INDIRA GANDHI NATIONAL OPEN UNIVERSITY SCHOOL OF CONTINUING EDUCATION

ASSESSMENT OF WATER ACCESS AND PREVALENCE OF WATERBORNE DISEASES IN RURAL COMMUNITY: A CASE OF ENDEGAGN WOREDA, GURAGE ZONE, SNNPR, ETHIOPIA

BY

MANYAWKAL BIREDA ESSA

MAY, 2015

Addis Ababa, Ethiopia

INDIRA GANDHI NATIONAL OPEN UNIVERSITY SCHOOL OF CONTINUING EDUCATION

ASSESSMENT OF WATER ACCESS AND PREVALENCE OF WATERBORNE DISEASES IN RURAL COMMUNITY: A CASE OF ENDEGAGN WOREDA, GURAGE ZONE, SNNPR, ETHIOPIA

BY

MANYAWKAL BIREDA ESSA

ADVISOR: DR. WONDEMAGEGN CHEKOL

A THESIS SUBMITTED TO THE INDIRA GANDHI NATIONAL OPEN UNIVERSITY SCHOOL OF CONTINUING EDUCATION IN PARTIAL FULFILLMENT OF THE REQUIRMENTS FOR THE DEGREE OF MASTER'S PROGRAMME IN RURAL DEVELOPMENT, M.A.(RD).

MAY, 2015

Addis Ababa, Ethiopia

DECLARATION

I hereby declare that the dissertation entitled 'ASSESSMENT OF WATER ACCESS AND PREVALENCE OF WATERBORNE DISEASES IN RURAL COMMUNITY: A CASE OF ENDEGAGN WOREDA, GURAGE ZONE, SNNPR, ETHIOPIA' submitted by me for the partial fulfillment of M.A.in Rural Development to Indira Gandhi National Open University (IGNOU), New Delhi is my own original work and has not been submitted earlier either to IGNOU or to any other institution for the fulfillment of the requirement for any course of study. I also declare that no chapter of this manuscript in whole or in part is lifted and incorporated in this report from any earlier work done by me or others.

Signature

Enrolment No: 089133063
Name: - Manyawkal Bireda Essa
Address: Addis Ababa, P.o.box: 80904
Date: May 2015
E-mail: monybireda@gmail.com/ monyb20022002@yahoo.com

CERTIFICATION

This is to certify that Mr. Manyawkal Bireda Essa, student of M.A.(RD) from Indira Gandhi National Open University, New Delhi was working under my supervision and guidance for his Project Work for the Course MRDP-001. His Project Work entitled 'ASSESSMENT OF WATER ACCESS AND PREVALENCE OF WATERBORNE DISEASES IN RURAL COMMUNITY: A CASE OF ENDEGAGN WEREDA, GURAGE ZONE, SNNPR, ETHIPIA' which he is submitting, is his genuine and original work.

Place:

Date:

Signature:

Name:

Address of the Supervisor:

Acknowledgments

I would like to thank the Almighty and the Virgin for keeping me strong in hard times. I would also like to thank all those who have contributed to the success of this work, especially Armauer Hansen Research Institute (AHRI), for providing facilities necessary to accomplish this work. Special thanks go to Dr. Abraham Assefa, AHRI Director and Prof. Beyene Petros, Addis Ababa University Instructor, for providing these opportunities at AHRI.

Thank you my family, especially my mom, Tadelech Habte Mariam and my sister, Miruk Bireda, for staying patient in difficult times of my life, and of course, Tati and Mimi for their consistent moral support. Love goes to my charming and persuasive wife, Melat Mengistu, without her continuous help and encouragement I could not have mustered up my courage to finish this study. Many thanks to my sister, Neyu Bireda, who encouraged me start and continue this study.

I would like to express my heartfelt thanks to my advisor, Dr. Wondimagegn Chekol, for his support in completing this report and for his positive looks all the time. And many thanks go to Melaku Adal, a friend and PhD student at AHRI, who helped me analyze the statistical part and for sharing his valuable ideas. Also many thanks go to Sisay Gatachew and Girum W/Giorgis, my close friends, with whom I was able to share my experiences and spent valuable times.

I acknowledge the contributions of Endegagn Woreda Administration, for allowing me to study the communities' health and water access situation, and St. Mary's University for providing this opportunity. My special thanks go to Asaminew Kibro and Fedlu Abbas, for helping me collect the data for this report; they supported me through translation, selected competent data collectors, introduced me to the people of Endegagn, the community language and the area in general, and most of all, they gave me a ride on a motor bike in some convenient roads.

Table of contents

Contents **Pages**

List of tables **Pages**

List of figures **Pages**

List of Plates **Pages**

ACRONYMS

DA:	Development Agents
DALY:	Disability Adjusted Life Year
DFID:	Department for International Development
GWSSA:	Global Water Supply and Sanitation Assessment
HH:	Household
HHH:	Household head
JMP:	Joint Monitoring Program
Lpcd:	liter per capita per day
MDG:	Millennium Development Goals
MoWE:	Ministry of Water and Energy
MoWR:	Ministry of Water Resources
NGO:	Non-Governmental Organizations
RWS:	Rural Water Supply
SNNPR:	Southern Nations Nationalities and Peoples' Region
SSA:	Sub-Saharan Africa
UNDP:	United Nations Development Program
UNESCO:	United Nations Educational, Scientific, and Cultural Organization
UNICEF:	United Nations Children's Fund
WaSH:	Water Sanitation and Hygiene
WB:	World Bank
WHO:	World Health Organization
WSP:	Water and Sanitation Program
WSS:	Water Supply and Sanitation

Glossary

Birr: Ethiopian currency

Enset: a type of crop, also known as false banana, serves as a main source of food in Endegagn district

Kebele: Local community (smallest administrative unit)

Woreda: district (Woreda is divided into Kebeles)

Zone: sub regional administrative areas (Zone is divided into Woredas)

ABSTRACT

Background: Lack of sustainability of water supply and sanitation services are always considered as major issues in developing countries that account for high prevalence of waterborne diseases. Socioeconomic status such as; education, income and occupation are also the bottle-necks in developing countries, like Ethiopia, which might be the other potential influential factors associated with prevalence of waterborne diseases. **Objective:** This study aims to assess two dependent variables, water access and waterborne diseases in the study area; and to investigate the probable association of water, sanitation and socioeconomic status with waterborne diseases. **Method:** The associations were established by collecting data via a self-prepared questionnaire in Endegagn Woreda, Gurage Zone, Southern Ethiopia. Data were analyzed by performing Chi-square test of independence, univariate and multivariate logistic regression analysis. **Result:** The prevalence of waterborne diseases was found to be 32% in our study. The multivariate analysis showed that; source of water, water availability, and water smell, were highly associated with risk of waterborne diseases. However, associations could not be established between sanitation and waterborne diseases, may be because sanitation facility is not a problem in the area. The result also showed that 64% of the people do not have basic access to water, with less than 5 liters per person per day. There was also no significant association between socio-economic status and diarrheal diseases. Source of water, tap water use, water availability, water smell, and water treatment mechanisms were associated factors for suffering diarrheal episodes, in the Chi-square test of independence analysis. **Conclusion:** Despite accessibility to sanitation facilities, waterborne/diarrheal diseases are prevalent in the study area, the most prevalent being typhoid, giardia and ameba. The study also finds out that, the majority of people had no basic access to water, most travel for an average of about a kilometer and spent an hour to fetch potable water. Since majority of the people used rivers for drinking and other domestic purposes, there should be assessment of availability of vectors, like infected snails, that transmit schistosomiasis (bilharziasis) to humans, which is a neglected disease of the tropics that stays unrecognized in the body. If untreated, it often results in death.

Key words: Diarrheal diseases, waterborne diseases, water access, sanitation, socioeconomic status, Endegagn Woreda, Ethiopia.

CHAPTER ONE

1. INTRODUCTION

1.1 Background

Water is essential for life. Safe drinking water and sanitation facilities are indispensable to sustain life and health, and fundamental to the dignity of all. Yet, 884 million people do not have access to improved sources of drinking water, while 2.5 billion lack access to improved sanitation facilities (UNICEF, 2006). While these numbers shed light on a worrying situation, the reality is much worse, as millions of poor people living in informal settlements are simply missing from national statistics. The roots of the current water and sanitation crisis can be traced to poverty, inequality and unequal power relationships, and it is exacerbated by social and environmental challenges: accelerating urbanization, climate change, and increasing pollution and depletion of water resources (UNDP, 2006).

Water is an essential resource for survival and to secure good health. But people around the globe face a problem of water scarcity. As of UNDP (2006), currently 700 million people in 43 countries live with water scarcity, of these many are in sub-Saharan Africa which represents one quarter of the global population that faces water scarcity live in developing countries. This scarcity of water forced people around the world to use unsafe water for drinking and other domestic uses (WHO, 2009).

Diarrheal diseases associated with unsafe water continue to be a major threat to child health in developing countries around the world. The latest estimates published by the World Health Organization indicate that diarrheal disease is responsible for approximately 800,000 deaths of children under the age of five per year, causing a higher number of under-age-5 deaths than malaria and HIV combined (WHO, 2007).

One of the key factors contributing to the frequency and burden of diarrheal disease is the pronounced lack of water and sanitation in a majority of developing countries (Zwane and Kremer, 2007). According to the United Nations report, more than half of the population in

developing countries still lacks access to the most basic form of sanitation (United Nations 2007). Somewhat more progress has been made in the water sector, but 21% of the population in developing countries still does not have access to adequate drinking water (UNDP, 2007/2008). The situation is most severe for Sub-Saharan African countries, where 63% of the population lacks access to basic sanitation and 45% of the population lacks safe drinking water supply (UNDP, 2007/2008).

From a public health perspective, the lack of access to water and sanitation infrastructure is disconcerting. Several studies have documented the significant positive effect of water and sanitation on reducing child diarrhea (Esrey et al., 1991; Fewtrell et al., 2005; and Waddington et al., 2009). Moreover, improved water and sanitation has been shown to lower the health risks related to schistosomiasis, trachoma, intestinal helminthes and other water related diseases. In addition, improved water and sanitation is likely to reduce the burden of disease related to other major health issues by reducing the average stress level for the immune system, and thus strengthening the immune response to new infections.

Despite the large number of observational and intervention studies on improved water and sanitation supply, a comprehensive empirical evidence base on their private and public health impact is still lacking. Epidemiological intervention studies in the field are expensive, which limits feasible sample sizes. This fact is unfortunate from a policy perspective since reducing diarrhea, unlike combating HIV, malaria and tuberculosis, has not been made an explicit target of the MDGs, and is therefore generally not as high on policy priority lists. The international community is instead highly committed to reducing child mortality (Millennium Development Goal 4). While diarrheal studies provide important information about the immediate health effects of water and sanitation, the link from water and sanitation to child mortality is indirect and cannot directly be derived from estimates on child diarrhea.

The major water related diseases in Ethiopia are diarrhea, hepatitis, roundworm, hookworm infection, trachoma, guinea worm, schistosomiasis, leishmaniasis, lymphatic filariasis, cholera and malaria. Thus, poor environmental sanitation and water quality play an important role in spreading the infectious diseases, which are presently emerging and creating a big public health

problem. Added to the present scenario of decrease in the quantity and quality of available water, increasing demand of water due to population growth, industrialization and agricultural development pose further new challenges to Ethiopia.

During the dry season more traditional sources of water are placed under pressure as shallow wells or other perennial sources dry-up. This situation worsens as these sources of water supply are shared with livestock. Taken together, rates of morbidity and mortality in rural areas is particularly high since few have access to improved water supply, sanitation facilities, and awareness of hygienic practices.

1.2. Statement of the Problem

According to UNDP (2006), in the world almost 2 million children die each year because they do not get a glass of potable water and basic sanitation. And millions of women and young girls are forced to spend hours fetching and carrying water. Sub-Saharan African countries are at the front of the water scarcity problem, one of which is Ethiopia despite the fact that the country has abundant groundwater, major lakes, and large volumes of rainfall (UNDP, 2006).

Even though water scarcity is a worldwide problem, urban poor and rural inhabitants are at the forefront to be affected by the problem of poor access to potable water and basic sanitation. This is also the situation in rural Ethiopia, where women and children walk for hours to collect polluted water from shallow and unprotected ponds, unprotected springs, and rivers, and in some areas they share the same water sources with their animals. All of these sources are subject to contamination as rainwater washes waste from surrounding areas into the sources.

Additionally, young girls spend hours to fetch and carry unsafe water to drink when they are at the age they are supposed to be in school. Because they do not have access to potable water nearby, a girl in rural Ethiopia spend hours fetching water but a girl at the same age in an urban area spends time in school. In addition to the time they spend, as a result of poor access to potable water and basic sanitation, people are becoming unhealthy which leads to loss of productivity.

It is not debatable that the poor access to potable water and basic sanitation is affecting lives of many in rural Ethiopia. Endegagn woreda, Gurage Zone, is one of the Ethiopian rural places where the community does not have access to potable water, though sanitation facility is not a problem in the area. Thus, the communities are forced to use water from unprotected streams and rivers which they may share with their animals.

The researcher visited the study area and recognized that the community is highly affected by lack of access to potable water supply. Accordingly, the community is obliged to use unimproved sources of water for drinking, cooking, and maintaining adequate standards of hygiene. It is quite easy to understand how necessary water is, but it is believed that unsafe drinking water is as risky as water scarcity. Though they have access to water those sources of drinking water are unimproved and unsafe. Thus, people are easily exposed to water borne and water related diseases and diseases related to poor access to basic sanitation. Therefore, the issue of ease of access to potable water and basic sanitation has to get attention from the responsible authorities as well as the community itself.

Thus, this study tried to assess and reveal the real situation in the area regarding water access and availability of water-borne diseases; and the impacts of poor access to potable water on the overall health of the community in the study area.

1.3. Significance of the Study

In Ethiopia, accessibility to improved water supply remains a major concern. Despite its good level of per capita water availability, only few of the population have drinking water within the residence. Among other factors, the high rate of population growth tends to contribute to the increase of water needs and thus reduces the level of access to safe water.

Therefore, efficient water management policy is important if health and welfare of the population, particularly in rural areas, are to be improved. Efficient water management for rural

areas requires a full understanding of existing pattern of water use as well as a forecast of future water consumption taking into consideration the different factors involved.

Moreover, accurate information about drinking-water, sanitation and hygiene related issues is invaluable to national leaders, decision-makers and stakeholders when making policy decisions. However, our focus in this study will be assessing the water accessibility and water-related diseases in the study area.

Thus, sound and evidence-based information can be used in a variety of ways, including:

- to assess progress towards national and international goals and targets;
- to promote increased investments in the sector;
- to focus attention on needy areas and efficiently allot resources.

1.4. Research Questions

Which factors influence the prevalence of waterborne/diarrheal diseases in rural areas? And what are the factors that are associated to water access in the rural community?

1.5 Objectives of the Study

1.5.1 General Objective:

The purpose of this study is to assess water availability and prevalence of waterborne diseases in Endegagn Woreda, Gurage Zone, Southern Ethiopia.

1.5.2 Specific Objectives:

- To explore the available water resources on which the villagers relied on.
- To assess the prevalence of preventable waterborne and water-related diseases in the area.
- To identify the association between water, sanitation, socioeconomic status and waterborne diseases.
- To assess the adequacy and quality of the water resources in the area
- To investigate the sanitation experience in the study site.

1.6 Scope and Limitation of the Study

The study, however, encountered certain limitations. These are:-

1. Because of the low educational level and less exposure to information, some sample respondents were unwilling to participate in the study.
2. Transportation problems affected the data collection process, and the study took more time than planned.
3. Because of lack of sponsorship and needed time to travel between Kebeles, there was financial constraint to complete the study according to schedule.

1.7 Definitions of Important Words/Phrases

Waterborne D**iseases:** are caused by pathogenic microorganisms that most commonly are transmitted in contaminated fresh water. Infection commonly results during bathing, washing, drinking, in the preparation of food, or the consumption of food thus infected. Various forms of waterborne diarrheal disease probably are the most prominent examples, and affect mainly children in developing countries.

Drinking Water Access: means that the source is less than 1 kilometer away from its place of use and that it is possible to reliably obtain at least 20 liters per member of a household per day. Access to safe drinking water is the proportion of people using improved drinking water sources: household connection; public standpipe; borehole; protected dug well; protected spring; rainwater. Drinking water is water used for domestic purposes, drinking, cooking and personal hygiene. According to Howard and Bertram (2003), there are four access levels; **No access** (>1km distance from source, >30 minutes collection time, <5 liters per capita per day), **Basic access** (100-1000m, 5-30 min, 5-20lpcd), **Intermediate access** (On-plot), **Optimal access** (multiple taps in house).

Diarrhea: is the condition of having at least three loose or liquid bowel movements each day. It often lasts for a few days and can result in dehydration due to fluid loss. Loose but non watery stools in babies who are breastfed may be normal. The most common cause is an infection of the intestines due to a virus, bacteria, or parasite; a condition known as gastroenteritis. These infections are often acquired from food or water that has been contaminated by stool, or directly from another person who is infected. It may be divided into three types: short duration **watery diarrhea**, short duration **bloody diarrhea**, and if it lasts for more than two weeks, **persistent diarrhea**. The short duration watery diarrhea may be due to an infection by **cholera**. If blood is present it is also known as **dysentery**. Prevention of infectious diarrhea is by improved sanitation, clean drinking water, and hand washing with soap. Breastfeeding for at least six months is also recommended as is vaccination against rotavirus. Oral rehydration solution (ORS), which is clean water with modest amounts of salts and sugar, is the treatment of choice.

Improved Drinking Water Sources: include sources that, by nature of their construction or through active intervention, are protected from outside contamination, particularly fecal matter. It comprises piped water on premises such as piped household water connection located inside the user's dwelling, plot or yard. Other improved drinking water sources include public taps or standpipes, tube wells or boreholes, protected dug wells, protected springs and rainwater collection.

Unimproved Drinking Water Sources: include unprotected dug well, unprotected spring, cart with small tank/drum, tanker truck, surface water (river, dam, lake, pond, stream, canal, and irrigation channels), and bottled water. Bottled water is considered unimproved drinking water source because of its quantity, not quality.

Improved Sanitation Facility: is defined as one that hygienically separates human excreta from human contact. Flush toilet, connection to a piped sewer system, connection to a septic system, flush / pour-flush to a pit latrine, ventilated improved pit (VIP) latrine, composting toilets, are considered improved sanitation facilities.

Unimproved Sanitation Facilities: Facilities that do not ensure hygienic separation of human excreta from human contact. Public or shared latrine, flush/pour flush to elsewhere (not into a pit, septic tank, or sewer), pit latrine without slab, open pit latrine, bucket latrines, hanging toilet / latrine, and no facilities / bush / field, are considered unimproved sanitation facilities.

Millennium Development Goal 7, Target 7c: calls on countries to: "Halve, by 2015, the proportion of people without sustainable access to safe drinking-water and basic sanitation".

(Sources of definitions above: Wikipedia and Joint Monitoring Program for WSS (JMP))

CHAPTER TWO

2 LITERATURE REVIEW

2.1 The Global Scenario

According to UNESCO (2006), every person needs 20 to 50 liter of potable water a day for their basic needs: drinking, cooking and cleaning, but more than one in six does not have access to such amount of potable water. Africa has the lowest total water supply coverage of any region, with only 62 percent of the population having access to improved water supply.

The situation is worst in rural areas, where coverage is only 47 percent. According to the JMP (2010), around 2.6 billion people do not have access to basic sanitation; and as a result of poor access to basic sanitation 1.5 million people die each year. Many of these people live in south East Asia and sub-Saharan Africa. Sanitation coverage in Africa also is poor, only 60 percent of the total population in Africa has sanitation coverage, with coverage varying from 84 percent in urban areas to 45 percent in rural areas (JMP, 2010).

The overall disease burden related to unsafe water, sanitation and hygiene (WSH) was first examined at a global level in 1990 (Murray & Lopez, 1996), and was limited to diarrheal diseases. This estimate was revised in 2002 (WHO 2002; Prüss-Üstün et al. 2004) based on a systematic and transparent method. Other estimates have since been performed, based on the same method (Cairncross and Valdmanis 2006). More recently, the impact of WSH on disease has been reassessed in a more comprehensive way (WHO 2007), which estimated that almost one tenth of the global burden of disease can be attributed to water, sanitation and hygiene.

The importance of adequate water quantity for human health has been recognized for many years and there has been an extensive debate about the relative importance of water quantity, water quality, sanitation and hygiene in protecting and improving health (Cairncross, 1990; Esrey et al., 1991). Despite this debate, international guidelines or norms for minimum water quantities that domestic water supplies should provide remain largely lacking. For instance, whilst the Millennium Declaration Goals include a target to 'halve the proportion of people who are unable

to reach or to afford safe drinking water by 2015' (UN, 2000) it does not specify in what quantity such water should be supplied. The WHO/UNICEF Joint Monitoring Programme, which produces the Global Assessment of Water Supply and Sanitation data, describe reasonable access as being 'the availability of at least 20 liters per person per day from a source within one kilometer of the users dwelling (WHO and UNICEF, 2000).

As of 2000 it was estimated that one-sixth of humanity (1.1 billion people) lacked access to any form of improved water supply within 1 kilometer of their home (WHO and UNICEF, 2000). Lack of access to safe and adequate water supplies contributes to ongoing poverty both through the economic costs of poor health and in the high proportion of household expenditure on water supplies in many poor communities, arising from the need to purchase water and/or time and energy expended in collection. Access to water services forms a key component in the UNDP Human Poverty Index for developing countries (UNDP, 1999).

Domestic water supplies are one of the fundamental requirements for human life. Without water, life cannot be sustained beyond a few days and the lack of access to adequate water supplies leads to the spread of disease. Children bear the greatest health burden associated with poor water and sanitation. Diarrheal diseases attributed to poor water supply, sanitation and hygiene account for 1.73 million deaths each year and contribute over 54 million Disability Adjusted Life Years, a total equivalent to 3.7% of the global burden of disease (WHO, 2002). This, places diarrheal disease due to unsafe water, sanitation and hygiene as the 6th highest burden of disease on a global scale, a health burden that is largely preventable (WHO, 2002). Other diseases are related to poor water, sanitation and hygiene such as trachoma, schistosomiasis, ascariasis, trichuriasis, hookworm disease, malaria and Japanese encephalitis and contribute to an additional burden of disease.

2.2 Ethiopia and Water Access

Ethiopia's water and sanitation coverage is also the lowest in the world. The water supply coverage in the country is 22 percent, of which the rural coverage is only 11 percent. The sanitation coverage is 6 percent, of which the rural coverage is 4 percent (JMP, 2010). The country's low health status, high population growth, and low literacy rates bring to bear a heavy burden on the state to increase delivery for water, health, education and other social services.

In comparison with the neighboring countries Ethiopia's water and sanitation coverage is even lower than Eritrea (formerly part of Ethiopia) which has 57 percent water coverage and 9 percent sanitation coverage. Another neighboring country, Kenya's water and sanitation coverage is much better than Ethiopia which is 62 and 48 percent respectively. Though, as the data taken from UNICEF and WHO show most Sub-Saharan African countries have the lowest coverage of water and sanitation of any world region, Ethiopia's water supply and sanitation coverage is the lowest (JMP, 2010).

Ethiopia has one of Africa's lowest rates of access to water supply, sanitation, and hygiene despite abundant surface and groundwater resources. According to the government in 2005, 40 percent of the population had access to safe water; however, according to the World Health Organization (WHO) and local nongovernmental organizations, the figure was closer to 22 percent. The WHO estimated that only 13 percent of the population had access to sanitation. Ethiopia's Millennium Development Goals (MDGs) for improved water and sanitation access are 70 percent and 56 percent respectively. To reach the MDG targets, the government will need to help ensure local water supply and sanitation (WSS) service providers continue to develop their capacity to manage operations. The government will also need to encourage consumer advocacy and hygiene awareness.

In most developing countries, especially in Sub- Saharan Africa (SSA), the basic causes of more than 80% of the diseases are inadequate and unsafe water supply, and improper disposal of waste. Ethiopia is among the poorest countries in the world, ranking 170 out of 177 in the UN human development index and is the second most populous country in Africa. Yet, Ethiopia's

rural populations are among the least served with rural water supply and sanitation access at only 24% and 8% respectively (ADF 2005).

Even though all human beings have the right to life, the right to education, the right to food…etc, these fundamental human rights cannot be fully realized unless people have access to potable water and basic sanitation. Independent of the other fundamental human rights, all human beings also have the right to access potable water and basic sanitation (WWC, 2009). Since people in the developing countries are suffering from lack of access to water and basic sanitation, we cannot talk much more about the so-called 'rights' before survival. Thus, the question of having access to potable water and basic sanitation goes beyond rights, rather it is a question of survival.

2.3 Water and Sanitation Facilities in Rural Areas

According to the World Bank (2010) 70 percent of the world's poor people live in rural areas. Thus, if development is to be achieved, attention should be given to rural water supplies and sanitation since any development activities address the poor. The 2010 updated estimate of JMP (2010) shows that rural Ethiopia has 8 percent access to basic sanitation and 26 percent have access to potable water in 2008 which shows an improvement from previous years. Of the total population of Ethiopia, 85 percent is estimated to live in rural areas, thus, the above data explains that only 26 percent from these 85 percent of population have access to potable water and basic sanitation.

The SNNPR total water coverage is reported to be 48 percent which is, according to the 2005 projection, among 14,507,098 people 6,935,649 have access to clean water coverage (BOFED, 2007). Water and sanitation coverage in rural areas is very low but 70 percent of the world poor population live in such areas, and therefore for development to be achieved due consideration should be given to these 70 percent of the world's poor population.

In rural Ethiopia, efforts are made to provide financial assistance to rural districts which helps to establish water supply and sanitation committees and build facilities (World Bank, 2011).

Despite this assistance by the World Bank and other aid organizations, and the Ethiopian government to increase the easy access to potable water supplies and basic sanitation in rural areas, there are still rural districts that do not get potable water and basic sanitation. There are rural areas which consider having ease access to potable water and basic sanitation as a privilege rather than as a right.

The other challenge in providing potable water services and increasing basic sanitation access to rural areas are infrastructural problem. As Buddeke (2010) stated, socio-economic development is closely linked to infrastructure which many rural areas lag far behind. Ease of access to potable water and basic sanitation is one type of infrastructure which also depends on the other types of infrastructure like roads. Thus, the unavailability of such infrastructure is a challenge to any private or government organizations.

2.4 Millennium Development Goals

Throughout the 1990s, members of the United Nations (UN) recognized the need for reducing poverty, increasing accessibility to health services, and protecting the environment throughout the world. In September 2000, the UN and development agencies committed to addressing these and other issues that will improve living conditions by creating the Millennium Development Goals (MDGs) (WHO, 2006a). These are the Millennium Development Goals:

- Goal 1. Eradicate extreme poverty and hunger
- Goal 2. Achieve universal primary education
- Goal 3. Promote gender equality and empower women
- Goal 4. Reduce child mortality
- Goal 5. Improve maternal health
- Goal 6. Combat HIV/AIDS, malaria and other diseases
- Goal 7. Ensure environmental sustainability
- Goal 8. Develop a global partnership for development

Each MDG incorporates various targets in order to detail the respective Goal. Describing Goal 7,

Target 10 is to “halve by 2015, the proportion of people without sustainable access to safe drinking water” (WHO, 2004c). The World Health Organization (WHO) reported that in 2002, 1.1 billion people still lacked access to improved water sources (WHO, 2004b).

In order to reach Target 10 of the MDGs, the status of water and sanitation must be clearly defined and understood. The Global Water Supply and Sanitation Assessment 2000 Report (GWSSA) was presented by the WHO and United Nations Children’s Fund (UNICEF) and summarizes the conditions of water supply and sanitation throughout the world. The GWSSA states that access to water and sanitation "does not imply that the level of service or quality of water is 'adequate' or 'safe'." The data from the GWSSA only recognizes if a source is improved or unimproved, as defined in Table 2.1 (WHO, 2000).

Table 2.1: Definitions of Improved and Unimproved Water Supplies (Taken from WHO, 2000)

Unimproved Water Supplies	**Improved Water Supplies**
Unprotected well	Household connections
Unprotected spring	Public standpipes
Vendor-provided water	Boreholes
Bottled water*	Protected dug wells
Tanker-truck provided water	Protected springs
	Rainwater collection

*Bottled water is considered unimproved because of possible problems of sufficient quantity, not quality (WHO, 2000).

2.5 Reasons for Poor Sanitation

2.5.1 Economic Reasons

It is clear that human waste is potentially dangerous material which needs to be managed properly. But there are some factors which may prohibit people from adopting latrine services, of which economic reason is to be listed as the main and the first. Poor people rely on subsistence income, of their income they prefer to spend on food and goods, than spending it on latrine construction. Of course it could be expensive to build a latrine for someone who doesn’t secure

his food. Even if people understand having latrine is beneficial, they may not be able and willing to spend high cost on it.

Though economic status inhibits people to build their own latrines, on the other hand this shows that, people do not realize the costs they spend on treating diseases caused by unsanitary environment, which the costs for curing might be higher than preventing. Thus, if people are aware of the consequences of unhealthy environment, the costs to prevent its consequences like diarrheal diseases would be the easiest than treating the diseases. So investing on latrine is also a means of minimizing expenses of medication that comes after unhealthy living environment.

2.5.2 Socio-cultural Reasons

There are also socio-cultural reasons why people do not adopt latrine use; 'what is dirty and clean can vary from culture to culture'. Many people view latrines as evil and dirty places. As a result people may prefer to defecate away from their houses in the fields which are considered more sanitary. Of course, it might be difficult to change long ingrained behavior dictating defecation practices; without proper support people will revert to old habits. The practice of open defecation is ritualized and bound in tradition (Mcconville, 2003). Both the economic and socio-cultural reasons for unimproved sanitation do not outweigh the costs of the consequences because of unimproved water and sanitation.

2.6 Water and Sanitation versus Development

The inclusion of access to potable water and basic sanitation in the MDGs for sustainable development shows that water and sanitation are important development indicators. It is a fact that infrastructure development and socio-economic development are much related. Infrastructure development may include road construction, water and sanitation improvements, and irrigation development. Thus, having access to such services is considered as a precondition for economic development. Accordingly water and sanitation infrastructures also have impact on the economic, social and human development of a nation.

According to UNDP (2006) the water and sanitation crisis has a role of reducing income poverty. National governments are very aware of the expenditure needed to increase the access to improved water and sanitation but they are not curious about the economic costs of the negative consequences of unimproved water and sanitation. If the world population had access to safe drinking water and appropriate sanitation, the child mortality rate would be minimized. As a result of poor water and sanitation many people in the world are insecure; additionally potable water and basic sanitation is the easily preventable way of reducing child mortality. Access to clean water and sanitation is also a means to reduce health related costs, improving girl's education, and it also ensures a sense of human dignity. Generally, access to clean water and improved sanitation "can make or break human development" and it is a condition for all human development goals achievement.

2.7 Benefits of Improving Access to Water and Sanitation Facilities

According to Postnote (2002), increasing access to water and sanitation is an input of development and poverty reduction, as it has major health benefits as well as associated social, economic and environmental benefits. Public health will be guaranteed if there is access to potable water and basic sanitation since the highest causes of illness and death in developing country is related to poor access to potable water and basic sanitation. As a result of this, illness and deaths reduce the productivity of the economy of a nation; poor sanitation has an adverse effect on the environment which in turn may affect the source of the economy like agriculture and tourism.

One of the major benefits of water and sanitation improvements is the time saving associated with better access. Time savings occur due to, for example, the relocation of a well or borehole to a site closer to user communities, the installation of piped water supply to households, closer access to latrines and shorter waiting times at public latrines. These time savings translate into either increased production, improved education levels or more leisure time (Hutton & Haller, 2004).

Thus, the improvement on water supply and sanitation has a direct and concrete impact on health. As Hutton, et al, (2007) explain the occurrence of diarrheal diseases caused by unsafe drinking water and improper sanitation would be reduced if improvements were made in water and sanitation. Since diarrheal diseases are highly associated with unsafe drinking water and sanitation and poor hygiene, the improvements in water and sanitation would have a significant outcome.

The improvements in water supplies and sanitation also have an impact on poverty and economy, as it is logical that only healthy people are strong enough to work and fulfill their needs. As Hutton, et al, (2007) stated the improvement to water and sanitation will have economic benefits of three types: direct economic benefits of avoiding diarrheal diseases, indirect economic benefits related to health improvements and non-health benefits related to improvements in water and sanitation. The direct economic benefits of avoiding diarrheal diseases include cost savings due to the reduced incidence of diarrheal disease, full health care costs, and non-health sector direct costs. The indirect economic benefits include productivity effects of improved health and the non-health benefits.

2.8 Linkages between Water Supply, Hygiene and Disease

Classifying access to a water source as improved or unimproved by the criteria in Table 1 is helpful when investigating a water source, but these criteria reveal no information about how the water is used or the quantity used by individuals or households. Access to a water source used by a household can be described in a different way—in a graded scale based on quantity used. WHO defines the term *reasonable access* to a water source as the "availability of at least 20 liters per person per day (L/capita-day) from a source within one kilometer of the user's dwelling" (WHO, 2000). Other studies provide different criteria of what is considered reasonable access to water, depending on varying conditions: for example, laundry and bathing may take place away from home, so the water use in the household describes different usage patterns.

Howard and Bartram (2003) describe four levels of access to water, or service levels, based on the distance the consumer travels or the time spent collecting water. The researchers indicate that

water quantity is not as important as service level, and volumes of water can be associated with the different service levels. Table 2.2 describes these service levels.

The table also describes the definitions of service levels based on these associated quantities of water and based on collection time. Collection time to a water source is the amount of time it takes for a person to travel from the home to the water source, collect water and return home. Finally, Table 2.2 associates a level of health concern with each service level.

Table 2.2: Service Level Descriptors Defined by Distance and Time to Water Source, Quantities of Water Collected and Level of Health Concern (Taken from Howard and Bartram, 2003)

Service Level	**Distance to source & Total collection time**	**Approximate Quantities collected**	**Level of Health Concern**
No access	>1000m	Very low	Very high
	>30 min total collection time	Less than 5 lpcd	Hygiene not assured, consumption needs may be at risk. Quality difficult to assure
Basic access	100-1000 m	Low	Medium
	5-30 min	Unlikely to exceed 20lpcd	Not all water needs may be mat. Quality difficult to assure.
Intermediate access	On-plot	Medium	Low
	e.g. single standpipe on compound or in house	Around 50lpcd	Most basic hygiene and consumption needs met. Quality more readily assured.
Optimal access	Multiple taps in house	Varies	Very low
		Likely to be 100lpcd and possibly up to 300 lpcd	All uses met. Quality readily assured.

Classifying diseases by causative agent such as microbe type for infectious disease has a value in terms of understanding etiology of infection. However, a more effective way to inform decision-making is to categorize pathogens /diseases in relation to the broad mode of transmission. Bradley (1977) suggests that there are four principal categories that relate to water and which are not mutually exclusive:

- Water-borne - caused through consumption of contaminated water (for instance diarrheal diseases, infectious hepatitis, typhoid, guinea worm);
- Water-washed - caused through the use of inadequate volumes for personal hygiene (for instance diarrheal disease, infectious hepatitis, typhoid, trachoma, skin and eye infections);
- Water-based - where an intermediate aquatic host is required (for instance guinea worm, schistosomiasis); and,
- Water-related vector - spread through insect vectors associated with water (for instance malaria, dengue fever).

Diseases primarily transmitted through the fecal-oral route include infectious diarrhea, typhoid, cholera and infectious hepatitis. Fecal-oral diseases are associated with acute symptoms (with a probability of death) and in some cases with delayed sequel. Transmission may occur through a variety of mechanisms, including consumption of contaminated water and food as well as through person-person contact.

2.9 Water Quantity Requirements for Hygiene

The need for domestic water supplies for basic health protection exceeds the minimum required for consumption (drinking and cooking). Additional volumes are required for maintaining food and personal hygiene through hand and food washing, bathing and laundry. Poor hygiene may in part be caused by a lack of sufficient quantity of domestic water supply. The diseases linked to poor hygiene include diarrheal and other diseases transmitted through the fecal-oral route; skin and eye diseases, in particular trachoma and diseases related to infestations, for instance louse and tick-borne typhus (Bradley, 1977).

The relative influence of consumption of contaminated water, poor hygiene and lack of sanitation on diarrheal disease in particular has been the topic of significant discussion. This has mirrored a broader debate within the health sector worldwide regarding the need for quantifiable evidence in reducing health burdens. The desire for evidence-based health interventions is driven by the need to maximize benefits from limited resources (a critical factor both for governments and their populations). It is also driven by the desire to ensure that populations benefit from the interventions that deliver the greatest improvement in their health.

CHAPTER THREE

3. METHODOLOGY AND RESEARCH DESIGN

3.1. Description of the study area

3.1.1. Location

Endegagn Woreda is found in Southern Nations, Nationalities, and Peoples Region of Ethiopia. Dinkula is the town of Endegn Woreda, which is 230kms away from Addis Ababa (Ethiopia's capital), 277kms from Hawasa (Region's capital), and 75kms from Wolkite (Zone's capital). The size of the Woreda is 127 sq. kms, which is the smallest of all other Woredas of Gurage Zone (Gurage Zone has an area of 5932 sq. kms), the largest being Enemor Ener Woreda. Endegagn Woreda was separated from this large Woreda. The main agricultural produce of the Woreda are Enset, cereals, fruits and vegetables, and with limited amount, khat and coffee. The Woreda is bordered by Enemor and Ener Woreda to the North and to the West, Geta Woreda to the North East, Hadiya Zone to the South, and Silti Zone to the South East. Administratively, the Woreda is divided in to 17 rural Kebeles and one urban Kebele. Each Kebele has 10 or more villages with different local names.

Gurage Zone has 13 Woredas (Abeshege, Kebena, Cheha, Enemor, Gumer, Ejah, Kokir, Mareko, Meskan, Sodo, Maehur Aklil, Geta, and Endegagn), 2 provisional city administrations (Wolkitie is the capital and Butajira is the largest city of Gurage Zone), and 411 Kebeles (local communities).

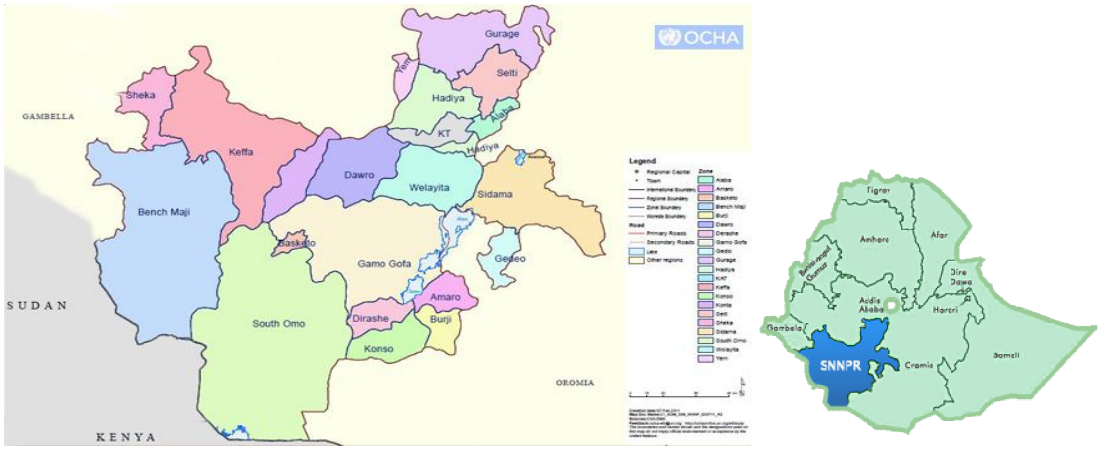


Fig.1. Map of study area (Gurage Zone, northern tip of SNNPR)

3.1.2. Population

The total population of Endegagn Woreda is 48,405 persons, according to the 2007 census report (recent unpublished report of the Woreda estimates it to be 53,794), of which 75% are Orthodox Christians, 21% Muslims and 2% Protestants. Out of the total population, 22,459 are males and 25,946 are females (see Appendix). There are 10,309 households in the Woreda.

3.1.3 Water Schemes

Endegagn has 2 boreholes, 8 shallow wells, 13 hand-dug wells, and 38 small springs developed (see Table 3.1). It is showing progress since 2005 (see appendix).

Table 3.1: Distribution of water schemes and public toilets by Kebele (Endegagn Woreda), 2015.

Kebele	Types of water schemes				Public Toilet
	Borehole	**Shallow well**	**Hand-dug well**	**Small springs development**	
Articho	-	1	-	-	9
Esimat	-	1	-	2	9
Wolecho	-	1	3	1	12
Shewura (Dinkula)	1	-	-	2	11
Bucha	-	1	-	3	16
Keres (Git)	-	-	-	3	10
Zigez	-	1	2	3	9
Hareg	-	-	-	3	8
Jeda	-	1	-	3	5
Genet	-	-	-	5	16
Shorka	-	-	-	1	8
Tefeka	-	-	-	4	5
Gomira	-	-	-	-	14
Becha	-	-	5	4	12
Ane	-	1	-	2	13
Debre Tsige	1	1	-	1	23
Wilo Lera	-	-	3	1	8
Total	**2**	**8**	**13**	**38**	**188**

Rivers

Endegagn has four main rivers which flow throughout the year. These rivers are Anzacha, Degosa, Gombegn and Zikir. Almost all of the people use these rivers in time of water scarcity, and for most households they are the main source of drinking water. Diarrheal diseases associated with unclean water are prevalent in the area.

Health Centers

There are two health centers in the Woreda, namely Dinkula Health Center and Jene Health Center. Every Kebele has its own health post that work day and night to prevent maternal and infant mortality, which is now 0%, according to the Woreda report. Every mother delivers her child in health centers and health posts, and never in her home. There is also one (and sometimes two) health extension workers employed in each Kebele.

3.2. Sampling Techniques and Sample Size

3.2.1. Sampling Technique

The study was a cross-sectional study which incorporates quantitative data through questionnaire. The data for this study was generated from both the primary and secondary sources. As to the primary source, information was collected through use of face-to-face questionnaire survey. Secondary data was gathered through reviewing relevant materials documented in the study area and some statistical reports, books, journals, bulletins, magazines, web sites, and unpublished thesis.

All Kebeles in Endegagn Woreda were included in the study. Each household was selected with random sampling method. The researcher selected two supervisors and four data collectors from the Woreda, who were employed in the Woreda. Fluency in the local language, experience in data collection, and good knowledge about research, were considered in recruiting enumerators.

Each data collector was given four Kebeles to interview households and the supervisors went with them in different times to investigate and help the enumerators. The supervisors and the data collectors were trained prior to the data collection time. The data collectors were told to include at least three villages in the Kebele, using random method. This was important especially to estimate the distance from the water source that every household is traveling relative to neighboring villages.

3.2.2 Sample Size

The sample size for collecting quantitative data for this research is determined by using (Cochran's, 1977) formula, which is used in most text books. Therefore, the study use's the following formula to calculate sample size.

$$n=N/1+N(e)^2$$

Where:
n =designates the sample size the research uses;
N=designates total number of households in 17 Kebeles;
e= designates maximum variability or margin of error 5% (.05):
l= designates the probability of the event occurring.

Therefore:
$n=N/1+N(e)^2$; $n=10309/1+10309(0.05)^2$; $n=385$

Sample size for each kebele should be 22.6. However, due to some technical errors and difficult topography of the area, we couldn't hit the exact number, which is around 23 households from each Kebele. This was the sample size we get from each Kebele: Araticho (20), Esimat (18), Wolecho (18), Shewura (17), Bucha (21), Keres (20), Zigez (7), Hareg (20), Jeda (20), Genet (20), Shorka (20), Tefeka (20), Gomira (19), Becha (20), Ane (20), Debre Tsige (21), Wilo Lera (20). The total sample size we used was therefore, 321.

3.3. Data Processing and Analysis

Quantitative raw data collected using questionnaires was organized and processed right after the field data collection is completed, and data was arranged categorically. Outputs were categorized into different components relating to relevant variables for convenience in analyzing the findings. Data is presented using statistical techniques such as, frequency distributions, tables, pie chart, and chi square test of independence, univariate and multivariate regression analysis. Explanation is provided to clarify information on observed data.

3.4. Quality and Ethical Consideration

The researcher received official permit from Endegagn Woreda Administration Bureau to conduct this study on the Woreda. Endegagn Woreda Health Centers (Dinkula Health Center and Jene Health Center) were willing to assist the researcher on data collection and in providing necessary data documented in the health centers.

Survey respondents were provided detail explanation on the overall objective of the study ahead of time. Interview is administered on free will of interviewees. Respondents were informed that they can decline if they don't want to be interviewed. Information provided by interviewees will not be transferred to a third party or will not be used for any other purpose.

CHAPTER FOUR

4. RESULTS AND DISCUSSION

According to the two health centers' report (Jene and Dinkula) of 2006 E.C, diarrheal disease cases associated with unclean water, were 399 (of which 177 were children under 5 years of age). This year's (2007 E.C.) six months report registered 139 total diarrhea cases. This shows that diarrhea is prevalent in the area and the Woreda administration needs to work on accessibility of clean water to these vulnerable people.

4.1. General Characteristics of the Study Area

Characteristics like household size, level of education, income per year and occupation were observed in the study site. Frequency and percentage of each of the variables is given in the table below (Table 4.1).

4.1.1. Socioeconomic Status

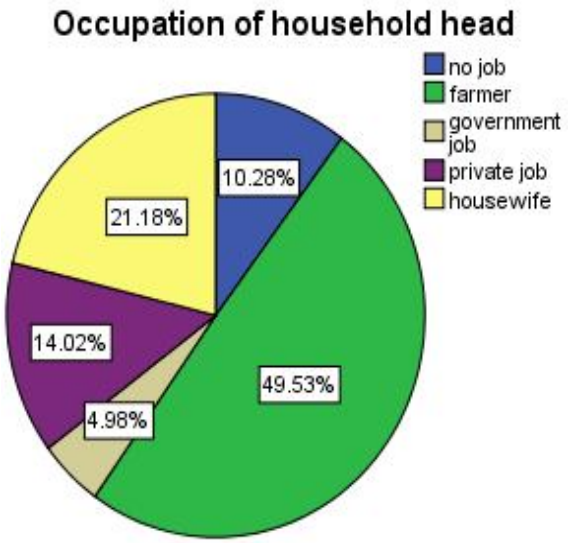
The study showed that most of the households (73%) have 5 or more members. Although it was found that only a few household heads were uneducated (40%), most of them were educated only up to primary level (54%), suggesting lesser number of years in school. Only 6% household heads showed a secondary or higher level of educational status (Table 4.1).

Table 4.1: General Characteristics of the study site

Characteristics	**Frequency (n=321)**	**Percentage (%)**
Household size		
0-4	86	27
5 & above	235	73
Education of household head		
Uneducated	128	40
Primary	175	54
Secondary/higher	18	6
Income of household head		
Low income	234	73
Middle income	45	14
Higher income	42	13
Occupation of household head		
No job	33	10
Farmer	159	50
Government job	16	5
Private job	45	14
Housewife	68	21

It was also found that most of the people (73%) have a low income level less than 6000 birr a year. This shows that most of the people live under the international poverty line with an income less than one dollar a day (recently changed to 1.25$, by the World Bank). The other households have middle (6000-10000 birr) and higher income (more than 10000 birr/ >500 USD), 14% and 13%, respectively (Figure 4.2).

49.5% of the people were dependent on agriculture as their main source of income for their livelihood, while 31% of them have no income that are either housewives or have no job, 21% and 10%, respectively (Figure 4.1). These categories of people in the study area are probably assisted by one or more of the family members who work in cities and towns of the country, as the area is believed to be over populated in terms of land size, which is the main reason for the local young people scattered everywhere in the country, searching for job. The clear image of the situation of income level and occupation of the study area are shown on figure 4.1 and figure 4.2 below.



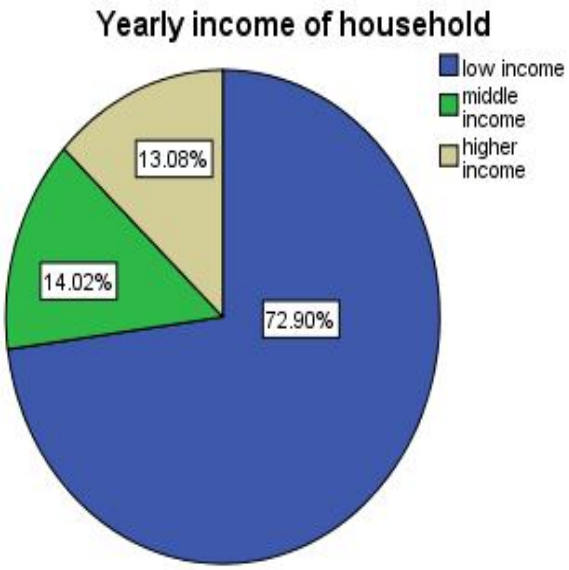


Figure 4.1: Occupation of household heads Figure 4.2: Income of households

These low income households are lucky in that most are getting their water from natural surface water sources, and it would have been very difficult for them to live without such resources, because they have to travel long enough to get tap water facilities. Moreover, even if facilities are around, they might have been in short of money to pay for that, unless cost is minimized to their level. In many countries, while the poorest get less water of a lower quality, they are also often charged the most. People living in the slums of Jakarta, Manila and Nairobi pay 5 to 10 times more for water than those living in high-income areas in those same cities and more than consumers in London or New York. In Accra, many of the 800,000 people living at or below the poverty line pay 10 times more for their water than residents in high-income areas (UNDP, 2006)

4.1.2. Characteristics of Water and Sanitation

The study revealed that half (49.8%) of the households get their daily water entirely from river, while 22% use well and stream together with river (Table 4.2). This adds up to make 72%, showing that people use river water either for a drink or other domestic purposes like cleaning, bathing and cooking. This might be dangerous for the people that might be vulnerable to other water-washed (Trachoma, Leprosy and skin diseases) and water-based (Schistosomiasis) diseases.

Trachoma, which is most common among populations living under poor sanitary conditions, is also prevalent in the area. Dinkula Health Center report of six months indicates that there appear 20 cases of trachoma this year, of which 5 cases are children under 5 years of age. However, no case of Schistosomiasis was registered, even though one of the respondents from Keres village, Git Kebele, complained that they had Schistosomiasis case this year. Further study should be undertaken to make sure that the disease is prevalent in this village and neighboring villages as well, or otherwise, the person might have brought it from some other place, since young people of the area have a general trend of traveling to different places of Ethiopia, searching for a job. Those people may import some diseases that are not prevalent in the area.

Table 4.2 shows that 18% of the people used stream and well interchangeably as a primary source of water for the households but untreated stream is also considered not safe to drink unless it is treated to remove bacteria, viruses, and parasites. Drinking water contaminated by these organisms can cause diseases like cryptosporidium, giardia and other waterborne diseases.

During the study it was found that only 10% (Table 4.2) of the population used public tap water as a primary source of drinking and other domestic purposes. The majority of the people does not use tap water and are dependent on other surface water sources. This is also dangerous for the people as the quality of surface water is unpredictable, because the water continually moves and pollutants can be introduced at any time. In other words, an area of lake or stream that is fine one day may be contaminated the next.

Table 4.2: Characteristics of water and sanitation facilities of the study site

Characteristics	**Frequency** (n=321)	**Percentage** (%)
Source of water		
River	160	50
Public tap	31	10
Well/stream	59	18
Well/stream/river	71	22
Tap use		
Tap	31	10
Others	290	90
Presence of latrine		
Yes	313	97
No	8	3
Type of latrine		
Temporary	35	12
Permanent	278	88

4.1.3. Characteristics of the Outcome Variables

Almost all of the households interviewed have their own private toilets. However, despite use of latrines we have observed diarrheal diseases which might have occurred because of people who defecate in the open, unknowingly what it might bring to them. Only 36% of the people have basic water access (5 upto 20 lpcd), while 64%% have no basic access to water (less than 5 lpcd) (Figure 4.3). However, the prevalence of diarrheal diseases in the study population is 32% where as the rest 68% have no complains having any kind of water related disease in this year (Figure 4.9).

4.2. Water Access

As stated above, the study indicated that 64% (Figure 4.3) of the households in Endegagn Woreda have no basic access to water, with a consumption of less than 5 liters per person per day, traveling more than a kilometer and spending more than an hour to fetch water and come back home.

The rest of the people (36%) have basic access to water, but this doesn't mean that they have access to clean water, because most of the residents use surface waters like river and stream for drinking purposes.

The first priority for interventions to improve access to water supplies is to ensure that at least basic access is achieved. At a basic level of service the volume of water collected is likely to be around 20 liters per capita per day. There is no evidence that behavior change interventions have been successful in promoting increases in water quantities used in households that have achieved basic access to improved water supply. At this level of service, it is the effective use of the available water that is of principal importance, including the importance and timing of hand and face-washing and household water treatment, in controlling infectious disease transmission. Once this level of access is achieved, attention should be placed on providing guidance and support in hygiene practices and water quality management techniques that will reduce the risk of diarrheal disease transmission.

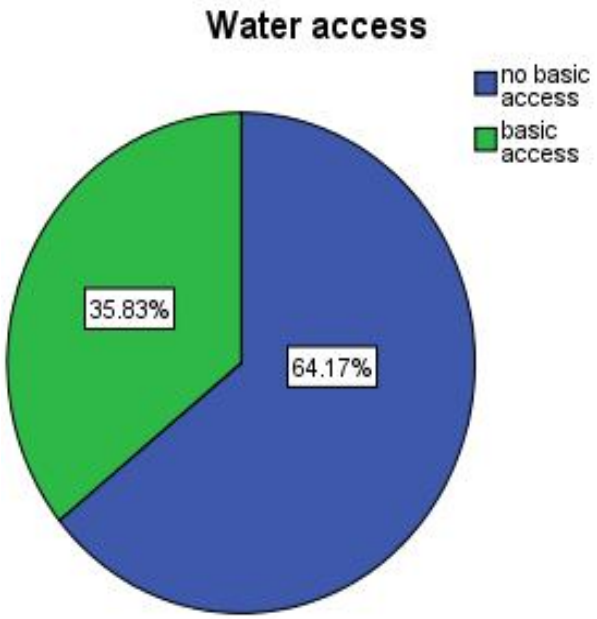


Figure 4.3: Water access in Endegagn Wereda

The Woreda report however, shows that it has clean water coverage of 38.5%. The report mentioned that the distribution of water schemes in the Woreda has grown much, since 2005 G.C census report. For example, the Woreda had no small spring's development schemes but now it has 38 small springs development. There were only 7 hand-dug wells but now it has 13 such wells. There were also no shallow wells in the area but now there are 8 shallow wells. The borehole water scheme was one and now there are two boreholes, one of which is found in the town of the Woreda, Dinkula (see Plate 1 below), and the other at Debre Tsige Kebele (Appedix 2).

Ensuring access to the basic level of service represents the primary objective of the Millennium Development Goal in relation to water, although the definition of the safety of water remains unclear. In many urban situations, it may be possible to move from no access to intermediate access without a middle phase of basic service level.

Plate 1*:Dinkula town's borehole water scheme with two pipeline distributors, Endegagn Woreda*

Ensuring basic access to the currently unserved and increasing the numbers of people with intermediate access are complementary activities. There remains no doubt that ensuring at least a basic level of service remains a key international goal. At the same time, investment should not focus solely on this level of access, but should also be targeted on addressing moving increasing numbers of people to an intermediate level of access.

As observed by the researcher, Dinkula, the town of the Woreda has 4 public tap water services, and most of the residents have private tap water in their homes. But, the overwhelming majority of the people (92.4%), according to the 2005 census report, live in the rural areas leading agricultural life. These people have no access to clean water and are highly vulnerable to catch waterborne and water-related diseases, such as thyphoid, giardia, amoeba, cholera, schistosomiasis, cryptosporidiosis, trachoma, leprosy, and other skin diseases.

4.2.1. Responsible Person to Fetch Water

As shown in the figure (Figure 4.4), the burden of fetching water is on the shoulder of females. The majority (67.6%) of the people responsible to fetch water are adult females (see Plate 2 below) and 17.8% are female children (Plate 3). Male children and adult males constitute 8.1% and 6.5%, respectively.

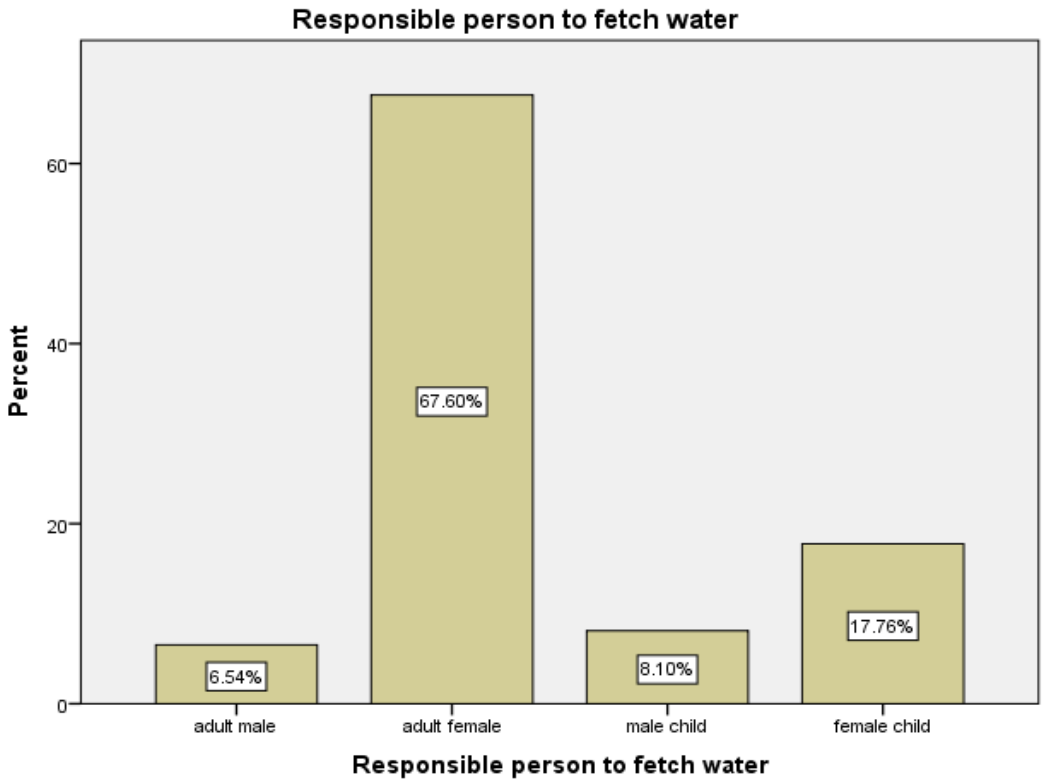


Figure 4.4: Family members who are responsible to fetch water

Lack of access to safe drinking water and sanitation affects women in particular. Women and children do most of the water collecting if drinking water is not available on the premises. Collecting and carrying water takes time and is a heavy burden on them. According to UNDP (2006), it also helps to explain the very large gender gaps in school attendance in many countries. It is not rare for women to spend up to four hours a day walking, queuing and carrying water, time that could be put to productive activities or housework and childcare. The water collected is often dirty and from unprotected sources. Women's health can be particularly

affected by the heavy burden of carrying water, as well as by water contact diseases such as schistosomiasis.

Plate 2*:Female adults queuing & fetching water*

Plate 3*:Female children fetching water*

Very often, women are excluded from decision-making concerning water and sanitation. As a result, their specific needs and circumstances are not taken into account in the development of water and sanitation programs or in the extension of these services.

4.2.2. Yearly Water Availability

72.6% of the households responded that they have water throughout the year, while 27.4% responded they have to travel more to get water in seasons of water shortage (Table 4.3).

Table 4.3: Percentage distribution of respondents on water access

Variables	**No. of respondents**	**Percentage**
Yearly water availability		
Yes	233	72.6
No	88	27.4
Reason for not using tap water		
Far from home	24	7.5
Not available	266	82.9
Use tap	31	9.7
Months of water scarcity		
December to February	199	62
March to May	29	9
No scarcity	93	29
Water source during scarcity		
No scarcity	93	29
Public tap	39	12.1
River	144	44.9
Stream	45	14
Water source damage		
Yes	51	15.9
No	270	84.1
Reason for water source damage		
Break	12	3.7
Dry	16	5
Flood/livestock	23	7.2
No damage	270	84.1

4.2.3. Tap Water Use

Very few people (9.7%) use public tap water for drinking purposes, where as 90.3% use sources other than tap water. The majority of the people (83%) responded that there is no public tap available in the area, while the rest of the people (7.5%) said they don't use tap water because it's far from home (Table 4.3).

4.2.4. Months of Water Scarcity

The seasons of water scarcity is mostly in December to February (62% of respondents), and March to May (9% of respondents). The rest (29%) responded that there is water throughout the year. Majority (44.9%) of the people get their water need from rivers during scarce seasons, but the rest got their water need from streams and public tap water, 14% and 12%, respectively.

4.2.5. Water Source Damage

When asked whether there is damage in the main water source, 16% responded there was damage on the main source. 84% replied there was no damage in the water source. The main reason for water source damage was due to livestock and flood. The others complained breakage and being dry are the reasons for the source damage.

4.2.6. Distance from Water Source

The figure below shows that people who fetch water for the family have to travel and average distance of nearly 1km (974metres), with a minimum travel distance of 6 meters and a maximum distance of travel for a few villages which travel for 5kms to get drinking water.

The average per capita use per day of the study area is 5.01 liters the majority of people (64%) get below this average amount of water for their daily needs (see Appendix). The rest of the people get 5-20 liters per person per day, which is considered as necessary for basic needs. No single family gets intermediate access to water (20-50 lpcd).

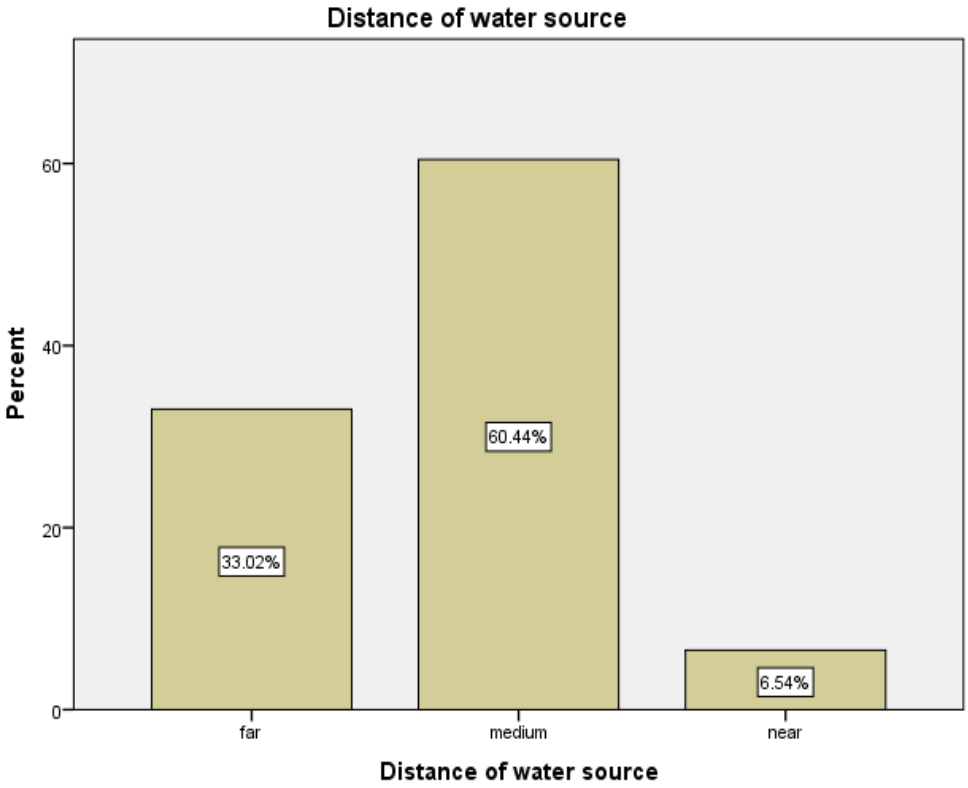


Figure 4.5: Distance traveled to fetch water in Endegagn Woreda

The distance from the source determines the amount of water they can collect. As the JMP (2006) stated if the distance from the source is 30 or less minutes to reach to and get back, most of the householders at least fetch enough drinking water to satisfy their basic needs. But if it takes more than 30 minutes, people collect less water than they need to meet their basic needs. Thus, there are many members of the community whose water needs per day are determined by the distance to the water source.

4.2.7. Time for One Trip to Fetch Water

These people who travel for such high kilometers spend about 5hrs to fetch drinking water and come back. Even though most of them have donkeys, the burden is still on those members of the family who are responsible to fetch water, mostly female adults and female children.

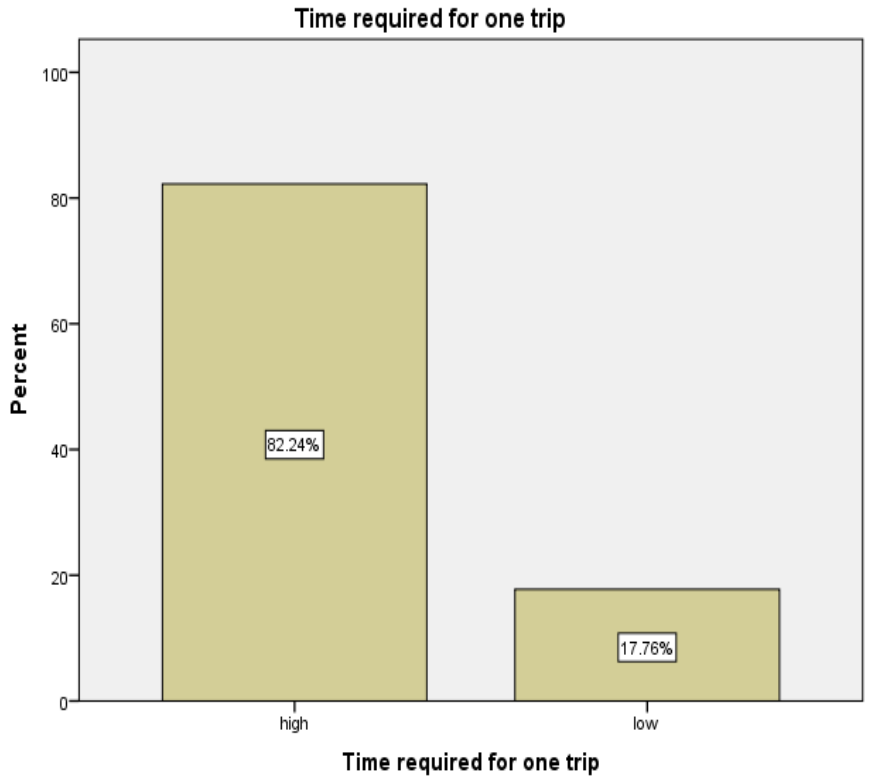


Figure 4.6: Time required to fetch water, Endegagn Woreda

As the amount of water accessed every day is largely determined by the distance to the water source and the collection time, a reasonable distance is one that allows everyone to collect sufficient water to cover personal domestic uses. According to WHO, in order to have a basic access to 20 liters per day, the water source has to be within 1,000 meters of the home and collection time should not exceed 30 minutes. When water is piped into the home, access is optimal and at least 100 liters per person per day is likely to be ensured (Howard and Bertram, 2003). Access to a regular supply of water within the home also eliminates the need for women and children to spend time and physically exert themselves to collect water from distant sources. However, this is unthinkable for rural areas with difficult topographies like Endegagn Woreda, let alone the country is the poorest. Protecting and improving available surface water is an option, that needs local labor force.

4.3. Sanitation Coverage

The report from the Woreda shows that there are 188 public toilets and 7069 private toilets in Endegagn Woreda. The investigator of this study has traveled 10 kilometers (Genet Kebele to Dinkula town) on foot to observe the availability of public toilets on roads to the market place. There were 8 road side public toilets and the road connects four Kebeles: Hareg, Jeda, Wolecho and Showura (Dinkula) (see Plate 4). This is very useful for travelers because they do not defecate on open places that might be washed away to contaminate the rivers through rainwater and flood.

Plate 4*: Road side public toilets,Genet Kebele to Dinkula town market place, Endegagn Woreda*

However, it should be known that, promotion of latrine use, rather than latrine construction, is the best way to make progress on ending open defecation, for people who have defecated in open fields their whole life. It's something that they consider to be good, even healthy: going out in the open early in the morning gives them the chance to take a walk, get some fresh air, check on their fields, and meet their neighbors. In fact, an informal communication with people who defecate in the open revealed that they do so because it is pleasurable, comfortable, or convenient.

4.3.1. Toilet Availability

Even though the government is successful in reaching 97.5% coverage of private toilet in every household, these people are also vulnerable to fecal-oral diseases, such as Ascariasis, Hookworm and Hepatitis, since they are using rivers for their domestic water use. However, the investigator also observed that there are public toilets available on roads every kilometer to the market place, which might minimize the risk of catching such fecal-oral diseases. Most of these public toilets are permanent, made of mud and wood (Figure 4.7).

Figure 4.7: Toilet availability in Endegagn

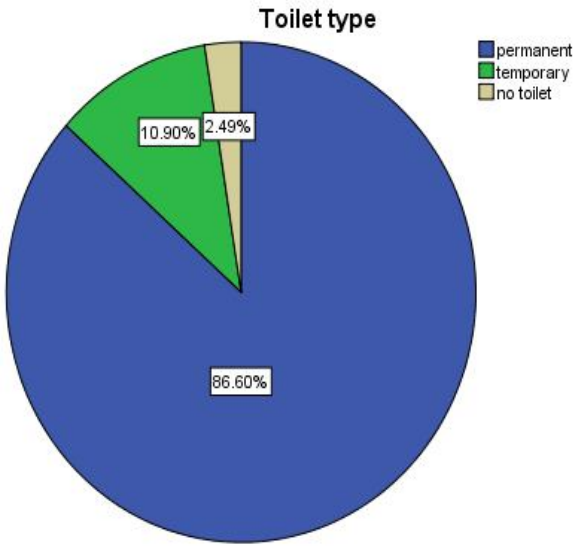


Figure 4.8: Toilet type in Endegagn

While the right to water does not imply that everyone should have access to water and sanitation at home, it requires such facilities to be in close proximity to, or at a reasonable distance from, each house. Water and sanitation should also be provided in schools and hospitals, at the workplace, in detention centers, as well as in camps for refugees.

In fact, a major reason why parents do not send their daughters to school in many countries is that there are no separate sanitation facilities for girls. In Nigeria, for instance, parents withdrew

their daughters from school because they had to defecate in the open. In Uganda, 94 per cent of girls reported problems at school during menstruation and 61 per cent reported staying away from school during that time (WaterAid, 2007).

4.3.2. Toilet Type

Of the private toilets, 88% are permanent; made of mud and wood, and 12% are temporary; made of either bamboo or plastic materials. And, no toilet is observed which is made of bricks and cement (Figure 4.8).

4.4. Waterborne Diseases

Waterborne diseases are caused by pathogenic microorganisms that most commonly are transmitted in contaminated fresh water. It affects mainly children in developing countries. Infection commonly results during bathing, washing, drinking, in the preparation of food, or the consumption of food thus infected.

4.4.1. Types of Waterborne and Water-related Diseases in Study Area

The prevalence rate of waterborne diseases in the study area was found to be 32% even though 97% of the population have private toilets.

Table 4.4: Prevalence rate of waterborne and water-related diseases

Disease	**Frequency (n=321)**	**Percentage (%)**
None	218	67.9
Giardia	10	3.1
Cholera	1	0.3
Typhoid	79	24.6
Amoeba	12	3.7
Bilharzia (Schistosomiasis)	1	0.3
Total	**321**	**100**

The study shows that, 68% of the people had no waterborne or water-related diseases occurred this year. However, amoeba and giardia (3.7% and 3.1%, respectively) seem to be more prevalent diseases in the area next to typhoid (24.6%), which is the most prevalent one. Only two households complained that they encountered during the year the diseases, cholera and bilharzias (schistosomiasis) each, contributing to 0.3% and 0.3% of the diseases occurred in the study area.

Further study should be planned to investigate those two diseases, especially Schistosomiasis, which is a water-based disease caused by blood infection with a parasitic flatworm, schistosome. It causes debilitation and can cause liver and intestinal damage in the long run. It is most common in Asia, Africa (including Ethiopia), and South America, especially in areas where the water is contaminated by freshwater snails that carry the parasite. Studying the presence of snails in the rivers is enough to investigate this neglected parasitic disease of humans which stays many years inside the body before it finally kills.

4.4.2. Prevalence of Diarrheal Diseases in the Study Area

The prevalence of diarrheal diseases in the study population is 32% where as the rest 68% have no complains having any kind of water related disease in the previous year (Figure 4.9).

Safe drinking water and sanitation are fundamental for children's health. In countries with high child mortality, diarrhea accounts for more deaths in children under five than any other cause—more than pneumonia, malaria and HIV/AIDS combined. Over 90 per cent of child mortality cases are related to contaminated water and inadequate sanitation (UNICEF, 2006).

Lack of safe drinking water makes children more vulnerable to disease. Their immune systems and detoxification mechanisms are not fully developed, so they are often less able to respond to a water-related infection. Children also have less body mass than adults. This means that waterborne chemicals may be dangerous for a child at a concentration that is relatively harmless for an adult.

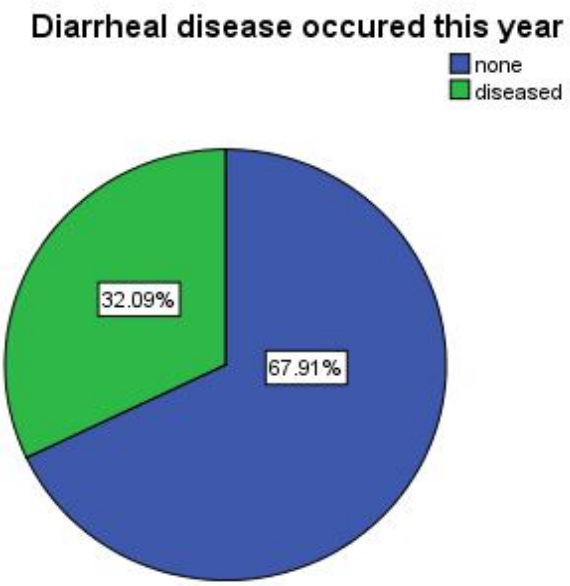


Figure 4.9: Prevalence rate of diarrheal diseases in Endegagn Woreda

Diseases related to unsafe water and poor sanitation are common in the community. Diarrheal diseases and diseases like trachoma are affecting the members of the community. Trachoma is a preventable eye disease but can be a cause of blindness which is spread by flies that breed in an unclean and dry environment. Some diseases are also life threatening because of water and sanitation problems. As a matter of fact some members of the community are forced to suffer at home with easily treatable and preventable diseases, simply because they have low income. The health of the community is greatly threatened because they do not have access to a hospital or clinic nearby. In order to reach to the closest health post, they have to walk for hours.

4.4.3. Water Quality

Table 4.5 shows that the taste of drinking water is considered good to most of the households (91%). Few of them took it as bad (9%). The majority replied the water has no smell and it is not turbid, 84% and 72%, respectively.

Table 4.5: Percentage distribution of respondents by selected household characteristics

Variable	**No. of respondents**	**Percentage**
Taste of drinking water		
Good	293	91.3
Bad	28	8.7
Color of drinking water		
Not turbid	231	72.0
Turbid	90	28.0
Smell of drinking water		
No smell	271	84.4
Bad smell	50	15.6
Under 5 years old bloody/watery diarrhea		
Yes	20	6.2
No	301	93.8
Above 5 years old bloody/watery diarrhea		
Yes	19	5.9
No	302	94.1
Water treatment mechanism		
Boil water	4	1.2
Filter water	55	17.1
No boiling and filtering	262	81.6

Most of the residents said the color of drinking water is not turbid, while it really looks turbid. For example, if we look at the following photo (Plate 5) taken from Genet Kebele, the stream looks turbid but almost all of the respondents said it is clear. And the people from this area said they don't have waterborne diseases unlike other villages around.

Plate 5*: Stream water used for drinking, Genet Kebele, Endegagn Woreda*

Their reason may not directly related to the quality of the water, rather there is a tradition which prohibits calling water 'bad', in many rural areas of Ethiopia. Actually there is a saying which shows respect to water equivalent to mothers '*water and mothers do not have bad*□. This implies that from whatever source the water comes the community has a culture of respecting water and drinks it while knowing it is not safe for their health.

4.4.4. Prevalence of Bloody/Watery Diarrhea

Our study shows that there is 6.2% prevalence rate of bloody/watery diarrhea in children below 5 years of age, while its prevalence is more or less the same (5.9%) for adults and children above 5 years of age (Table 4.5).

Infections that can present with bloody diarrhea include Salmonella spp., Escherichia coli, Shigella spp., Entamoeba histolytica, schistosomiasis. Whereas, most cases of acute, watery diarrhea are caused by viruses. The most common ones in children are rotavirus. Rotavirus is the most common cause of severe diarrhea among infants and young children. Nearly every child in

the world has been infected with rotavirus at least once by the age of five and immunity develops with each infection, so subsequent infections are less severe; adults are rarely affected (Dennehy, 2000).

The virus is transmitted by the fecal-oral route. It infects and damages the cells that line the small intestine and causes gastroenteritis. Interventions to prevent diarrhea, including safe drinking-water, use of improved sanitation and hand washing with soap can reduce disease risk.

4.4.5. Water Treatment Mechanism

Most of the households do not treat water by boiling or filtering (81.6%). Very few households filter or boil their water, 17.1% and 1.2%, respectively. Awareness should be given to the community to use other treatments such as tablets. Much is expected from the local authorities to train people to treat their water and deliver tablets at a reasonable price. However, the easy option to treat water is boiling the water but many complain that they do not have time to boil the water since they have lots of other responsibilities at home.

4.5. Associations between Independent Variables and Diarrheal Diseases.

4.5.1. Descriptions of the Independent Variables for Diarrhea

Table 4.6 shows that the main source of water for drinking is river water. Almost half of the households (49.8%) are dependent on rivers. 22.1% of the respondents also used river water together with streams and wells, while 18.4% of the households use well and stream alone. Only 9.7% of the people use tap water from public tap services.

Table 4.6: Percentage distribution of the independent variables to diarrhea

Variable	Frequency	Percentage
Source of water		
River	160	49.8
Public tap	31	9.7
Well/stream	59	18.4
Well/stream/river	71	22.1
Tap use		
No tap	290	90.3
Use tap	31	9.7
Yearly water availability		
Yes	233	72.6
No	88	27.4
Smell of water		
No smell	271	84.4
Bad smell	50	15.6
Water treatment mechanism		
Boil water	4	1.2
Filter water	55	17.1
No boiling/filtering	262	81.6

When asked for the availability of water year round, 72.6% replied that they get water throughout the year, where as 27.4% replied that there is scarcity of water in the dry season (Table 4.6). Smell of water was considered bad for 15.6% of the respondents, while the rest 84.4% replied that the water has no smell. Majority of the people (81.6%) do not boil or filter water, while few people applied filtering and boiling to treat their drinking water, 17.1% and 1.2%, respectively. The respondents were also asked whether there was damage in the water source this year. 84.1% of the respondents said that there was no damage at the main source of water. A few people replied there was damage to the water source due to livestock and flood.

4.5.2. Chi-square test for Diarrhea

Studying the relationship between some independent variables, the Chi-square test revealed that water source, tap water use, yearly water availability, smell of water, and water treatment mechanisms are the main independent variables which have significant relationship to diarrhea.

The study shows that among diarrhea cases occurred this year, 46.6% use river water as a main source for drinking (Table 4.7). 30.1% of the affected families use river together with wells and streams. Only 1.9% of the diseased family use tap water. The rest 21.4% use wells and streams interchangeably. The Chi-square test results, therefore, shows a highly significant relationship observed with a P-value of 0.002.

Of all the diseased individuals, 98.1% do not use tap water as a main source of drinking water. The result shows that tap water use has a significant relationship with occurrence of diarrheal diseases in the family (P-value=0.001). Yearly water availability also shows a significant association with diarrhea (P-value=0.013). 18.4% of the affected family does not get water the whole year, and they might have been obliged to use unclean water sources around their village. Smell of water has also shown a significant association with diarrhea occurrence. 8.7% of the affected household said the water has bad smell.

The water treatment mechanism also shows a significant relationship with waterborne disease. The ones who do not use boiling and filtering are the most affected (85.4%). Those who filter water are the next affected (11.7%), and the ones who boil water (2.9%) are the least affected.

Table 4.7: Chi-square test of independence for diarrhea

Factor	Diarrhea				P-value
	None		Diseased		
	Frequency	Percentage	Frequency	Percentage	
Source of water					
River	112	51.4	48	46.6	.002
Public tap	29	13.3	2	1.9	
Well/stream	37	17	22	21.4	
Well/stream/river	40	18.3	31	30.1	
Tap use					
No tap	189	86.7	101	98.1	.001
Use tap	29	13.3	2	1.9	
Yearly water availability					
Yes	149	68.3	84	81.6	.013
No	69	31.7	19	18.4	
Smell of water					
No smell	177	81.2	94	91.3	.020
Bad smell	41	18.8	9	8.7	
Water treatment mechanism					
Boil water	1	0.5	3	2.9	.043
Filter water	43	19.7	12	11.7	
No boiling/filtering	174	79.8	88	85.4	

4.5.3. Univariate and Multivariate Regression Analysis for Diarrhea

For the logistic regression analysis only source of water, tap use, smell of water, yearly water availability and water treatment mechanisms were included as independent/explanatory variables to find out the association with the dependent variable, diarrhea.

Table 4.8 shows the regression analysis to check whether there is association with the independent variables and diarrhea. The univariate logistic regression analysis showed a significant association between source of water and waterborne diseases. River water users showed increased risk of waterborne diseases compared to others (OR=0.553; CI=0.310-0.986) with a p-value=0.002 (see Table 4.8).

Tap water use also has a significant association with diarrhea. The ones who do not use tap water for drinking are highly vulnerable to catch the disease (OR=7.749; CI=1.812-33.137) with P-

value=0.001. Yearly water availability (OR=2.047; CI=1.153-3.634) and smell of water (OR=2.419; CI=1.127-5.192) showed a significant relationship with diarrheal disease, with P-value of 0.013 and 0.20, respectively.

The multivariate logistic regression analysis showed a significant association between two independent variables and waterborne diseases, source of water and yearly water availability. Public tap water users showed a decreased risk of waterborne diseases compared to others (OR=0.122; CI=0.026-0.587) with a p-value=0.002 (see Table 4.8). It also shows a significant association between yearly water availability and waterborne diseases. Those who do not get water throughout the year have an increased risk of catching the disease in scarce months (OR=2.719; CI=1.175-6.295) with P-value of 0.013. However, the other variables did not show significant statistical association with waterborne diseases.

Table 4.8: Univariate and multivariate analysis for diarrhea

Explanatory variables	**Univariate analysis COR(CI of 95%)**	**Multivariate analysis AOR(CI of 95%)**
Source of water		
River	0.553(0.310-0.986)*	.695(.374-1.295)
Public tap	0.089(0.020-0.402)*	.122(.026-.587)*
Well/stream	0.767(0.379-1.554)	.841(.404-1.750)
Well/stream/river	Ref.	Ref.
Tap use		
No tap	7.749(1.812-33.137)*	-
Use tap	Ref.	Ref.
Yearly water availability		
Yes	2.047(1.153-3.634)*	2.719(1.175-6.295)*
No	Ref.	Ref
Smell of water		
No smell	2.419(1.127-5.192)*	1.967(.604-6.404)
Bad smell	Ref	Ref.
Water treatment mechanism		
Boil water	5.932(0.608-57.857)	8.173(.787-84.855)
Filter water	0.552(0.277-1.099)	1.710(.563-5.194)
No boiling/filtering	Ref.	Ref.

*indicates significant difference at P<0.05

4.6. Associations between Independent Variables and Water Access

4.6.1. Descriptions of the Independent Variables for Water Access

The majority of the households (73.4%) in the study site have 5 or more people living in a house (Table 4.9). The rest (26.8%) of the households have 4 or less people inside a house. Regarding the occupation of household heads in the area, almost half of them are farmers (49.5%). The house wives and household heads with no job constitute 21.2% and 10.3%, respectively. 5% of the household heads work for the government and 14% have private jobs.

Table 4.9: Descriptions of the independent variables for water access

Variable	**Frequency**	**Percentage**
Source of water		
River	160	49.8
Public tap	31	9.7
Well/stream	59	18.4
Well/stream/river	71	22.1
Household size		
0-4	86	26.8
>=5	235	73.4
Tap use		
No tap	290	90.3
Use tap	31	9.7
Occupation of household head		
No job	33	10.3
Farmer	159	49.5
Government job	16	5
Private job	45	14
Housewife	68	21.2
Distance from water source		
Far	106	33
Medium	194	60.4
Near	21	6.5

The distance from the water source is very far (>1km) for 33% of the households. Majority of the people (60.4%) fetch from a relatively medium distance (100meters to 1km), and very few people (6.5%) find their source from the nearest water source (<100meters).

4.6.2. Chi-square test for Water Access

Studying the relationship between some independent variables, the Chi-square test revealed that water source, tap water use, household size, occupation of household and distance from water source are the main independent variables which have significant relationship to water access.

The study shows that 45.2% of the people who have basic access to water are using river water as a main source of drinking water. 26.1% of people who have basic access to water had their water from all three sources, river, well and stream. The rest of the households who maintain their basic water access are getting their water from public tap and well/stream, 15.7% and 13%, respectively. The Chi-square result shows a significant difference between water source and water access, with a P-value of 0.009.

Household size also shows a significant association with water access. Majority (59.1%) of the people who have basic access are those that have 5 or more people in the house. The Chi square test shows a significant relationship, with P-value of 0.000. Same is true for occupation of household head and distance of water source, with P-value of 0.027 and 0.002, respectively.

The quantity of water that households collect and use is primarily dependent on accessibility (as determined by both distance and time). There is some indication that cost and reliability may also influence quantity of water collected. The debate regarding quantity is not related to volumes of water available but by the level of service provided. Increases in quantities of water used will only be achieved through upgrading of service level. Furthermore household water security improves with increasing service level, which will contribute to reducing poverty.

Table 4.10: Chi-square test of independence for water access

Factor	Water Access				P-value
	No basic access		Basic access		
	Frequency	Percentage	Frequency	Percentage	
Source of water					
River	108	52.4	52	45.2	.009
Public tap	13	6.3	18	15.7	
Well/stream	44	21.4	15	13	
Well/stream/river	41	19.9	30	26.1	
Household size					
0-4	39	18.9	47	40.9	.000
>=5	167	81.1	68	59.1	
Tap use					
No tap	193	93.7	97	84.3	.007
Use tap	13	6.3	18	15.7	
Occupation of household head					
No job	24	11.7	9	7.8	.027
Farmer	97	47.1	62	53.9	
Government job	13	6.3	3	2.6	
Private job	22	10.7	23	20	
Housewife	50	24.3	18	15.7	
Distance from water source					
Far	82	39.8	24	20.9	.002
Medium	111	53.9	83	72.2	
Near	13	6.3	8	7	

4.6.3. Univariate and Multivariate Regression Analysis for Water Access

For the logistic regression analysis only source of water, tap use, household size, occupation and distance of water source were included as independent/explanatory variables to find out the association with the dependent variable, water access.

Table 4.11 shows the regression analysis to check whether there is association with the independent variables and water access. The univariate logistic regression analysis showed a significant association between source of water and water access.

Well and stream users had better access to water compared to others (OR=0.466; CI=.220-.988) with a p-value=0.009 (see Table 4.11). Tap water use also has a significant association with

water access. The ones who use tap water for drinking have better access to water (OR=0.363; CI=.171-.771) with P-value=0.007.

Household size (OR=2.960; CI=1.778-4.927) and occupation of household head (OR=2.904; CI=1.312-6.430) showed a significant relationship with water access, with P-value of 0.000 and 0.027, respectively. Those having private jobs had better access to water than the rest of the households, who are mostly farmers and housewives.

The multivariate logistic regression analysis showed a significant association between three independent variables and water access, source of water, household size and occupation of household head. Well and stream users had better access to water compared to others (OR=0.369; CI=.163-.833) with a p-value=0.009 (see Table 4.11).

Household size (OR=3.043; CI=1.738-5.326) and occupation of household head (OR=2.800; CI=1.197-6.551) showed a significant relationship with water access, with P-value of 0.000 and 0.027, respectively. Those having private jobs also show better access to water, in the multivariate regression analysis, than the rest of the households. Households with minimum family size had a better water access, probably because there is a minimum competition to use water once collected.

Factors such as supply reliability may also influence quantities of water collected, although again there is very limited published data to establish what relationships exist. Zerah (2000) indicates that low-income families in New Delhi are likely to be at greatest risk from poor water supply continuity. As they have more limited resources, they are less able to store large volumes of water at home and this led to the use of smaller volumes of water and impaired hygiene, although this is not quantified. It is likely that the nature of the discontinuity will affect the hardship caused.

Table 4.11: Univariate and multivariate analysis for water access

Explanatory variables	Univariate analysis COR(CI of 95%)	Multivariate analysis AOR(CI of 95%)
Source of water		
River	.658(.370-1.170)	.614(.328-1.147)
Public tap	1.892(.805-4.449)	1.254(.480-3.275)
Well/stream	.466(.220-.988)*	.369(.163-.833)*
Well/stream/river	Ref.	Ref.
Household size		
0-4	2.960 (1.778-4.927)*	3.043(1.738-5.326)*
>=5	Ref.	Ref.
Tap use		
No tap	.363(.171-.771)*	-
Use tap	Ref.	Ref.
Occupation of household head		
No job	1.042(.408-2.657)	1.136(.422-3.057)
Farmer	1.775(.949-3.320)	1.622(.835-3.148)
Government job	.641(.164-2.513)	.417(.094-1.845)
Private job	2.904(1.312-6.430)*	2.800(1.197-6.551)*
Housewife	Ref.	Ref.
Distance from water source		
Far	.476(.177-1.282)	.422(.141-1.260)
Medium	1.215(.482-3.066)	.971(.353-2.666)
Near	Ref.	Ref.

*indicates significant difference at P<0.05

Whilst regular discontinuity may cause more hardship, this may be mitigated to some extent if the interruption in supply is predictable as this will allow the household to develop coping strategies for water collection. The greatest problems may be felt when discontinuity is frequent, but very unpredictable. Anecdotal evidence from many African cities indicates that this is common and may lead to collection of water from piped networks at odd hours, including late at night.

Even though the regression analysis does not show any significant relationship between distance of water source and water access, studies show that, a reduced collection time may allow more time to be spent on other activities, such as child care or food preparation. Another study in the review (Esrey, 1991) suggests that there are only significant gains in health when water becomes available on-plot. Unfortunately, most studies do not cover a wide range of collection times. For

example, studies compare households with water on the compound to households using a water source 500 meters away, or with collection times of thirty minutes to two hours.

Another study shows that hand-washing is less common when a water source is greater than one kilometer from the home, but more frequent when the water is more accessible (Curtis et al., 2000). Time and energy spent collecting water is also an important factor. Although an improved water source may provide more water that can be used for increased hygiene practices, people may still need to travel long distances to collect the water.

Fewtrell et al. (2005) state that the risk of contamination is present during the transport of water from the source to the home and storage, but there is too little data to relate this risk to service level or water supply interventions. Recorded data do not show that water consumption increases with the improvement of water supply (if collection time is not decreased), but the authors acknowledge that increased supply may decrease the risk of contamination during transport or storage of water.

Howard and Bartram (2003) also review studies which investigate the distance to a water source and show a reduction in the incidence of diseases. Occurrence of trachoma is greatly affected by significant changes in distance to the water source. For example, lack of water for sufficient bathing can allow for more disease transmission: when more water is available, hygiene behaviors can be improved and disease transmission can decrease. For large reductions in collection time, the use of water can increase drastically.

CHAPTER FIVE

5. CONCLUSIONS AND RECOMMENDATIONS

This study was conducted in a rural community, Endegagn Woreda, Gurage Zone, SNNPR, Ethiopia. The prevalence rate of waterborne diseases in the study area was 32%. Compared to other waterborne diseases, the prevalence rate of typhoid was found to be the highest in the study site, amoeba and giardia being the second and third prevalent waterborne diseases. The secondary data obtained from the six-month report of the two health centers in the Woreda supported our result in that there was a high prevalence of waterborne diseases in the area, children aged less than 5 years being the most affected group. A total number of 139 cases were registered to have diarrheal diseases in this six-month report (2007 E.C.), majority might have been treated at home because the study revealed that most of the people in the area had low income with only primary level of education. Most households relied on agriculture as their occupation.

The majority of the people (64%) do not have basic access to water, with water use of less than 5 liters per capita per day (lpcd), contrary to the standard requirement, by the WHO, indicating that a person needs 5-20 lpcd in order to have his or her basic need. Moreover, the average distance that a household travels to a water source in the study site was about a kilometer, and the time to fetch water and come back home was about an hour. The distances that households travel to collect water and the time they spent fetching water are provided in the appendix. The majority of people use unimproved drinking water sources such as rivers, streams and unprotected wells, and only 9.7% of people in the area use improved drinking water source, which is from public tap water.

The logistic regression analysis showed that, source of water, household size and occupation were significantly associated with water access. Regarding the waterborne diseases, the logistic regression analysis showed that, source of water, yearly water availability, and smell of drinking water were significantly associated with waterborne diseases (typhoid, giardia, amoeba and

cholera). And, no association could be established between water, sanitation and waterborne diseases.

Almost all households (97%) have access to latrines as observed by data collectors, and are made of mud and wood, which is considered permanent, and no brick or cement is used for latrine construction. The researcher observed public toilets on sides of roads to the market place, and according to the report from the Woreda, every Kebele has its own public toilets in convenient places. Open defecation becomes impossible if people are educated to use those facilities provided by the government and improve their sanitation practices.

Therefore, our study recommends the following points:-

Due to the topography of the area, the researcher could not observe the quality of each water source, and therefore, could not identify whether water supplies in the study site are protected, improved or not. Frequent quality assessment of the water sources should be conducted in the long run. However, this model can be used as a research model for further investigation.

Awareness programs related to water treatment and water quality should be carried out in the rural areas to improve the status of public health. Thus, the responsible authorities should strive to the best of their ability. In addition, it is the constitutional right of all Ethiopians to live in a healthy environment, thus there should be no excuse for the rural people to suffer from the negative consequences of an unhealthy environment. Therefore, it is the responsibility of the government to teach the society to take care of their environment and to supply them with potable water.

Since we had one household affected with schistosomiasis disease (not clinically confirmed during the study), and most of the people are using river water for drinking and other domestic purposes, rivers should be examined whether it has vectors, like infected snails, which transmit schistosomiasis to human beings. Schistosoma parasite that is released from the snail penetrates human skin, enter the blood and migrate to the liver, intestine and urinary bladder. This is a neglected disease that stays unrecognized in the body and might be fatal at final stage.

Socioeconomic inequalities such as education, income and occupation in the rural parts should be taken care of by the Government of Ethiopia. Education should be prioritized in rural areas, especially to educate people on water, sanitation and hygiene. Even though the government is very successful in constructing latrines to every household, educational interventions regarding personal hygiene, cleanliness and sanitary programs should be organized.

References

African Development Fund (ADF). 2005. Rural water supply and sanitation program in Ethiopia. *Appraisal Report*, 1:10-15.

BOFED. 2007. Socio-economic statistics, http://www.snnprbofed.gov.et/other_statistics.htm [Accessed 14 September 2014]

Bradley, D. 1977. Health aspects of water supplies in tropical countries, In Feachem R, McGarry M and Mara D, Water, wastes and health in hot climates, John Wiley and Sons, Chichester, UK, pp 3-17.

Buddeke, B. 2010. Sustainability assessment of fund board Water and sanitation projects in Nepal. Master Thesis. Utrecht University.

Cairncross, A. M. 1990. Health impacts in developing countries: new evidence and new prospects. Journal of the Institution of Water and Environmental Management. 4(6): 571-577.

Cairncross, S. and Valdmanis, V. 2006. Water supply, sanitation and hygiene promotion. In: Disease control priorities in developing countries, eds: Jamison, D et al. 2nd ed. Oxford University Press and World Bank, Washington.

Cochran, W. G. 1977. Sampling techniques (3rd, ed.). New York: John Wiley & Sons.

Curtis V, Cairncross S, Yonli R (2000). Domestic hygiene and diarrhoea—pinpointing the problem. Tropical Medicine and International Health 5 (1) 22-32.

Dennehy, P.H. 2000. Transmission of rotavirus and other enteric pathogens in the home. *Pediatr. Infect. Dis. J*. 19 (10 Suppl): S103–5.

Esrey, S., Potash, J., Roberts, L., & Shiff, C. 1991. Effects of Improved Water Supply and Sanitation on Ascariasis, Diarrhoea, Dracunculiasis, Hookworm Infection, Schistosomiasis, and Trachoma. *Bulletin of the World Health Organization*: 69 (5).

Fewtrell, L., & Kaufmann, R. 2005. Water Sanitation and Hygiene Intervetnions to Reduce Diarrhoea in Developed Countries: A Systematic Review and Meta-Analysis. *Lancet Infectious Diseases*, 5.

Howard, G., Bartram, J. 2003. Domestic Water Quantity, Service Level and Health. New York: World Health Organization.

Hutton, G. & Haller, L. 2004. Evaluation of the Costs and Benefits of Water and Sanitation Improvements at the Global Level, http://www.who.int/water_sanitation_health/wsh0404.pdf [Accessed 08 October 2014]

Hutton,G., Haller,L. & Bartram,J. 2007. Global cost benefit analysis of water supply and sanitation interventions. *Journal of water and health*.05(4). 481-502. http://www.iwaponline.com/jwh/005/0481/0050481.pdf [Accessed 08 March 2014]

Mcconville, J. 2003. How to Promote the Use of Latrines in Developing Countries, http://cee.eng.usf.edu/peacecorps/images/Technical%20Briefs/5%20%20How%20to%20Promote%20the%20Use%20of%20Latrines%20in%20Developing%20Countries.pdf [Accessed 27 April 2014]

JMP. 2010. Progress on sanitation and drinking water 2010 update' http://www.wssinfo.org/fileadmin/JMP_report_2010_en.pdf [Accessed 20 March 2015]

Murray, C.J.L., and Lopez, A.D. 1996. The global burden of disease: a comprehensive assessment of mortality and disability from diseases, injuries and risk factors in 1990 and projected to 2020. Global Burden of Disease and Injury. Harvard School of Public Health, Cambridge.

Postnote. 2002. Access to sanitation in developing countries. Parliamentary office of science and technology http://www.parliament.uk/documents/post/pn190.pdf [Accessed 10 June 2014]

Prüss-Üstün, A., Kay, D., Fewtrell, L. and Bartram, J. 2004. Unsafe water, sanitation and hygiene. In: Comparative quantification of health risks. Global and regional burden of disease attributable to selected major risk factors. Volume 1. Ezzati M, Lopez AD, Rodgers A, Murray CJL, eds. World Health Organization. Geneva.

UNDP. 1999. Human Development Report 1999. Oxford University Press, New York, USA.

UNDP. 2006. 'Beyond scarcity: Power, poverty and the global water crisis' Human Development Report 2006 http://hdr.undp.org/en/media/HDR06-complete.pdf [Accessed 7 September 2014]

UNDP. 2007/2008. Human Development Report. New York: United Nations Development Program.

UNESCO. 2006. World water assessment program: Meeting Basic needs. http://www.unesco.org/water/wwap/facts_figures/basic_needs.shtml [Accessed 10 March 2015]

UNICEF. 2006. Children and Water, Sanitation and Hygiene: The Evidence, occasional paper for the *Human Development Report 2006*.

United Nations. 2007. The Millennium Development Goals Report 2007. New York: United Nations.

United Nations General Assembly. 2000. Resolution 55/2: Millennium Declaration United Nations, New York.

Waddington, H., Snilstveit, B., White, H., & Fewtrell, L. 2009. Water, sanitation and hygiene interventions to combat childhood diarrhoea in developing countries. International Initiative for Impact Evaluation. Synthetic Review 001.

WaterAid. 2007. Global cause and effect: How the aid system is undermining the Millennium Development Goals

World Bank. 2011. Agriculture and rural development, http://data.worldbank.org/topic/agriculture-and-rural-development [Accessed 15 June 2014]

WHO. 2002. Reducing risks, promoting healthy life. World Health Report 2002. World Health Organization, Geneva.

WHO. 2007. Preventing disease through healthy environments. In: The contribution of water, sanitation and hygiene. World Health Organization, Geneva.

WHO (World Health Organization) (2004b). Water, sanitation and hygiene links to health. http://www.who.int/water_sanitation_health/facts2004/en/index.html, last accessed 20 March 2015.

WHO (World Health Organization) (2004c). Health in the Millennium Development Goals. http://www.who.int/mdg/goals/en/, last accessed 20 March 2015.

WHO (World Health Organization) (2006a). Health and the MDGs: background. http://www.who.int/mdg/background/en/index.html, last accessed 13 January 2015.

WHO. 2006b. Typhoid and paratyphoid enteric fevers. http://www.who.int/water_sanitation_health/diseases/typhoid/en/, last accessed 8 September 2014.

WHO. 2009. ‘10 facts about water scarcity’ http://www.who.int/features/factfiles/water/water_facts/en/index3.html [Accessed 20 August 2014]

WHO and UNICEF. 2000. Global Water Supply and Sanitation Assessment 2000 Report. WHO/UNICEF. Geneva/New York.

WWC. 2009. ‘Why a right to water is necessary?’ http://www.worldwatercouncil.org/index.php?id=1764 [Accessed 8 September 2014]

Zerah M-H, 2000, Household strategies for coping with unreliable water supplies: the case of Dehli, Habitat International, 24: 295-307.

Zwane, A. P. & Kremer, M. 2007. What Works in Fighting Diarrheal Diseases in Developing Countries? A Critical Review. The World Bank Research Observer , 22 (1).

Appendices

Appendix 1: Endegagn Woreda Household and Population Size: 2007

Area	Both Sexes	Male	Female	HHs	HH units
ENDEGAGN-WEREDA	**48,405**	**22,459**	**25,946**	**10,309**	**10,086**
1. ARTICHO	1,975	854	1,121	458	455
2. ESIMAT	2,195	935	1,260	539	538
3. WOLECHO	2,078	890	1,188	456	445
4. SHEWURA	2,520	1,162	1,358	545	539
5. BUCHA	4,623	2,228	2,395	967	949
6. KERES	2,172	1,103	1,069	402	397
7. ZIGEZ	1,868	834	1,034	423	417
8. HAREG	1,805	839	966	379	372
9. JEDA	2,040	884	1,156	482	469
10. GENET	3,549	1,741	1,808	723	701
11. SHORKA	1,826	801	1,025	412	391
12. TEFEKA	3,248	1,555	1,693	654	635
13. GOMIRA	3,985	1,783	2,202	916	896
14. BECHA	3,044	1,339	1,705	676	649
15. ANE	4,339	2,126	2,213	816	794
16. DABIR TSIGE	3,898	1,874	2,024	804	794
17. WILO LERA	3,240	1,511	1,729	657	645

(www.csa.gov.et/.../**STATISTICAL_SNNPR/Statistical_SNNPR_Part**I.pdf)

Appendix 2: Discription of water schemes in Endegagn Woreda, compared to report on 2005 G.C

Types of water scheme	**2005**	**2015**
Borehole	1	2
Shallow well	0	8
Hand-dug well	7	13
Small springs development	0	38
Total	**8**	**61**

Appendix 3: Description of water access in Endegagn Woreda

	N	Minimum	Maximum	Mean	Std. Deviation
Distance to water source (metres)	321	6	5000	974.96	1036.221
Time required to fetch water and come back (minutes)	321	5	300	61.93	56.106
Standard household water **requirement** per day (litres)	321	40	280	113.21	36.878
Total household water **consumption** per day (litres)	321	3	95	25.67	12.755
Per capita per day consumption (lpcd)	321	1	20	5.01	2.915
Valid N (listwise)	321				

Appendix 4: Questionnaire

Name of Investigator_____ Telephone_____

Date _____

Hello, my name is _____, and I work for _____. I am here to collect information on the water access and prevalence of waterborne diseases in this Woreda. May I speak to an adult member of your household?

I. Demographic Questions:

1. What is your name? _____ Age ____Sex____
2. Kebele _____ Village_____
3. Number of people in the house: _____
4. Head of Household: _____Age ____Sex____
5. Education level of household head.
   A) Illiterate B)Non-formal C) 1-4 D) 5-8 E)9-12 F) graduate
6. Occupation of household head: _____
7. How many members in the household are employed?_____
8. How much do the family earn per year from sale of crops, farm products and salary (in birr)?
   A)<1000 B) 1000-3000 C)3000-6000 D)6000-10000 E)>10000

II. Water, sanitation and disease

9. What is the major source of your domestic water supply? (multiple responses possible)
   a) Hand-dug well
   b) Borehole
   c) River
   d) Stream
   e) Rainwater
   f) Public tap water
   g) Household tap water
   h) Truck/vendor
   i) Other (specify) _____

10. Why are the other sources listed above not being used?
    a) Far from home
    b) Have to pay to use them
    c) Not available all the time
    d) Other (specify) _____

11. Why do you use that particular source?
    a) Well kept and maintained
    b) Reliable
    c) Close to home
    d) Allows me to socialize
    e) Used by fewer people
    f) Good quality
    g) Other (specify) _____

12. Do you consider the quantity of water sufficient for you?

    A) Sufficient B) Not sufficient

13. How much water do you consider sufficient for your household needs? _____

14. What do you use to store drinking water? _____liters (request to see the container and estimate its size)

15. How long does this stored drinking water last? _____days

16. What do you use to store domestic water (other than drinking water)? _____liters (request to see the container and estimate its size)

17. How long does this stored domestic water last? _____days

18. How far is the main water source? _____meters

19. How long does it take to fetch water and return home? _____minutes

20. How does the water smell?
    A) no smell B) bad smell

21. How does the water taste?
    A) excellent B) good C) acceptable D) unacceptable
22. What does the water look like?
    A) clear B) dirty
23. Who fetches water most often?
    A) Adult male B) Adult female C) Male child D) Female child
24. Is water from the main source available throughout the year?
    A) yes B) no
25. Which months do you face scarcity? _____
26. Where do you get your water need during water shortage time? _____
27. Has there been any problem on the main source this year?
    A) yes B) no
28. If yes, what was the problem? _____
29. Do you pay for water?

A) yes B) no

30. If yes, how much do you pay a month? _____birr
31. Has anyone in your household <5 years of age had unusual diarrheal symptoms (watery/bloody diarrhea for a few days) in the past four weeks?
    A) yes B) no C) doesn't apply
32. Has anyone in your household >5 years of age had unusual diarrheal symptoms (watery/bloody diarrhea for a few days) in the past four weeks?
    A) yes B) no C) doesn't apply
33. How do you treat drinking water?
    A) boil water B)filter water C) No need to treat (clean) D) other (specify) _____
34. Do you have latrine in your house?
    A) Yes B) No
35. If yes, what is it made of?
    A) Wood B) Mud C) bamboo D) Plastic E) other (specify) _____
36. Which of the following diseases has occurred in this house in the past year? (Multiple answers possible)

    A) Amoeba B) Jiardia C) Cholera D) Typhoid E) diarrhea F) Bilharzia G)Other_____

37. Number of members who were affected by those diseases? ___

38. How many times have they been affected by those diseases in the past year? ___

…….. Thank you very much for your valuable response!.....

PROFORMA FOR SUBMISSION OF M.A. (RD) PROPOSAL FOR APPROVAL

Signature :_____

Name & Address of Guide :_____

_____

_____

Name & Address of the student : Manyawkal Bireda Essa

P.o.box 80904

Addis Ababa

Ethiopia

Enrolment No : 089133063

Date of Submission :_____

Name of Study Centre : St. Mary's University

Name of Guide : Dr. Wondimagegn Chekol

Title of the Project : Assessment of Water Access and Prevalence of Waterborne Diseases in Rural Community: A Case of Endegagn Woreda, Gurage Zone, SNNPR, Ethiopia.

Signature of the Student :_____

Approved/Not Approved

Date:

Assessment of water access and prevalence of waterborne diseases in rural community - a case of Endegagn Woreda, Gurage Zone, Southern Ethiopia.

By:

MANYAWKAL BIREDA ESSA

A Thesis Proposal
Submitted to IGNOU in partial fulfillment of the requirements for the degree of Master of Arts in Rural Development (MARD)

December, 2014

Contact Information

Programme Title: Master's Programme in Rural Development

Programme Code: MARD

Course Code: MRDP-001

Course Title: Dissertation

Study Centre: St. Mary University College

Name of Student: Manyawkal Bireda Essa

Enrollment No: 089133063

Address: P.O.Box 80904

Addis Ababa

E-mail: monyb20022002@yahoo.com

Tel: 0911401505

Table of Contents

1. Introduction

1.1.Background

Water is an essential resource for survival and to secure good health. But people around the globe face a problem of water scarcity. As of UNDP (2006), currently 700 million people in 43 countries live with water scarcity, of these many are in sub-Saharan Africa which represents one quarter of the global population that faces water scarcity live in developing countries. This scarcity of water forced people around the world to use unsafe water for drinking and other domestic uses (WHO, 2009). In schools and in some public places, we are getting familiar with a slogan which states *'water is life'*. Of course, it is true without which any living things cannot exist, but it would have been better if the slogan is replaced by '*clean water is life*' because we have learnt that everyday many people are dying because of water borne and water related diseases. Thus, it is not only the availability of water that guarantees life but it is also its quality.

The major water related diseases in the country are diarrhea, hepatitis, roundworm, hookworm infection, trachoma, guinea worm, schistosomiasis, leishmaniasis, lymphatic filariasis, cholera and malaria. Thus, poor environmental sanitation and water quality play an important role in spreading the infectious diseases, which are presently emerging and creating a big public health problem. Added to the present scenario of decrease in the quantity and quality of available water, increasing demand of water due to population increase, industrial growth and agricultural development pose further new challenges to Ethiopia.

During the dry season more traditional sources of water are placed under pressure as shallow wells or other perennial sources dry-up. This situation worsens as these sources of water supply are shared with livestock. Taken together, rates of morbidity and mortality in rural areas is particularly high since few have access to improved water supply, sanitation facilities, and awareness of hygienic practices.

Water Supply and Sanitation (WSS) service has been fully decentralized to towns and local Woreda Water Desks (WWD); however, decentralization has also redistributed vital equipment and staff throughout rural areas to the extent that poorer areas now have even less access to

technical assistance. Although the government has established technical training institutes and is now training adequate personnel, the WSS sector's financing and stock of equipment supplies and services still need improvement.

1.2. Statement of the Problem

According to UNDP (2006), in the world almost 2 million children die each year because they do not get a glass of potable water and basic sanitation. And millions of women and young girls are forced to spend hours fetching and carrying water. Sub-Saharan African countries are at the front of the water scarcity problem, one of which is Ethiopia despite the fact that the country has abundant groundwater, major lakes, and large volumes of rainfall (UNDP, 2006).

Even though water scarcity is a worldwide problem, urban poor and rural inhabitants are at the forefront to be affected by the problem of poor access to potable water and basic sanitation. This is also the situation in rural Ethiopia, where women and children walk for hours to collect polluted water from shallow and unprotected ponds, unprotected springs, and rivers, and in some areas they share the same water sources with their animals. All of these sources are subject to contamination as rainwater washes waste from surrounding areas into the sources.

Additionally, young girls spend hours to fetch and carry unsafe water to drink when they are at the age they are supposed to be in school. Because they do not have access to potable water nearby, a girl in rural Ethiopia spend hours fetching water but a girl at the same age in an urban area spends time in school. In addition to the time they spend, as a result of poor access to potable water and basic sanitation, people are becoming unhealthy which leads to loss of productivity.

It is not debatable that the poor access to potable water and basic sanitation is affecting lives of many in rural Ethiopia. Endegagn woreda, Gurage Zone, is one of the Ethiopian rural places where the community does not have access to potable water and basic sanitation. Thus, the communities are forced to use water from unprotected ponds which they may share with their animals.

The researcher visited the study area and recognized that the community is highly affected by lack of access to potable water supply and basic sanitation. Accordingly, the community is

obliged to use unimproved sources of water for drinking, cooking, and maintaining adequate standards of hygiene. It is quite easy to understand how necessary water is, but it is believed that unsafe drinking water is as risky as water scarcity. Though they have access to water those sources of drinking water are unimproved and unsafe. Thus, people are easily exposed to water borne and water related diseases and diseases related to poor access to basic sanitation. Therefore, the issue of ease of access to potable water and basic sanitation has to get attention from the responsible authorities as well as the community itself.

Thus, this study will try to assess and reveal the real situation in the area regarding water consumption patterns and availability of water-borne diseases; and the impacts of poor access to potable water on the overall health of the community in the study area.

1.3.Significance of the study

In Ethiopia, accessibility to improved water supply remains a major concern. Despite its good level of per capita water availability, only few of the population have drinking water within the residence. Among other factors, the high rate of population growth tends to contribute to the increase of water needs and thus reduces the level of access to safe water.

Therefore, efficient water management policy is important if health and welfare of the population, particularly in rural areas, are to be improved. Efficient water management for rural areas requires a full understanding of existing pattern of water use as well as a forecast of future water consumption taking into consideration the different factors involved.

Moreover, accurate information about drinking-water, sanitation and hygiene related issues is invaluable to national leaders, decision-makers and stakeholders when making policy decisions. However, our focus in this study will be assessing the water consumption patterns and water-related diseases in the study area.

Thus, sound and evidence-based information can be used in a variety of ways, including:

- to assess progress towards national and international goals and targets;
- to promote increased investments in the sector;
- to focus attention on needy areas and efficiently allot resources.

1.4. Research Question

Which factors influence the prevalence of waterborne/diarrheal diseases in rural areas?

1.5. Objectives of the Study

1.5.1. General objective:

- To assess water availability and prevalence of waterborne diseases in Endegagn Woreda, Gurage Zone, Southern Ethiopia.

1.5.2. Specific objectives:

- To explore the available water resources on which the villagers relied on.
- To assess the prevalence of preventable waterborne diseases in the area.
- To identify the association between water, sanitation, socioeconomic status and waterborne diseases.
- To assess the adequacy and quality of the water resources in the area

1.6. Scope and Limitation of the Study

Despite time and resource constraints and for the sake of making the study more addressable for future investigations, the investigator will try to include all 16 Kebeles in the Woreda. Four experienced data collectors from the Woreda will address four Kebeles each. The investigator will try to supervise each data collector in different days.

The study, however, might encounter certain limitations. These are:-

1. Because of the low educational level and less exposure to information, some sample respondents may be unwilling to participate in the study.
2. Transportation problems may adversely affect the data collection process, and the study may take more time than planned.
3. Because of lack of sponsorship and needed time to travel between kebeles, there may be financial constraints to complete the study according to schedule.

2. Literature review

The overall disease burden related to unsafe water, sanitation and hygiene (WSH) was first examined at a global level in 1990 (Murray & Lopez, 1996), and was limited to diarrhoeal diseases. This estimate was revised in 2002 (WHO 2002; Prüss et al, 2002; Prüss-Üstün et al. 2004) based on a systematic and transparent method. Other estimates have since been performed, based on the same method (Cairncross and Valdmanis 2006). More recently, the impact of WSH on disease has been reassessed in a more comprehensive way (WHO 2007), which estimated that almost one tenth of the global burden of disease can be attributed to water, sanitation and hygiene.

The importance of adequate water quantity for human health has been recognised for many years and there has been an extensive debate about the relative importance of water quantity, water quality, sanitation and hygiene in protecting and improving health (Cairncross, 1990; Esrey et al., 1985; Esrey et al., 1991). Despite this debate, international guidelines or norms for minimum

water quantities that domestic water supplies should provide remain largely lacking. For instance, whilst the Millennium Declaration Goals include a target to 'halve the proportion of people who are unable to reach or to afford safe drinking water by 2015' (UN, 2000) it does not specify in what quantity such water should be supplied. The WHO/UNICEF Joint Monitoring Programme, which produces the Global Assessment of Water Supply and Sanitation data, describe reasonable access as being 'the availability of at least 20 litres per person per day from a source within one kilometre of the users dwelling' (WHO and UNICEF, 2000).

As of 2000 it was estimated that one-sixth of humanity (1.1 billion people) lacked access to any form of improved water supply within 1 kilometre of their home (WHO and UNICEF, 2000). Lack of access to safe and adequate water supplies contributes to ongoing poverty both through the economic costs of poor health and in the high proportion of household expenditure on water supplies in many poor communities, arising from the need to purchase water and/or time and energy expended in collection. Access to water services forms a key component in the UNDP Human Poverty Index for developing countries (UNDP, 1999).

Domestic water supplies are one of the fundamental requirements for human life. Without water, life cannot be sustained beyond a few days and the lack of access to adequate water supplies leads to the spread of disease. Children bear the greatest health burden associated with poor water and sanitation. Diarrhoeal diseases attributed to poor water supply, sanitation and hygiene account for 1.73 million deaths each year and contribute over 54 million Disability Adjusted Life Years, a total equivalent to 3.7% of the global burden of disease (WHO, 2002). This places diarrhoeal disease due to unsafe water, sanitation and hygiene as the 6th highest burden of disease on a global scale, a health burden that is largely preventable (WHO, 2002). Other diseases are related to poor water, sanitation and hygiene such as trachoma, schistosomiasis, ascariasis, trichuriasis, hookworm disease, malaria and Japanese encephalitis and contribute to an additional burden of disease.

In most developing countries, especially in Sub- Saharan Africa (SSA), the basic causes of more than 80% of the diseases are inadequate and unsafe water supply, and improper disposal of waste. Ethiopia is among the poorest countries in the world, ranking 170 out of 177 in the UN human development index and is the second most populous country in Africa. Yet, Ethiopia’s

rural populations are among the least served with rural water supply and sanitation access at only 24% and 8% respectively (ADF 2005).

Ethiopia has one of Africa's lowest rates of access to water supply, sanitation, and hygiene despite abundant surface and groundwater resources. According to the government in 2005, 40 percent of the population had access to safe water; however, according to the World Health Organization (WHO) and local nongovernmental organizations, the figure was closer to 22 percent. The WHO estimated that only 13 percent of the population had access to sanitation. Ethiopia's Millennium Development Goals (MDGs) for improved water and sanitation access are 70 percent and 56 percent respectively. To reach the MDG targets, the government will need to help ensure local water supply and sanitation (WSS) service providers continue to develop their capacity to manage operations. The government will also need to encourage consumer advocacy and hygiene awareness.

Even though all human beings have the right to life, the right to education, the right to food…etc, these fundamental human rights cannot be fully realized unless people have access to potable water and basic sanitation. Independent of the other fundamental human rights, all human beings also have the right to access potable water and basic sanitation (WWC, 2009). Since people in the developing countries are suffering from lack of access to water and basic sanitation, we cannot talk much more about the so-called 'rights' before survival. Thus, the question of having access to potable water and basic sanitation goes beyond rights, rather it is a question of survival.

3. Methodology

3.1. Description of the study area

3.1.1. Geographical Location

Gurage zone, which is part of the Southern Nation, Nationalities and People Region, is located in the western part of central Ethiopia; and at the same time it is the northern tip of the region. It is bounded with Hadiya zone and Yem special woreda in the south and south west respectively. The northern, western and eastern portions are sharing boarder with Oromia state.

3.1.2. Area and Administrative Units

The zone has an area of 5932 sq.km. For the purpose of administration, the zone has been divided in to twelve woredas (districts), two provisional city administration and 421 kebeles (local communities). Endegagn woreda has an area of 127 sq.km, which is the smallest of all woredas.

3.1.3. Population

The total population of the zone is estimated to be 1577074 in 1997 E.C having distribution of 763643 male and 813431 female with, percentages of 48.4 and 51.6 respectively. The overwhelming majority, 92.4%, lives in rural areas leading an agricultural life.

3.1.4. Distribution of water schemes by Woreda:

Woreda/Town	Types of water schemes			
	Borehole	Shallow well	Hand-dug well	Small springs development
Abeshege	5	47	27	-
Kebena	2	16	32	-
Cheha	15	76	40	2
Enemor	7	76	9	1
Gumer	8	14	22	-
Ejah	5	13	15	2
Kokir	2	4	6	2
Mareko	7	41	28	-
Meskan	6	37	91	2
Sodo	10	17	30	2
Endegagn	1	-	7	-
M/Aklil	3	-	12	2
Butajira	4	-	-	-
Wolkite	5	-	-	-

(www.guragezone.gov.et/development/summary)

3.2. Data collection tools and procedures

The study will employ a cross-sectional study which incorporates quantitative as well as qualitative nature. The data for this study will be generated from both the primary and secondary sources. As to the primary source, information will be collected through the use of face-to-face questionnaire survey. Secondary data will also be gathered through reviewing relevant materials such as statistical reports, books, journals, bulletins, magazines, web sites, and unpublished thesis. The primary data will be gathered from rural households in Endegagn Woreda. The questionnaire will be organized so as to get information on four broad perspectives; socio-economic, infrastructure, environmental health, and behavior and environmental awareness. The entire community under study will be divided into the Kebeles as per the number of interviewers and then random selection of houses will be performed in the ratio of nearly 1 in 5.

3.3. Analysis of data

Data collected from the survey respondents will be entered in to computer for analysis using Statistical Packages for Social Science (SPSS) software. Following this, the data will be edited, coded, and cleaned. The researcher will use mainly a qualitative approach, although some quantification will be used with percentages.

4. Schedule

No.	Activities	Duration
1.	Surveillance and data collection	January-February 2015
2.	Data organization and analysis	March 2015
3.	Thesis write up and final documentation	April 2015
4.	Report submission	May 2015

5. Budget estimate

Perdiem, Fuel expense and related	7500.00
Stationery and Photocopy services	1250.00
Contingency	875.00
GRAND TOTAL	**9625.00 Birr**

References

African Development Fund (ADF). 2005. Rural water supply and sanitation program in Ethiopia. *Appraisal Report*, 1:10-15.

Cairncross, A. M. 1990. Health impacts in developing countries: new evidence and new prospects. Journal of the Institution of Water and Environmental Management. 4(6): 571-577.

Cairncross, S. and Valdmanis, V. 2006. Water supply, sanitation and hygiene promotion. In: Disease control priorities in developing countries, eds: Jamison, D et al. 2nd ed. Oxford University Press and World Bank, Washington.

Esrey, S.A., Feachem R.G. and Hughes, J.M. 1985. Interventions for the control of diarrhoeal diseases among young children: improving water supplies and excreta disposal facilities. Bulletin of the World Health Organization. 63(4): 757-772.

Esrey, S.A., Potash, J.B., Roberts, L. and Shiff, C. 1991. Effects of improved water supply and sanitation on ascariasis, diarrhoea, dracunculiasis, hookworm infection, schistosomiasis, and trachoma. Bulletin of the World Health Organization. 69(5): 609-621.

Murray, C.J.L. and Lopez, A.D. 1996. The global burden of disease: a comprehensive assessment of mortality and disability from diseases, injuries and risk factors in 1990 and projected to 2020. Global Burden of Disease and Injury. Harvard School of Public Health, Cambridge.

Prüss, A., Kay, D., Fewtrell, L. and Bartram, J. 2002. Estimating the burden of disease from water, sanitation and hygiene at global level. Environ Health Perspect. 110:537-42.

Prüss-Üstün, A., Kay, D., Fewtrell, L. and Bartram, J. 2004. Unsafe water, sanitation and hygiene. In: Comparative quantification of health risks. Global and regional burden of disease attributable to selected major risk factors. Volume 1. Ezzati M, Lopez AD, Rodgers A, Murray CJL, eds. World Health Organization. Geneva.

UNDP. 1999. Human Development Report 1999. Oxford University Press, New York, USA.

UNDP. 2006. 'Beyond scarcity: Power, poverty and the global water crisis' Human Development Report 2006 http://hdr.undp.org/en/media/HDR06-complete.pdf [Accessed 7 September 2012]

United Nations General Assembly. 2000. Resolution 55/2: Millennium Declaration United Nations, New York.

WHO. 2002. Reducing risks, promoting healthy life. World Health Report 2002. World Health Organization, Geneva.

WHO. 2007. Preventing disease through healthy environments. In: The contribution of water, sanitation and hygiene. World Health Organization, Geneva.

WHO. 2009. '10 facts about water scarcity' http://www.who.int/features/factfiles/water/water_facts/en/index3.html [Accessed 20 August 2012]

WHO and UNICEF. 2000. Global Water Supply and Sanitation Assessment 2000 Report. WHO/UNICEF. Geneva/New York.

WWC. 2009. 'Why a right to water is necessary?' http://www.worldwatercouncil.org/index.php?id=1764 [Accessed 8 September 2012]

Questionnaire

Name of Investigator_____ Telephone_____

Date _____

Hello, my name is _____, and I work for _____. I am here to collect information on the water access and prevalence of waterborne diseases in this Woreda. May I speak to an adult member of your household?

I. Demographic Questions:

12. What is your name? _____ Age ____Sex____
13. Kebele _____ Village_____
14. Number of people in the house: _____
15. Head of Household: _____Age ____Sex____
16. Education level of household head.
    A) Illiterate B)Non-formal C) 1-4 D) 5-8 E)9-12 F) graduate
17. Occupation of household head: _____
18. How many members in the household are employed?_____
19. How much do the family earn per year from sale of crops, farm products and salary (in birr)?
    A)<1000 B) 1000-3000 C)3000-6000 D)6000-10000 E)>10000

II. Water, sanitation and disease

20. What is the major source of your domestic water supply? (multiple responses possible)
    j) Hand-dug well
    k) Borehole
    l) River
    m) Stream
    n) Rainwater
    o) Public tap water
    p) Household tap water
    q) Truck/vendor
    r) Other (specify) _____

21. Why are the other sources listed above not being used?
    e) Far from home
    f) Have to pay to use them
    g) Not available all the time
    h) Other (specify) _____

22. Why do you use that particular source?

h) Well kept and maintained
i) Reliable
j) Close to home
k) Allows me to socialize
l) Used by fewer people
m) Good quality
n) Other (specify) _____

23. What domestic activities do you use water for?

Activity	Frequency Once daily [1] Twice daily [2] Three times daily [3] Once a week [4] Once in two weeks[5] Once in a month[6]	Source of water a) Hand-dug well b) Borehole c) River d) Stream e) Rainwater f) Public tap water g) Household tap water h) Truck/vendor i) Other (specify)
1. Drinking		
2. Cooking		
3. Washing dishes		
4. Washing clothes		
5. Bathing		
6. Backyard gardening		
7. Livestock		

13. Do you consider the quantity of water sufficient for you?

A) Sufficient B) Not sufficient

14. How much water do you consider sufficient for your household needs? _____

15. What do you use to store drinking water? _____liters (request to see the container and estimate its size)

16. How long does this stored drinking water last? _____days

17. What do you use to store domestic water (other than drinking water)? _____liters (request to see the container and estimate its size)

18. How long does this stored domestic water last? _____days

19. How far is the main water source? _____meters

20. How long does it take to fetch water and return home? _____minutes

32. How does the water smell?
A) no smell B) bad smell
33. How does the water taste?
A) excellent B) good C) acceptable D) unacceptable
34. What does the water look like?
A) clear B) dirty
35. Who fetches water most often?
B) Adult male B) Adult female C) Male child D) Female child
36. Is water from the main source available throughout the year?
A) yes B) no
37. Which months do you face scarcity? _____
38. Where do you get your water need during water shortage time? _____
39. Has there been any problem on the main source this year?
A) yes B) no
40. If yes, what was the problem? _____
41. Do you pay for water?
A) yes B) no
42. If yes, how much do you pay a month? _____birr
43. Has anyone in your household <5 years of age had unusual diarrheal symptoms (watery/bloody diarrhea for a few days) in the past four weeks?
A) yes B) no C) doesn't apply
33. Has anyone in your household >5 years of age had unusual diarrheal symptoms (watery/bloody diarrhea for a few days) in the past four weeks?
A) yes B) no C) doesn't apply
34. How do you treat drinking water?
A) boil water B)filter water C) No need to treat (clean) D) other (specify) _____
35. Do you have latrine in your house?
A) Yes B) No
36. If yes, what is it made of?
A) Wood B) Mud C) bamboo D) Plastic E) other (specify) _____
37. Which of the following diseases has occurred in this house in the past year? (Multiple answers possible)

A) Amoeba B) Jiardia C) Cholera D) Typhoid E) Jaundice F) Bilharzia

38. Number of members who were affected by those diseases? ___

39. How many times have they been affected by those diseases in the past year? ___

…….. Thank you very much for your valuable response!.....