of 63% among patients who were treated at the hospital's alcohol and drug unit[210]. All these fall below the abstinence rate that was found among people treated by traditional healers using plant derivatives in this study.

Participants in this study reported personal and social benefits upon stopping drinking. Most reported improved health, better relations with spouse and children, saving money earned, and improved image in the community. These results are consistent with other studies that show there are additional advantages to quitting drinking besides abstinence. Outcomes such as improved health, social well-being, occupation, and responsibility for one's life and family have been described in low and middle-income settings (Ramin Mojtabai, 2003; LaFave et al., 2008). The strength of this study is the use of in-depth interviews to document not only stopping drinking as an outcome of alcohol treatment, but also to describe reported perceived personal, family and societal benefits following abstaining from alcohol.

In the study's second objective, an ethnopharmacological survey was conducted to document the plants and associated practices employed by TMPs for treating alcohol-related disorders in Bushenyi District, southwestern Uganda.

**Participant characteristics**

The observation in this study that the majority of TMPs were women, and predominantly older, aligns with findings in various regions of Uganda [184, 218]. However, it is divergent from other studies that reported a predominant male presence [219, 220]. The higher representation of female traditional medicine practitioners compared to their male counterparts can be attributed to women taking on more roles as primary healthcare providers for their families, which aligns with societal traditions. Consequently, the responsibility of treating individuals with alcohol-related disorders often falls upon women. Furthermore, the notable representation of older individuals among the participants in this survey corresponds with observations in other studies conducted in Uganda and the wider region [221, 222]. Older individuals often possess extensive knowledge of medicinal plants and their uses, attributed to their prolonged and direct interaction with plant resources.

**Diversity of medicinal plants**

Our observation that the most utilized plant species employed by traditional medicine practitioners belonged to the Asteraceae family aligns with other studies in Uganda and other African regions which acknowledged its significant medicinal value [184, 223, 224]. These plants are widely distributed in Uganda and the chances of TMPs using them for medicinal purposes are high[225]. The predominant use of these families may also be due to the fact that most plant species in this family are mainly herbs and shrubs, so they grow quickly and are available throughout the year. The four most commonly used ethnomedicinal plant species were

*Dracaena fragrans, Coffea canephora, Saccharum officinarum, and Melanthera scandens.* In contrast, only one plant, *Dracaena steudneri Engl.*, belonging to the Dracaenaceae family, was identified for its use in treating alcohol-related problems in an ethnobotanical study carried out in communities surrounding Mabira Forest in Central Uganda[226]. This finding confirms the use of medicinal plants in the traditional treatment of alcohol-related disorders across different regions of Uganda.

**Plant life forms and parts used**

Comparable to other studies, this survey found that herbs were the most predominant plant life form utilized by the TMPs for treating alcohol-related problems, with shrubs and trees following in frequency. The common use of herbs, trees, and shrubs has been reported in most studies in Uganda and elsewhere[227-229]. Their widespread utilization can be attributed to their abundance in gardens, bushes, and forests and their ease of collection. The high utilization of leaves could be attributed to the ease with which they can be collected in large quantities compared to other plant parts[230]. Studies reporting the preference for leaves by traditional medicine practitioners suggest that it is driven by their abundance and the high concentrations of compounds with diverse medicinal properties found within leaves[230]. Similar findings have been described in Uganda [231-235] and other countries in Africa[235, 236]. The prevalent utilization of leaves, roots, flowers, and barks in herbal medicine preparations is a widespread practice across numerous communities in Uganda, as documented in central Uganda[237], southern Uganda[232], western Uganda[238], communities surrounding Kibale National Park[239], and Mpigi in central Uganda[240]. Similar practices are also reported in other countries, such as Tanzania[241], Ethiopia[242] and Italy[243].

**Homogeneity of use**

A relatively high ICF was observed in this study, which is comparable to other research. High ICFs were noted for plants used by traditional medicine practitioners in treating breast cancer(Lutoti et al., 2023), malaria (Adia et al., 2014a), and other ailments[244]. Other studies in Uganda have reported even higher ICF levels of up to 0.9[226]. The high ICF signifies high levels in agreement among the healers on the plants used to treat alcohol related problems. The difference in informant consensus factor in this study compared to others may stem from variations in ecological diversity and the extent of knowledge sharing within the study areas.

**Preparation and administration of plant remedies**

The methods employed by the TMPs in preparation of medicinal plant remedies in our study aligns with the findings of another study conducted in southwestern Uganda[164] which highlighted crushing/pounding then mixing in water as a common method for preparing herbal remedies. Powders are preferred primarily for their prolonged shelf life, proving especially beneficial when utilizing seasonal plant parts like flowers and fruits. In contrast, infusions are consumed within a day, while decoctions are stored in tightly sealed containers for at least one week at room temperature. However, this finding contrasts with other research conducted in Uganda and the broader East African and African regions, where decoction is frequently identified as the dominant method of herbal preparation[245, 246]. Decoctions may be preferred when the part of the plant used is available all year round, such as leaves and bark. The widespread use of water as a solvent is attributable to its ready availability and its ability to dissolve a large number of metabolites. This property allows for the swift extraction of active ingredients during the preparation of herbal remedies [246]. An interesting observation by

healers of mixing the prepared powder or tincture into alcohol is contradictory. The healers may see this as the easiest method to administer the remedy.

In its third objective, this study investigated the effect of *Dracaena fragrans* extract on voluntary alcohol consumption in adult male Sprague-Dawley rats. The results demonstrated that intragastric administration of the extract led to a significant reduction in alcohol intake, with the most pronounced effects observed at low and high doses. However, the moderate dose group exhibited a less marked decrease in alcohol consumption, suggesting a non-linear dose-response relationship. Quantitative analysis revealed that rats administered low and high doses of the extract consumed significantly less alcohol compared to the negative control group, with p-values of 0.016 and 0.036, respectively. The medium dose group showed a reduction that was not statistically significant ($p = 0.078$). Graphical representations through strip charts, box and whisker plots, and confidence interval plots consistently supported these differences in consumption patterns. Compared to the positive control (disulfiram), there were no statistically significant differences in alcohol consumption for any of the extract dose groups. However, the mean alcohol intake was marginally lower in the low-dose group.

The observed reduction in voluntary alcohol intake indicates that *Dracaena fragrans* may contain phytochemicals with therapeutic potential for alcohol use disorders. The efficacy observed here could be attributed to the plant's phytochemical profile, which includes saponins, flavonoids, and possibly alkaloids[247, 248]. Saponins, in particular, have been linked to reductions in alcohol intake through modulation of GABAergic and dopaminergic pathways[249]. While no direct mechanism has been confirmed for *D. fragrans*, it is plausible that similar neurochemical interactions are at play. Future phytochemical analysis and

neuropharmacological assays will be needed to confirm these pathways. The non-linear dose-response may point to complex interactions among the plant's constituents or differing metabolic thresholds at varying concentrations. Comparatively, few studies, if any, have explored the alcohol-reducing properties of *Dracaena fragrans*. However, similar findings have been reported with other plant-based interventions such as *Pueraria lobata* (kudzu) and *Salvia miltiorrhiza*, which also showed efficacy in reducing alcohol intake in animal models through their isoflavones and terpenoids respectively[250, 251]. The limited research on *Dracaena fragrans* makes this study a novel contribution to the ethnopharmacological literature.

**Strengths and Limitations**

This study has several notable strengths. First, it employed a multi-method approach, combining qualitative interviews, ethnopharmacological survey, and experimental animal study, which enhances the validity and depth of the findings. Second, by focusing on a culturally grounded and under-researched area, the study sheds light on the role of traditional medicine in managing alcohol-related problems, addressing a critical knowledge gap, and promoting the relevance of indigenous knowledge. Third, while the experimental findings provided preliminary support for the therapeutic potential of *Dracaena fragrans*, they also offer a foundation for future clinical trials, underscoring the need to validate these promising results in human populations.

Despite the valuable insights generated, this study had several limitations. First, the findings on treatment outcomes among individuals treated by traditional medicine practitioners relied on self-reported experiences, which may be subject to recall bias, social desirability bias, or lack of clinical verification. There was no objective clinical follow-up to confirm abstinence or assess biochemical markers of alcohol use reduction. Secondly, although 25 plant species were identified, it is possible that some traditional medicine practitioners withheld information on

specific plants due to concerns about intellectual property, secrecy, or mistrust, which may have limited the completeness of the ethnobotanical data. Third, the experimental findings on *Dracaena fragrans* were limited to an animal model. While the rat model provides preliminary evidence of efficacy, the results cannot be directly extrapolated to humans without further validation through pharmacological, toxicological, and clinical studies. Though the animal model is a well-established proxy for human alcohol use, behavioral and metabolic differences limit direct translation to clinical populations.

**Conclusions**

The findings of this study indicate that individuals treated for alcohol-related problems by traditional medicine practitioners using plant-based remedies reported sustained abstinence from alcohol, along with personal and social improvements. These outcomes highlight the potential therapeutic value of the medicinal plants used. This study identified 25 medicinal plant species across 20 botanical families used by traditional medicine practitioners in Bushenyi District to manage alcohol-related disorders, with Asteraceae emerging as the most represented family. Among these, *Dracaena fragrans, Coffea canephora, Saccharum officinarum*, and *Melanthera scandens* were the most frequently cited species, indicating their perceived efficacy and cultural prominence in traditional alcohol treatment practices. Experimental findings from the rat model confirmed that *Dracaena fragrans* extract significantly reduced voluntary alcohol intake, providing scientific validation for its traditional use in managing alcohol-related disorders. These results highlight the plant's potential as a therapeutic agent for alcohol use disorders.

**Recommendations**

**Research:** Further research is needed to validate the therapeutic potential of *Dracaena fragrans* in alcohol use disorders. Priorities include isolating active compounds, elucidating

pharmacological mechanisms, and assessing safety and efficacy through phased clinical trials. Collaborative, multidisciplinary approaches will ensure scientific rigor and contextual relevance.

**Clinical Practice:** Translation into clinical use will require standardized preparations, clear dosing protocols, and clinician training on the safe integration with existing AUD treatments. Given its cultural acceptance, *D. fragrans* may improve patient engagement and treatment adherence, particularly in settings with limited access to conventional therapies.

**Policy:** Policy frameworks should support the regulation, quality control, and ethical sourcing of evidence-based traditional medicines for AUDs. Integration into national treatment programs can enhance accessibility and reduce costs.

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# 7 APPENDICES

## 7.1 Appendix 1: Ethnobotanical survey questionnaire

### a. Demographic characteristics of the traditional medicine practitioner

Age in years: ----------

Gender: 0= Male 1=Female----------

Ethnicity: ----------

Main Occupation: ----------

Other occupations: ----------

Status/Position in society/households.....

**Religion:**

1=Protestant

2=Catholic

3=Moslem

4=Seventh Day Adventist

5=Born Again

6=African Religion

7=Other, Specify----------

**Marital status:**

1=Married

2=Single

3=Divorced/separated

4=Widowed

5 = Living with a partner

**Education level:**

1= No formal education, specify.....

2=Primary

3= Secondary

4= Tertiary

**Physical Address**

Village: ----------

Parish: ----------

Sub-county:----------

District: ----------

Telephone contact (s): ----------

Duration of experience managing alcohol related problems: ----------

**b. Details of medicinal Plant(s) used and treatment practices for alcohol problems**

Local name of plant: ---------- (Description) ----------

Please describe for me which **part of the plant** that you use (probe: which part and why explain)

Please describe for me **how you collect** the plant (detailed process of collection.....)

Please describe for me **how you prepare** the plant to make the medicine for treating alcohol drinking (detailed process ---- )

Please describe for me **how you administer** the medicine (tangible and intangible process)

Please tell me the dose **of the medicine** that you use (how much, many times and for how long)

Apart from plants, what other therapies do you use to treat alcoholism?

.....

**c. Plant collection (Filed trip with TMP):**

Voucher specimen number: ----------

Date Collected: ----------

Type of area where that plant is found (swamp, forest, farmland, grassland etc.): ----------

**Location of medicinal plant (May be different from where TMP lives):**

Village ----------

Parish ----------

Sub-county ----------

GPS Coordinates: ----------

**d. Scientific identification in the herbarium**

Botanical name of plant: ----------

Species: ----------

Family: ----------

**e. Treatment outcome of people seen by TMP**

Do you still drink alcohol?

What had caused you to excessively drink alcohol?

How long had you been drinking alcohol before you went to see the Traditional medicine practitioner?

What drinking problems did you have that made you visit the Traditional medicine practitioner?

What benefits concerning your alcohol drinking did you get when the traditional medicine practitioner treated you?

**f. Scientific identification in the herbarium**

Botanical name of plant: ----------

Species: ----------

Family: ----------

## 7.2 Appendix 2: Data capture form

Cage No----------

| Day | Date | Time | Weight of rat (Mon-Wed-Fri) | Weight of Alcohol consumed | Weight of food consumed | Weight of Water consumed |
|---|---|---|---|---|---|---|
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | |
| 6 | | | | | | |
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| 32 | | | | | | |

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|---|---|---|---|---|---|---|
| 33 | | | | | | |
| 34 | | | | | | |
| 35 | | | | | | |

## 7.3 Appendix 5: TMPs Consent Form (English)

**MBARARA UNIVERSITY OF SCIENCE AND TECHNOLOGY**
**FACULTY OF MEDICINE RESEARCH COMMITTEE**
P.O. Box 1410 Mbarara, Tel: +256-48-543-3795, Fax: +256-48-542-0782

**INFORMED CONSENT FORM**

**Study title** – This should be the same as on all other documents related to the study.

| |
|---|
| Exploration of Medicinal Plants Used by Traditional Medicine Practitioners in the Management of Alcohol-Related Problems in Southwestern Uganda |

**Principal Investigator(s)**

| |
|---|
| Dr. Samuel Maling |

**Introduction**

You are being asked to join a research study about plants used to treat alcohol problems. This consent form explains the research study and your part in the study. Please read it carefully or it can be explained to you and take as much time as you need. You are a volunteer. You can choose not to take part and if you join, you may quit at any time. There will be no penalty if you decide to quit the study.

**Brief background to the study**

| |
|---|
| This research is going to get information on the plants used by Traditional Medicine Practitioners (also called Traditional Healers) for treating people with alcohol drinking problems in Bushenyi District. The research will look for information on the names of the plants used, how they are collected, prepared and given to people with drinking problems. The plant that is most used by the Traditional healers will be tested in the laboratory at Mbarara University on rats to see if in can reduce the amount of alcohol drunk by the rats. The research will also test if the plant most commonly used by the |

traditional healers will stop rats from starting to drink again once they had stopped.

**Purpose of the research project**

This research will involve 50 Traditional healers. If you agree to participate, you will be asked questions about plants used in the management of people with drinking problems.

**Why you are being asked to participate?**

You have been requested to participate in the study because of your experience and practice in managing people with drinking problems using herbal medicine. Your knowledge of plants you use for treating alcohol related problems will be useful in the study.

**Procedures**

You will be asked questions about how you collect, prepare and give herbal medicines to people with drinking problems. In addition, you will also be asked to go out to the field (bushes, jungle, forest etc.) to identify the plants you have mentioned by local names. The researcher will take part of the plant to enable a scientist to also identify the plant using a scientific name.

**Risks or discomforts**

During the field visit, there is a risk of insect and snake bites and getting pricked by thorns. We shall plan in advance to avoid those risks.

**Benefits**

This research is beneficial in that it will very useful both in the western and traditional setting for treating people with alcohol problems. This is expected to lead to better recovery of this people and this will benefit society.

**Incentives or rewards for participating**

You will be provided with a pair of gumboots as a way of thanking you for your time.

**Protecting data confidentiality**

The information that you provide will not be shared with anybody and of course not with other Traditional healers. The records will be kept in a tablet (small computer) with a password that is known to only the researchers.

**Protecting subject privacy during data collection**

During the interviews and field visits, you will only be with the researches and no one else.

**Right to refuse or withdraw**

Your participation in this research is voluntary. You can choose to withdraw from the study at any time.

**What happens if you leave the study?**

You will not be punished in any way if you decline to take part and you are free to stop your participation if you feel so.

**Who do I ask/call if I have questions or a problem?**

If you have any problem or require more information, please contact: Dr. Samuel Maling, 0776700225 or Dr. Paul Alele, 0773573372

**What does your signature or thumbprint on this consent form mean?**

Your signature on this form means that: You have been informed about this study's purpose, procedures, possible benefits and risks, You have been given the chance to ask questions before you sign and that You have voluntarily agreed to be in this study

| | | |
|---|---|---|
| Name of adult participant | Signature of participant or Legally authorized representative | Date |
| Name of person obtaining consent | Signature | Date |
| Print Name of witness | Signature or thumbprint or mark | Date |

## 7.4 Appendix 6: Patients consent form (English)

**MBARARA UNIVERSITY OF SCIENCE AND TECHNOLOGY**

**RESEARCH ETHICS COMMITTEE**

P.O. Box 1410 Mbarara, Tel: +256-48-543-3795, Fax: +256-48-542-0782

E-mail: irc@must.ac.ug, mustirb@gmail.com

INFORMED CONSENT FORM

**(For Patients seen by Traditional Medicine Practitioners)**

---

This document outlines the research study and expectations for potential participants. It should be written in layman terms and typed on MUST-REC letterhead.

**Instructions**

1. The wording of this document should be directed to the potential participant not MUST-REC.
2. If a technical term must be used, then define it the first time it is used and any acronyms or abbreviations used should be spelled out the first time they are used.
3. All the sections of this document must be completed without any editing or deletions.
4. Please use a typing font that is easily distinguishable from the questions of this form. Preferably the font size should be 12.

**Study title** – This should be the same as on all other documents related to the study.

| |
|---|
| Exploration of Medicinal Plants Used by Traditional Medicine Practitioners in the Management of Alcohol-Related Problems in Southwestern Uganda |

**Principal Investigator(s)**

| |
|---|
| Dr. Samuel Maling |

**Introduction**

What you should know about this study:

1. You are being asked to join a research study.
2. This consent form explains the research study and your part in the study.

3. Please read it carefully and take as much time as you need.
4. You are a volunteer. You can choose not to take part and if you join, you may quit at any time. There will be no penalty if you decide to quit the study.

**Brief background to the study**

This study is going to get information on the plants used by Traditional Medicine Practitioners (also called Traditional Healers) for treating people with alcohol drinking problems in Bushenyi District. The research will look for information on the names of the plants used, how they are collected, prepared and given to people with drinking problems. The plant that is most used by the Traditional healers will be tested in the laboratory at Mbarara University on rats to see if in can reduce the amount of alcohol drunk by the rats. The research will also test if the plant most commonly used by the traditional healers will stop rats from starting to drink again once they had stopped.

In addition, the research will also find out whether the plants helped stop or reduce drinking among those people who used them. This last part is why we are talking to you.

You will be asked questions on why you visited the traditional healer, what happened to your alcohol drinking problem when you used the medicine given to you by the traditional healer. You will be asked if you got better, nothing changed or you may have become worse.

**Purpose of the research project**

Include a statement that the study involves research, estimated number of participants, an explanation of the purpose(s) of the research procedure and the expected duration of the subject's participation.

You are being asked to take part in a research study. This research will involve 50 Traditional healers and 50 people who went to them for treatment for alcohol related problems. If you agree to participate, you will be asked questions about what happened to your drinking after you visited the traditional healer. Your participation will involve answering questions on what happened to you when you visited a traditional healer seeking help for your drinking problem. The reason you are being asked to participate is that the information you are going to provide on how you felt after visiting the traditional healer in very important in knowing if the plant used is helpful. The questions will not take more than 30 minutes of your time.

**Why you are being asked to participate?**

Explain why you have selected the individual to participate in the study.

You have been requested to participate in the study because you went to get treatment from the traditional healer for your alcohol drinking problem. What happened to your drinking problem will form part of the evidence to see if the plant that was used to treat you helps.

**Procedures**

Provide a description of the procedures to be followed and identification of any procedures that are experimental, clinical etc. If there is need for storage of biological (body) specimens, explain why, and include a statement requesting for consent to store the specimens and state the duration of storage.

You will be asked questions about what problems resulting from alcohol drinking that you had that made you go to see the traditional healer. You will also be asked to see if the treatment from the traditional healer made your alcohol drinking problem better, made you worse or the problem did not change.

**Risks or discomforts**

Describe any reasonably foreseeable risks or discomforts-physical, psychological, social, legal or other associated with the procedure, and include information about their likelihood and seriousness. Discuss the procedures for protecting against or minimizing any potential risks to the subject. Discuss the risks in relation to the anticipated benefits to the subjects and to society

Some of the questions about your drinking may make you feel uncomfortable.

**Benefits**

Describe any benefits to the subject or other benefits that may reasonably be expected from the research. If the subject is not likely to benefit personally from the experimental protocol note this in the statement of benefits

If we find out that your drinking problem has continued despite of the treatment by the traditional healer, we shall offer you brief counselling and refer to Mbarara Hospital for more assessment and treatment.

**Incentives or rewards for participating**

It is assumed that there are no costs to subjects enrolled in research protocols. Any payments to be made to the subject, e.g., travel expenses, a token of appreciation for time spent, must also be stated, including when the payment will be made.

You will be provided with a bar of soap for your time.

**Protecting data confidentiality**

Provide a statement describing the extent, if any, to which confidentiality or records identifying the subjects will be maintained. If data is in form of tape recordings, photographs, movies or videotapes, researcher should describe period of time they will be retained before destruction. Showing or playing of such data must be disclosed, including instructional purposes

*The information that you provide will not be shared with anybody. The records will be kept in a tablet (small computer) with a password that is known to only the researchers.*

**Protecting subject privacy during data collection**

Describe how the privacy of the participant will be ensured during the process of data collection.

During the interviews, you will only be with the researches and no one else

**Right to refuse or withdraw**

Include a statement that participation is voluntary and that refusal to participate will involve no penalty or loss of benefits to which the subject is otherwise entitled.

Your participation in this research is voluntary. You can choose to withdraw from the study at any time.

**What happens if you leave the study?**

Include a statement that the subject may discontinue participation at any time without penalty or loss of benefits.
You will not be punished in any way if you decline to take part and you are free to stop your participation if you feel so

**Who do I ask/call if I have questions or a problem?**
Include contact for the researcher and Chairperson, MUST-REC.

1. Dr. Samuel Maling,
   0776700225
2. Dr. Francis Bajunirwe
   Chairman, MUST-REC

   P.O. Box 1410 Mbarara

   Tel: 0485433795

**What does your signature or thumbprint on this consent form mean?**

Your signature on this form means

- You have been informed about this study's purpose, procedures, possible benefits and risks
- You have been given the chance to ask questions before you sign
- You have voluntarily agreed to be in this study

| | | |
|---|---|---|
| _____ | _____ | _____ |
| Name of adult participant | Signature of participant or Legally authorized representative | Date |
| _____ | _____ | _____ |
| Name of person obtaining consent | Signature | Date |
| _____ | _____ | _____ |
| Print Name of witness | Signature or thumbprint or mark | Date |

## 7.5 Appendix 7: Runyankole consent form TMPs

**MBARARA UNIVERSITY OF SCIENCE AND TECHNOLOGY**

**RESEARCH ETHICS COMMITTEE**

P.O. Box 1410 Mbarara, Tel: +256-48-543-3795, Fax: +256-48-542-0782

E-mail: irc@must.ac.ug, mustirb@gmail.com

FOOMU Y'OKUMANYISIBWA OKAIKIRIZA

**(Ahabw'Abashaho b'Enzaarwa)**

Ekihandiiko eki nikishoboorora aha mushomo gw'okucondooza kandi n'ebirikuteekateekwa abashemereire kugwetabamu. Kishemereire kuba kihandiikirwe omu rurimi rw'omuntu wa buriijo kandi kiteirwe omu kyapa aha rupapura rw'ekitongore eki.

**Eby'okukuratira**

5. Ebigambo by'omu kihandiiko eki bishemereire kuba nibigyenderera aha muntu oshemereire kugwetabamu atari owa MUST-REC.
6. Haaba hariho ekigambo ky'obukugu ekirikuteekwa kukozesibwa, okishoboorore omurundi gw'okubanza obu kyakozesibwa nari ekihandiikirwe omu bugufu kihezeyo omurundi gw'okubanza obu kyakozesibwa.
7. Ebicweka byona eby'omu kihandiiko eki nibiteekwa kwijuzibwa hatariho okugororamu nari okusanguramu.
8. Nooshabwa kuteera omu nyuguta ezaakugira entaaniso n'ez'omu foomu y'ebibuuzo egi. Ningira nka saizi y'ebigambo ebiri omu nyuguta z'obuhango bwa 12.

**Omutwe gw'Omushomo** – Ogu gushemereire kuba guri gumwe omu bihandiiko byona ebiine akakwate n'omushomo.

| |
|---|
| Okujumbura Ebishaka by'Emibazi erikukozesibwa Abashaho b'Enzaarwa omu kujanjaba oburemeezi obwine akakwate n'Amaarwa omuri Burengyerwaizooba bwa Uganda. |

**Omucondooza Mukuru**

| |
|---|
| Dr. Samuel Maling |

**Okwanjura**

Ebi oshemereire kumanya aha mushomo ogu:

5. Nooshabwa kwetaba omu mushomo gw'okucondooza
6. Foomu y'okwikiriza neeshoboorora omushomo gw'okucondooza kandi n'omwanya gwawe omu mushomo
7. Nyabura ogishome n'obwegyendesereza kandi otware obwire obu orikuhurira nooyetenga.

8. Ori nyekundiire. Noobaasa kusharamu obutaza omu mushomo kandi waaguzamu, noobaasa kurugamu ahu oraayendere. Tihariho kufubirwa kwona waasharamu kuruga omu mushomo.

**Ebikwatiraine n'omushomo omu bugufu**

Okucondooza oku orikushabwa kwetabamu n'okw'okushoma ebishaka ebirikukozesibwa Abashaho b'Enzaarwa kuragurira abantu abaine oburemeezi bw'okunywa amaarwa omu Disiturikiti ya Bushenyi. Okucondooza nikwija kuronda amakuru aha maziina g'ebishaka ebirikukozesibwa, oku birikurundaanwa, bikatebeekanisibwa kandi bikaheehwa abantu abaine oburemeezi bw'okunywa. Ekishaka ekirikukira kukozesibwa Abashaho b'Enzaarwa nikiija kukyeberwa omu ikyeberero ry'emibazi erya Mbarara University aha mbeba kureeba kyaba nikibaasa kukyendeza obwingi bw'amaarwa aganywairwe embeba. Okucondooza nikwija nabwo kukyebera ekishaka ekirikukira kukozesibwa Abashaho b'Enzaarwa kureeba yaaba nabwo nikibaasa kuzibira embeba kugaruka kutandika kunywa obundi yaaba yaagarekire.

**Ekigyendererwa ky'omurimo gw'okucondooza**

Yongyeramu ekihandiiko ku omushomo gurimu okucondooza, abantu abarikubariirirwa kugwetabamu, okushoboorora aha kigyendererwa/ebigyendererwa by'entwaza y'okucondooza n'obwire obu buri kicweka kirikuteekateekwa kuheza.

Okucondooza oku nikwija kuba kurimu Abashaho b'Enzaarwa 50. Waikiriza kukwetabamu, noija kubuuzibwa ebibuuzo aha bishaka ebirikukozesibwa omu kujanjaba abantu abaine oburemeezi bw'okunywa. Okucondooza kugyendereire kworeka ebishaka bya buriijo ebirikukozesibwa omu kuragurira abantu abaine oburemeezi bw'okunywa amaarwa.

**Ahabw'enki nooshabwa kwetaba omu mushomo?**

Shoboorora ahabw'enki waaronda omuntu nanka kwetaba omu mushomo.

Waashabwa kwetaba omu mushomo ahabw'obumanyirizi bwawe n'oku otwire nookora omu kujanjaba abantu abaine oburemeezi bw'okunywa orikukozesa emibazi y'ebishaka. Enshonga endiijo n'okugira ngu noomanya ebishaka ebirikukozesibwa omu kuragurira abantu abaine oburemeezi obwine akakwate n'amaarwa kandi eki nikiija kuba kiri kikuru omu kucondooza.

**Entwaza**

Yoreka enshoboorora y'entwaza eraakuratirwe kandi shoboorora entwaza yoona y'okugyezibwaho, eby'obushaho n'ebindi. Haaba niheetengwa okubiika eby'okureeberaho kukyebera eby'obuhangwa (omubiri) shoboorora ahabw'enki kandi oyongyeramu ekihandiiko kirikushaba okwikiriza kubiika eby'okureeberaho kuyebera kandi oyorekye obwire obu orikwenda biheze bibiikirwe.

Noija kubuuzibwa ebibuuzo aha ku orikubirundaana, okabitebeekanisa kandi okaheereza abantu emibazi y'ebishaka abaine oburemeezi bw'okunywa. Ekindi, noija kushabwa kuzayo omu kishaka, ekibira n'ahandi kworeka ebishaka ebyagambwa amaziina gaabyo. Omucondooza naija kutwara ebicweka bimwe by'ekishaka omu kuyamba aba saayansi nabo kumanya ekishaka barikukozesa eiziina ryabo.

### Akabi nari obutaguubwa gye

Yoreka kyona ekyakureebeka kwija kureeta akabi nari obutaguubwa gye omu magara, omu mutwe, omu ntuura y'abantu, omu by'amateeka nari ebindi byona ebikwatiraine n'entwaza, kandi otemu amakuru oku byakweshushaniriza n'amaani gaakyo. Hajaana aha ntwaza oku waakwerinda nari okakyendeza akabi k'amaani ahabw'omushomo ogu. Hajaana aha kabi orikubugyeragyeranisa n'amagoba agaakurugamu ahabw'omushomo kandi n'ahabw'ekyanga.

Omu kuza omu kishaka, harimu akabi k'okurumwa obukooko n'enjoka kandi n'okucumitwa amahwa. Nitwija kutaho entebeekanisa bukiri kare ahabw'okwenda kurinda akabi ako. Noija kujwara buutusi ezi ndakuheereze kwerindisa.

### Amagoba

Shoboorora haaba hariho amagoba goona ahabw'omushomo ogu nari amagoba agandi agarikurikuteekateekwa kuruga omu kucondooza. Omushomo ogu gwaba nigureebeka gutarikwija kukugobesa nk'omuntu kurugiirira omu bi orikureeba birikukorwa kihandiikye omu rukarara rw'amagoba.

Ahabwawe noobaasa obutagira magoba g'ahonaaho omu kucondooza oku. Kwonka nabwo, okucondooza kushemereire kuheereza obuhame omu muringo gw'embeba kureeba yaaba ekishaka ekyayorekwa nikiija kukyendeza obwingi bw'amaarwa agu enywairwe. Amakuru aga nigaija kuba gari makuru nk'obuhame bw'okwija kucondooza omu bantu omu bwire bw'omu maisho. Kyashangwa ngu nikibaasa kukora omu bantu abaraakyeberwe omu kucondooza okuraabeho obwire bw'omu maisho, ekyo nikiija kwebembezibwa omu kutambira abantu abaine oburemeezi bw'okunywa kandi ekyo nikiba kyagasira ekyanga.

### Ebirikwetereza nari ebihembo ahabw'okwetaba omu mushomo

Nikiteekateekwa ngu tihariho kushohoza omu mushomo ogu nk'oku entwaza eri omu kucondooza, Haaba hariho okushashura omuri eki nka sente z'engyendo, akasiimo ahabw'obwire obu oherize nibiteekwa kworekwa kandi n'obu oshemereire kuba nooshashurwa.

### Noija kuheebwa peeya ya buutusi nk'omuringo gw'okukusiima ahabw'obwire bwawe.

### Okurinda ebyarundanwa omu kihama

Yoreka ekihandiiko kirikushoboorora orurengo, rwaba ruriho, oku okubiika ebihama nari ebihandiiko ebirikworekwa biraije kurindwa. Ebyarundaanwa byaba bikwatsirwe aha katambi, bateire ebishushani, ebishushani

ebirikworekwa aha katambi, omucondooza ashemereire kushoboorora obwire obu biraaheze bitakanagirwe. Okworeka ebirundainwe nari okuzaana obutambi kishemereire kugambwa oteireho n'ebigyendererwa by'okubyegyesaho.

Amakuru agu oraaheereze, tigarikwija kubaganwaho n'ondiijo muntu okukira omushaho w'enzaarwa ondiijo. Amakuru nigaija kubiikwa omu kompyuta eraabe eine enamba y'okugiigura erikumanywa abacondooza bonka.

### Okurinda ekihama omu bwire bw'okurundaana amakuru

Shoboorora oku oraahamize owaayetaba omu mushomo ku ari omu kihama omu bwire obw'okurundaana amakuru.

Omu kubuuzibwa n'okutaayaya omu kishaka, noija kuba oine omucondooza wenka hatariho ondiijo muntu weena.

### Obugabe bw'okwanga nari okurugamu

Yongyeramu ekihandiiko ngu owaayetabamu ni nyekundiire kandi ahabw'enshonga egyo eky'okwanga kuzamu tikirimu kufubirwa nari kufeerwa amagoba agu ashemereire kuba naatunga.

### Okwetabamu kwawe ni nyekundiire. Noobaasa kucwamu kuruga omu mushomo obwire bwona.

### Ni habaho ki waaruga omu mushomo?

Yongyeramu ekihandiiko ngu waaruga omu mushomo obwire bwona tihariho kufubirwa nari kufeerwa amagoba agaakuba gagurimu.

### Torikwija kufubirwa omu muringo gwona waayanga kwejumbamu kandi oine obugabe kurugamu waahurira waakikunda.

### Nimbuuza /ninteerera oha naaba nyine ekibuuzo nari oburemeezi?

Yongyeramu endagiiriro y'omucondooza kandi Ceyapaasoni, MUST-REC.

Dr. Francis Bajunirwe

Chairman, MUST-REC

P.O. Box 1410 Mbarara

Tel: 0485433795/0772 576 396

### Omukono nari ekinkumu kyawe aha foomu y'okwikiriza nikimanyisa ki?

Omukono gwawe aha foomu nigumanyisa

- Waamanyisibwa aha bigyendererwa by'omushomo, entwaza, amagoba agaakuba garimu nari akabi
- Waatunga omugisha gw'okubuuza ebibuuzo otakateireho mukono gwawe

- Waayekundira kuza omu mushomo

| | | |
|---|---|---|
| _____<br>iina ry'omuntu mukuru owaayetabamu | _____<br>Omukono gw'owaayetabamu nari Orikwikirizibwa kujwekyera ab'ebiragiro | _____<br>Ebiro by'okwezi |
| _____<br>iina ry'omuntu oine okwikiriza | _____<br>Omukono gwe | _____<br>Ebiro by'okwezi |
| _____<br>iina ry'omujurizi | _____<br>Omukono nari ekinkumu nari akamanyiso | _____<br>Ebiro by'okwezi |

## 7.6 Appendix 8: Runyankore consent form for patients

**MBARARA UNIVERSITY OF SCIENCE AND TECHNOLOGY**

**RESEARCH ETHICS COMMITTEE**

P.O. Box 1410 Mbarara, Tel: +256-48-543-3795, Fax: +256-48-542-0782

E-mail: irc@must.ac.ug, mustirb@gmail.com

FOOMU Y'OKUMANYISIBWA OKAIKIRIZA

**(Ahabw'abarwaire abareebirwe Abashaho b'Enzaarwa)**

Ekihandiiko eki nikishoboorora aha mushomo gw'okucondooza kandi n'ebirikuteekateekwa abashemereire kugwetabamu. Kishemereire kuba kihandiikirwe omu rurimi rw'omuntu wa buriijo kandi kiteirwe omu kyapa aha rupapura rw'ekitongore eki.

### Eby'okukuratira

9. Ebigambo by'omu kihandiiko eki bishemereire kuba nibigyenderera aha muntu oshemereire kugwetabamu atari owa MUST-REC.
10. Haaba hariho ekigambo ky'obukugu ekirikuteekwa kukozesibwa, okishoboorore omurundi gw'okubanza obu kyakozesibwa nari ekihandiikirwe omu bugufu kihezeyo omurundi gw'okubanza obu kyakozesibwa.
11. Ebicweka byona eby'omu kihandiiko eki nibiteekwa kwijuzibwa hatariho okugororamu nari okusanguramu.
12. Nooshabwa kuteera omu nyuguta ezaakugira entaaniso n'ez'omu foomu y'ebibuuzo egi. Ningira nka saizi y'ebigambo ebiri omu nyuguta z'obuhango bwa 12.

**Omutwe gw'Omushomo** – Ogu gushemereire kuba guri gumwe omu bihandiiko byona ebiine akakwate n'omushomo.

| |
|---|
| Okujumbura Ebishaka by'Emibazi erikukozesibwa Abashaho b'Enzaarwa omu kujanjaba oburemeezi obwine akakwate n'Amaarwa omuri Burengyerwaizooba bwa Uganda |

### Omucondooza Mukuru

| |
|---|
| Dr. Samuel Maling |

### Okwanjura

Ebi oshemereire kumanya aha mushomo ogu:

9. Nooshabwa kwetaba omu mushomo gw'okucondooza
10. Foomu y'okwikiriza neeshoboorora omushomo gw'okucondooza kandi n'omwanya gwawe omu mushomo
11. Nyabura ogishome n'obwegyendesereza kandi otware obwire obu orikuhurira nooyetenga.
12. Ori nyekundiire. Noobaasa kusharamu obutaza omu mushomo kandi waaguzamu, noobaasa kurugamu ahu oraayendere. Tihariho kufubirwa kwona waasharamu kuruga omu mushomo.

**Ebikwatiraine n'omushomo omu bugufu**

ucondooza oku orikushabwa kwetabamu n'okw'okushoma ebishaka ebirikukozesibwa Abashaho b'Enzaarwa kuragurira abantu abaine oburemeezi bw'okunywa amaarwa omu Disiturikiti ya Bushenyi. Okucondooza nikwija kuronda amakuru aha maziina g'ebishaka ebirikukozesibwa, oku birikurundaanwa, bikatebeekanisibwa kandi bikaheehwa abantu abaine oburemeezi bw'okunywa. Ekishaka ekirikukira kukozesibwa Abashaho b'Enzaarwa nikiija kukyeberwa omu ikyeberero ry'emibazi erya Mbarara University aha mbeba kureeba kyaba nikibaasa kukyendeza obwingi bw'amaarwa aganywairwe embeba. Okucondooza nikwija nabwo kukyebera ekishaka ekirikukira kukozesibwa Abashaho b'Enzaarwa kureeba yaaba nabwo nikibaasa kuzibira embeba kugaruka kutandika kunywa obundi yaaba yaagarekire

indi, okucondooza nikwija kusheruriza yaaba ebishaka biyambire omu kukiza nari kukyendeza omu kunywa omu bantu ababikozeise. Omu kicweka eki ky'aha muheru nikyo ahabw'enki turiyo nitugamba naiwe,

ija kubuuzibwa ebibuuzo ahabw'enki waagiire ow'Omushaho w'Enzaarwa, hakabaho ki aha buremeezi bwawe bw'okunywa amaarwa ku waakozeise emibazi ei omushaho w'enzaarwa yaakuhaire. Noija kubuuzibwa yaaba waabaire gye, tihaine ekyakuhindukireho nari obereire kimwe kubi.

**igyendererwa ky'omurimo gw'okucondooza**

ngyeramu ekihandiiko ku omushomo gurimu okucondooza, abantu abarikubariirirwa kugwetabamu, ishoboorora aha kigyendererwa/ebigyendererwa by'entwaza y'okucondooza n'obwire obu buri kicweka kuteekateekwa kuheza.

aaba nooshabwa kwejumba omu mushomo gw'okucondooza. Okucondooza oku kurimu ashaho b'Enzaarwa 50 n'abandi bantu 50 abaagiireyo kutunga obujanjabi ahabw'oburemeezi mwe obwine akakwate n'amaarwa. Ku oraikirize kwetabamu, noija kubuuzibwa ebibuuzo aha abaire aha kunywa kwawe bwanyima y'okutaayaayira Omushaho w'Enzaarwa. Okwetabamu awe nikwija kuba kurimu ebibuuzo aha kyakubaireho ku waatayayiire Omushaho Enzaarwa orikuronda obuyambi aha buremeezi bw'okunywa kwawe. Enshonga ahabw'enki oshabwa kwetabamu n'okugira ngu amakuru agu oraaheereze aha ku waabaire bwanyima kutaayayira Omushaho w'Enzaarwa ni makuru munonga omu kumanya yaaba ekishaka yakozesiibwe nikiyamba. Ebibuuzo nibiija kutwara edakiika zitarikurenga omuri 30 z'obwire awe.

**Ahabw'enki nooshabwa kwetaba omu mushomo?**

Shoboorora ahabw'enki waaronda omuntu nanka kwetaba omu mushomo.

Waaba nooshabwa kwetaba omu mushomo ahabw'okuba okaza kutunga obujanjabi ow'Omushaho w'Enzaarwa ahabw'oburemeezi bw'okunywa amaarwa. Ekyabaire aha buremeezi bwawe bw'okunywa nikiija kuba kimwe aha buhame kumanya ngu ekishaka ekyakozesiibwe kukujanjaba nikiyamba.

**Entwaza**

Yoreka enshoboorora y'entwaza eraakuratirwe kandi shoboorora entwaza yoona y'okugyezibwaho, eby'obushaho n'ebindi. Haaba niheetengwa okubiika eby'okureeberaho kukyebera eby'obuhangwa (omubiri) shoboorora ahabw'enki kandi oyongyeramu ekihandiiko kirikushaba okwikiriza kubiika eby'okureeberaho kuyebera kandi oyorekye obwire obu orikwenda biheze bibiikirwe.

Noija kushabwa kubuuzibwa ebibuuzo kumanya ni buremeezi ki obwarugire omu kunywa amaarwa obwatumire waaza kureeba Omushaho w'Enzaarwa. Noija nabwo kushabwa kumanya yaaba obujanjabi obu waatungire kuruga ow'Omushaho w'Enzaarwa bwakuyambire aha buremeezi bwawe bw'okunywa amaarwa, bwatumire waayeyongyera nari tihaine kyakuhindukireho.

**Akabi nari obutaguubwa gye**

Yoreka kyona ekyakureebeka kwija kureeta akabi nari obutaguubwa gye omu magara, omu mutwe, omu ntuura y'abantu, omu by'amateeka nari ebindi byona ebikwatiraine n'entwaza, kandi otemu amakuru oku byakweshushaniriza n'amaani gaakyo. Hajaana aha ntwaza oku waakwerinda nari okakyendeza akabi k'amaani ahabw'omushomo ogu. Hajaana aha kabi orikukagyeragyeranisa n'amagoba agaakurugamu ahabw'omushomo kandi n'ahabw'ekyanga.

Bimwe aha bibuuzo ebikwatiraine n'okunywa kwawe nibibaasa obutakubeisa gye.

**Amagoba**

Shoboorora haaba hariho amagoba goona ahabw'omushomo ogu nari amagoba agandi agarikurikuteekateekwa kuruga omu kucondooza. Omushomo ogu gwaba nigureebeka gutarikwija kukugobesa nk'omuntu kurugiirira omu bi orikureeba birikukorwa kihandiikye omu rukarara rw'amagoba

Ku turaashangye ngu oburemeezi bwawe bw'okunywa amaarwa bugumiizemu n'obu oraabe otungire obujanjabi kuruga aha Mushaho w'Enzaarwa, nitwija kukuhuumuriza kandi tukwohereze aha eirwariro erya Mbarara ahabw'okushwijumwa munonga n'okujanjabwa.

**Ebirikwetereza nari ebihembo ahabw'okwetaba omu mushomo**

Nikiteekateekwa ngu tihariho kushohoza omu mushomo ogu nk'oku entwaza eri omu kucondooza, Haaba hariho okushashura omuri eki nka sente z'engyendo, akasiimo ahabw'obwire obu oherize nibiteekwa kworekwa kandi n'obu oshemereire kuba nooshashurwa.

Noija kuheebwa omuti gwa sabuuni ahabw'okutuha obwire bwawe.

**Okurinda ebyarundanwa omu kihama**

Yoreka ekihandiiko kirikushoboorora orurengo, rwaba ruriho, oku okubiika ebihama nari ebihandiiko ebirikworekwa biraije kurindwa. Ebyarundaanwa byaba bikwatsirwe aha katambi, bateire ebishushani, ebishushani ebirikworekwa aha katambi, omucondooza ashemereire kushoboorora obwire obu biraaheze bitakanagirwe. Okworeka ebirundainwe nari okuzaana obutambi kishemereire kugambwa oteireho n'ebigyendererwa by'okubyegyesaho.

Amakuru agu oraaheereze, tigarikwija kubaganwaho n'ondiijo muntu okukira munonga Omushaho w'Enzaarwa ondiijo. Amakuru nigaija kubiikwa omu kompyuta eraabe eine enamba y'okugiigura erikumanywa abacondooza bonka.

**Okurinda ekihama omu bwire bw'okurundaana amakuru**

Shoboorora oku oraahamize owaayetaba omu mushomo ku ari omu kihama omu bwire obw'okurundaana amakuru.

Omu kubuuzibwa, noija kuba oine abacondooza bonka hatariho ondiijo muntu weena.

**Obugabe bw'okwanga nari okurugamu**

Yongyeramu ekihandiiko ngu owaayetabamu ni nyekundiire kandi ahabw'enshonga egyo eky'okwanga kuzamu tikirimu kufubirwa nari kufeerwa amagoba agu ashemereire kuba naatunga.

Okwetabamu kwawe ni nyekundiire. Noobaasa kucwamu kuruga omu mushomo obwire bwona .

**Ni habaho ki waaruga omu mushomo?**

Yongyeramu ekihandiiko ngu waaruga omu mushomo obwire bwona tihariho kufubirwa nari kufeerwa amagoba agaakuba gagurimu.

Torikwija kufubirwa omu muringo gwona waayanga kwejumbamu kandi oine obugabe kurugamu waahurira waakikunda.

**Nimbuuza /ninteerera oha naaba nyine ekibuuzo nari oburemeezi?**

Yongyeramu endagiiriro y'omucondooza/Abacondooza kandi Ceyapaasoni, MUST-REC.

1. Dr. Samuel Maling, 0776700225
2. Dr. Francis Bajunirwe
   Chairman, MUST-REC

   P.O. Box 1410 Mbarara

   Tel: 0485433795

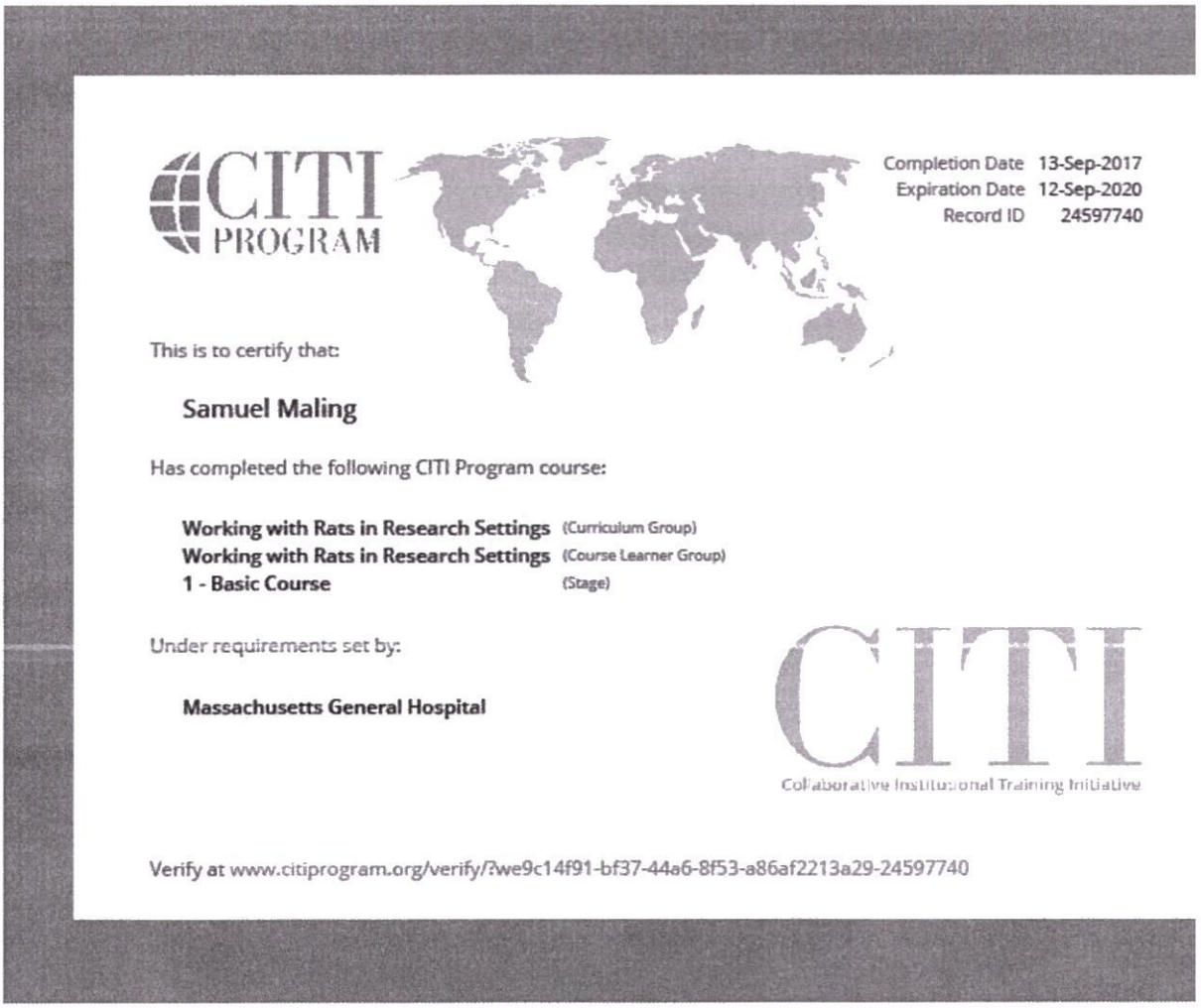
**Omukono nari ekinkumu kyawe aha foomu y'okwikiriza nikimanyisa ki?**

Omukono gwawe aha foomu nigumanyisa

- Waamanyisibwa aha bigyendererwa by'omushomo, entwaza, amagoba agaakuba garimu nari akabi
- Waatunga omugisha gw'okubuuza ebibuuzo otakateireho mukono gwawe
  Waayekundira kuza omu mushomo

| | | |
|---|---|---|
| _____ | _____ | _____ |
| Eiziina ry'omuntu mukuru owaayetabamu | Omukono gw'owaayetabamu nari Orikwikirizibwa kujwekyera ab'ebiragiro | Ebiro by'okwezi |
| _____ | _____ | _____ |
| Eiziina ry'omuntu oine okwikiriza | Omukono gwe | Ebiro by'okwezi |
| _____ | _____ | _____ |
| Eiziina ry'omujurizi | Omukono nari ekinkumu nari akamanyiso | Ebiro by'okwezi |

## 7.7 Appendix 9: CITI Certificate



CITI PROGRAM

Completion Date 13-Sep-2017
Expiration Date 12-Sep-2020
Record ID 24597740

This is to certify that:

**Samuel Maling**

Has completed the following CITI Program course:

**Working with Rats in Research Settings** (Curriculum Group)
**Working with Rats in Research Settings** (Course Learner Group)
**1 - Basic Course** (Stage)

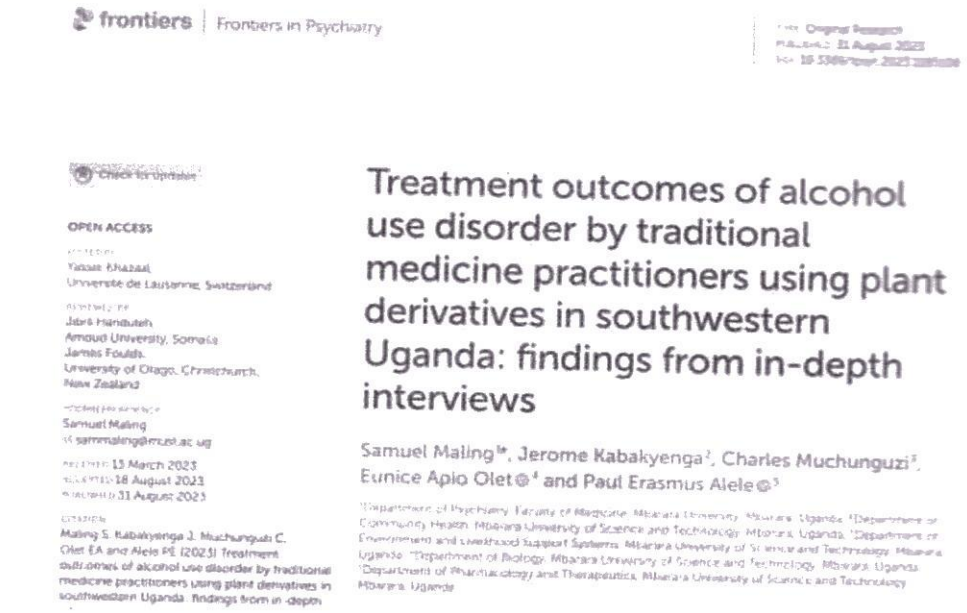
Under requirements set by:

**Massachusetts General Hospital**

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?we9c14f91-bf37-44a6-8f53-a86af2213a29-24597740

## 7.8 Appendix 12: Publications



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# Treatment outcomes of alcohol use disorder by traditional medicine practitioners using plant derivatives in southwestern Uganda: findings from in-depth interviews

Samuel Maling[1]*, Jerome Kabakyenga[2], Charles Muchunguzi[3], Eunice Apio Olet[4] and Paul Erasmus Alele[5]

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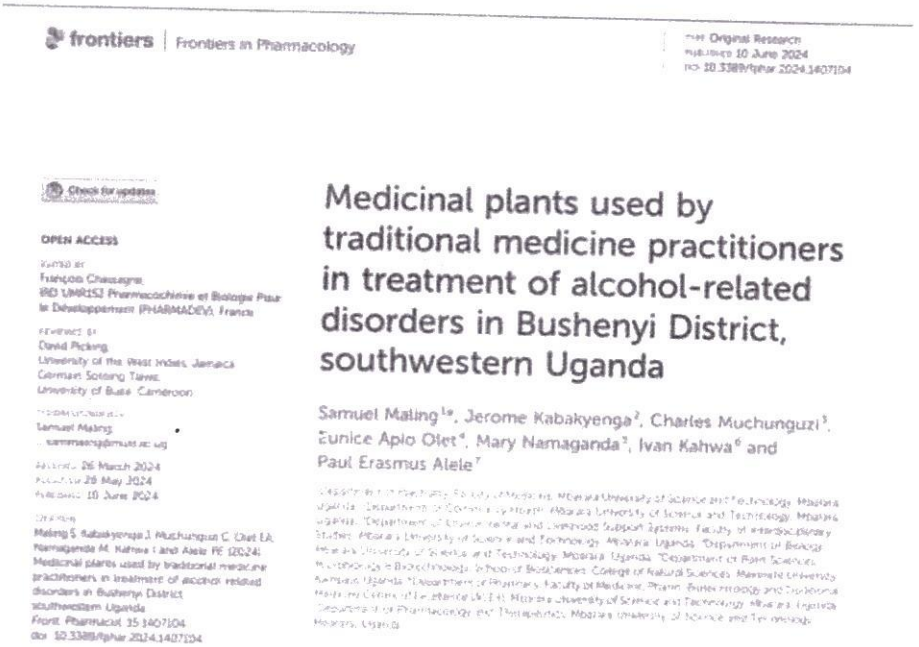

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# Medicinal plants used by traditional medicine practitioners in treatment of alcohol-related disorders in Bushenyi District, southwestern Uganda

Samuel Maling[1]*, Jerome Kabakyenga[2], Charles Muchunguzi[3], Eunice Apio Olet[4], Mary Namaganda[3], Ivan Kahwa[6] and Paul Erasmus Alele[7]

[1]Department of Psychiatry, Faculty of Medicine, Mbarara University of Science and Technology, Mbarara, Uganda, [2]Department of Community Health, Mbarara University of Science and Technology, Mbarara, Uganda, [3]Department of Environment and Livelihood Support Systems, Faculty of Interdisciplinary Studies, Mbarara University of Science and Technology, Mbarara, Uganda, [4]Department of Biology, Mbarara University of Science and Technology, Mbarara, Uganda, [5]Department of Biochemistry, School of Biosciences, College of Natural Sciences, Makerere University, Kampala, Uganda, [6]Department of Physiology, Faculty of Medicine, Pharm. Biotechnology and Traditional Medicine Centre of Excellence (MUST), Mbarara University of Science and Technology, Mbarara, Uganda, [7]Department of Pharmacology and Therapeutics, Mbarara University of Science and Technology, Mbarara, Uganda