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CDC	Centers for Disease Control and Prevention
CDD	Control of Diarrheal Diseases
CFR	Case fatality rate
E. Coli	Escherichia coli
EDHS	Ethiopia Demographic and Health Survey
EIEC	Enteroinvasive *Escherichia coli*
EHEC	Enterohemorrhagic *Escherichia coli*
EAggEC	Enteroaggregative *Escherichia coli*
EPEC	Enteropathogenic *Escherichia coli*
ETEC	Enterotoxigenic *Escherichia coli*
FDA	Food and Drug Administration
FSIS	Food safety and inspection service
GIT	Gastrointestinal Tract
HAART	Highly Active Anti Retroviral Treatment
HIMS	Health Management and Information System
HuCVs	Human caliciviruses
LPS	Lipopolysaccharide
MDRST	Multi-drug resistant *Salmonella typhi*
MIC	Minimal inhibitory concentrations
MMT	Morbidity-Mortality-and Treatment
NARST	Nalidixic-acid-resistant *Salmonella typhi*
NIH	National Institute of Health
ORS	Oral rehydration salt
ORT	Oral rehydration therapy
PCR	Polymerase chain reaction
Sd1	*Salmonella dysenteriae* type 1
W H O	World Health Organization
UNICEF	United Nations Children's Fund

Content Page

List of tables

Tables Page

Figures Page

Diarrheal diseases are physiological abnormalities of the gastrointestinal tract caused mostly by invasion of harmful bacteria, parasites, viruses, with common symptom of episodes of watery stool. They are more rampant in poor developing countries like Ethiopia that lack clean water supply and proper sanitation facilities. The infections have been aggravated with HIV co-infection. For many years now, there have been different efforts worldwide to reduce poverty with packages of primary health care, improved sanitation and supply of clean water enshrined in the recent Millennium Development Plan. Accordingly, Ethiopia has been beneficiary of such programs to improve health care of the population and reduce diseases including diarrhea. There are different reports in the country that showed improvement in the reduction of diarrheal diseases. However, there is limited information about the status of diarrhea in Kamash Town. To this end, a retrospective survey was conducted from secondary data collected from outpatients visiting Kamash Health Centre from 2011-2015 to determine the reported cases of diarrheal diseases and HIV co-infection. Accordingly, 27.8% of the outpatients were diagnosed for diarrheal disease. Although fewer males visited the Health Centre in all years, the prevalence of diarrhea was slightly higher in males (30.8%) than in females (25.5%) showing males were more vulnerable to diarrhea than females (1.2:1). The highly infected patients were found in the 6-15 years age group with prevalence of 24.4%, followed by 20.1% infection in the age group of ≥ 46. The lowest prevalence of 5.9% was recorded from the age group of ≤5. Among the associated factors of the diarrheal diseases E, histolytica /dispar/ contributed to 50% of all infections followed by Giardia lamblia, helminthes and other unidentified causative agents implicated with 27.7%, 16.5% and 5.6% of the diseases, respectively. The diarrheal diseases, in general, showed different pattern along seasons with the highest prevalence of 29.4% in June-August, and the lowest prevalence of 20.6% in September-November seasons, respectively. However, the parasites showed different pattern where E histolytica was high in the June-August seasons whereas the highest G lamblia infections were recorded in December-February seasons; not the least the highest helminthes and other infections were recorded from the months between March and May. The prevalence of HIV co-infection was in the range of 13.9% in 2011 to that of 17.6% in 2015 with the overall mean infection of 16.3%. The data showed a steady increase of co-infection with time. The male to female diarrheal infection was 1.2:1; and in similar way the male to female HIV co-infection was even higher 2.1:1 where males were more infected than females. The co infection showed a steady increase over the years, but the maleto female infection equally leveled in 2014 and 2015. The data generally indicates that there was no improvement in diarrheal infection as a function of time in the area.

Keywords: diarrhea; prevalence; infection; retrospective; E histolytica; G lamblia

Diarrheal diseases are food and water borne illnesses of the gastrointestinal (GI) tract caused by harmful bacteria, parasites, viruses, or chemicals with common symptoms such as vomiting, diarrhea, abdominal pain, fever, and chills (NIH, 2012). In fact the diseases are characterized by intestinal disorder with abnormal fluidity and frequency of fecal evacuations (Afroza *et al*., 2013).The infectious agents associated with diarrheal diseases are transmitted chiefly through the fecal- oral route (Shivali *et al*., 2015).

According to the World Health Organization (WHO, 2010), there were about two billion cases of diarrheal disease worldwide , every year, of which 1.9 million children younger than 5 years of age die from the infection. This amounts to 18% of all the deaths of children under the age of five and means that more than 5000 children are dying every day which is the second leading cause of death of the age group. According to Farthing (2012), 78% of child death occurs in African and South-East Asian regions (Farthing, 2012).

The most important groups of protozoan and helmintheic parasites that cause diarrhea include; *Giardia lamblia, Entamoeba histolytica, Cyclospora cayetanensis and Cryptosporidium, helminthes* such as *Ascaris lumbricoides* and *Trichuris trichiuri, Strongloides stercoralis, hookworms* and *Teania* spp. *a*re common among diharreal diseases (Eyasu *et al.,* 2010). The major bacterial pathogens that are associated with diaharreal diseases are; *Shigella, Salmonella, Campylobacter, Yersinia, Vibrio* cholera, and Enterotoxigenic *Escherichia coli* (ETEC) (Afroza *et al*., 2013).

Diarrhea is also one of the most common AIDS-related illness causing a significant morbidity and mortality in HIV-infected patients (Siddiqui *et al*., 2007). Several reports indicated that diarrhea occurs in 30-60% of AIDS patients in developed countries and in about 90% of AIDS patients in developing countries (Framm and Soave, 1997). HIV infection has added considerable burden among adults and children. According to the estimates in 2011, 34 million people were living with HIV globally (U.S. Global HIV/AIDS Epidemics 2011).

In Ethiopia, morbidity reports and community-based studies have shown that diarrhea is a major public health problem that causes morbidity and mortality in the population. A recent report of the World Health Organization showed that about 80% of diseases in Ethiopia are attributed to infectious diseases related to personal and environmental hygiene and malnutrition. Most of the disease infections are caused by water-borne and food borne pathogens and parasites. According to the same report, Ethiopia was the 35th country from 172 countries in the world, in having 49.54 death rates per 100,000 people in diarrheal diseases (WHO; 2014).

Morbidity-Mortality-and Treatment (MMT) surveys conducted in Ethiopia in 2000 at different times revealed five diarrheal episodes per child/year; and the two-week incidence rate to be 16%.The diarrhea associated mortality rate is about 10/1000 under-five population. Similar Morbidity-Mortality-and Treatment (MMT) surveys conducted later in Ethiopia at various times have revealed five diarrheal episodes per child per year, and the two-week incidence to be 16% (Godana and Mengistie, 2013). Studies conducted in central, rural Ethiopia have revealed diarrhea to be one of the common causes of under-five mortality, accounting for approximately 8.4% to 27% of all deaths (Shimelis, 2008).

Ethiopia is one of the countries in Africa with high HIV prevalence. According to the 2014 Ethiopia Demographic and Health Survey (EDHS), the number of people living with HIV in the country was estimated at 769,000 of which 458,100 (59.5%) and 311,500(40.5%) were females and males, respectively (Federal HIV/AIDS Prevention and Control Office, 2014). Both immune-competent and immune compromised individuals could be the victims of diarrheal diseases caused by these parasites (Beyene *et al.,* 2010). For children with HIV, diarrhea is even more deadly; with the death rate 11 times higher than the rate for children without HIV. Despite these sobering statistics, strides made over the last 20 years have shown that, in addition to rotavirus vaccination and breastfeeding, diarrhea prevention focused on safe water and improved hygiene and sanitation has been possible and cost effective (CDC, 2012).

The Benishangul Gumuz Regional State has the highest mortality rate especially in less than five year of age (EDHS, 2011*)*. The region had the worst and declining child health outcomes in the past decade. This poor performance can be clearly seen in the rise of the under five diarrheal morbidity which rose from 21.1% in 2005 to 22.7% and mortality from 157 to 169 per 1000 live births in the 2011 (Sinmegn, 2014). A study conducted about HIV/AIDS at Assossa Hospital showed the prevalence of HIV/AIDS for male at 40.2% and for females at 18.8% (Benishangul-Gumuz Region, 2004).

Kamash town is located in Benishangul Gumuz Regional State .One of the major problems in Kamash town is related to health problems associated with diarrheal diseases. It is also a serious health problem especially, with HIV/AIDS-infected patients (Kamash zone HIMS annual report, 2015).Knowledge of the status of diarrheal disease in relation to HIV-infected individuals in the area can give base line information for a possible implementation of specific intervention strategies.

The main objective of this study was to determine the reported cases of diarrheal diseases in Kamash Town and surrounding area by using retrospective secondary data (2011-2015).

1. To determine the reported cases of diarrheal disease in Kamash town and surrounding area with respect to age and sex.
2. To identify the major associated factors of diarrheal diseases in the area.
3. To determine the reported cases of co-infection of diarrheal diseases with HIV/AIDS.

The main research questions in this study are;

1. What was the status of diarrheal diseases in Kamash town within the past five years?
2. What were the major associated factors of diarrhea in Kamash town?
3. What was the trend of co-infection of diarrhea with HIV/AIDS in the area?

This research was limited to secondary data (with five years) of Kamash Health Center, with poor records (not computerized) of data at the Health Center.

Diarrheal illness is defined as three or more loose or liquid stools per day, or more frequent occurrence of stools than in normal time for an individual. It can be caused by infectious diseases, changes in diet, such as eating more than usual amounts of certain foods, and use of some medications (Oklahoma State Department of Health, 2014).

Diarrhea is characterized by an increased frequency and volume, and decreased consistency of stool from the norm. It must be remembered that frequency of passing stool varies with age and is higher in infants. Dysentery is defined as the passage of blood and mucous in diarrheal stools. Persistent diarrhea occurs when the duration of symptoms exceeds seven days and chronic diarrhea when it lasts more than 14 days (Cooke, 2010).

According to etiological factors, there are two general types of diarrhea: infectious and non-infectious diarrhea. Infectious Diarrhea is caused by a virus, parasite, or bacterium It can spread quickly from person-to-person, especially in daycare centers. Some of the causes of infectious diarrhea are Campylobacteriosis, shiga-toxin producing E. coli, giardiasis, salmonellosis and shigellosis. There are other agents that can also cause infectious diarrhea in children. These include parasites (e.g., cryptosporidiosis, amoeba) other bacteria (e.g., Yersinia) and other viruses (e.g., Rotavirus) (National Center for Rural Water Supply Technical Guidance, 2005).

Non-infectious Diarrhea is caused by mal-dietary, for example diarrhea of the infant who take cow's milk instead of mother's milk or caused by adding food unknown before, toxins (e.g., certain types of food poisoning), chronic diseases (e.g., cystic fibrosis) or allergic diarrhea caused by antibiotics (e.g., ampicillin)(CDC, 2009).

There are three major diarrhea syndromes: acute watery, persistent, and bloody diarrhea. Acute watery diarrhea is the one that lasts less than 2 weeks, rapidly dehydrating, with stool losses of 250 milliliters per kilogram per day or more is considered acute (Hall, 2010). This phenomenon is most likely caused by an infectious agent, such as bacterial, parasitic or viral invasion, or by a non-infectious agent such as dietary indiscretion or a new medication (Amerine and Keirsey,

2006).These pathogens can cause an inflammatory response in the gut where the epithelial lining is damaged either by a toxin produced by the organism or by an organism invading the mucosa (Bliss *et al.,* 2006).Acute diarrhea most likely leads to rapid dehydration. This form is the most deadly in young children and is commonly associated with rotavirus, enterotoxigenic E. coli, or *V.cholerae* (Wellness, 2011).

Persistent diarrhea lasts longer than two weeks but resolving within a month is known as persistent diarrhea. It is less common and typically connected with malnutrition and is disproportionally associated with an increased risk of death (Wellness, 2011). Chronic diarrhea, on the other hand, lasts longer than four weeks (Bliss *et al*., 2006). Chronic diarrhea can be the result of disease processes, medication, genetic abnormalities, or a variety of other causes. Bloody diarrhea is often related to malnutrition, intestinal damage, and secondary sepsis. It is often associated with dysentery (Marchiondo, 2009).

According to the World Health Organization (WHO, 2010) and UNICEF, there are about two billion cases of diarrheal disease worldwide every year, and 1.9 million children younger than 5 years of age perish from diarrhea each year, mostly in developing countries. This amounts to 18% of all the deaths of children under the age of five and means that more than 5000 children are dying every day as a result of diarrheal diseases. Of all child deaths from diarrhea, 78% occur in the African and South-East Asian regions (Farthing, 2012).

Diarrheal diseases account for 1 in 9 child deaths worldwide, making diarrhea the second leading cause of death among children under the age of 5. In Ethiopia, morbidity reports and community-based studies have shown that diarrheal disease is a major public health problem that causes morbidity and mortality in children. Morbidity-Mortality-and Treatment (MMT) surveys conducted in Ethiopia in 2000 at different times revealed five diarrheal episodes per child/year; and the two-week incidence rate to be 16%.The diarrhea associated mortality rate is about 10/1000 under-five population. For children with HIV, diarrhea is even more deadly; the death rate for these children is 11 times higher than the rate for children without HIV. Despite these sobering statistics, strides made over the last 20 years have shown that, in addition to rotavirus

vaccination and breastfeeding, diarrhea prevention focused on safe water and improved hygiene and sanitation is not only possible, but cost effective (CDC, 2012).

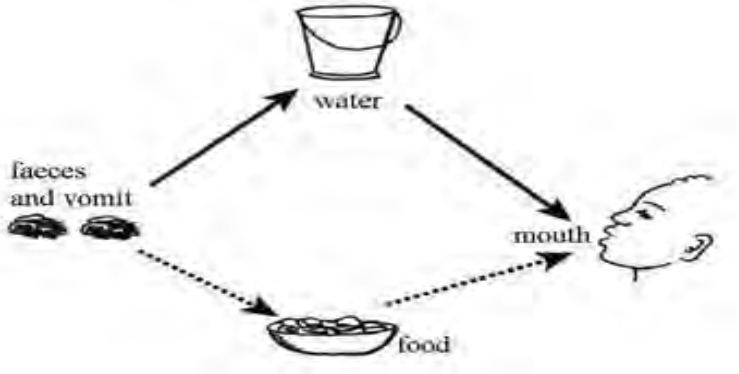


Fig.1 The fecal oral rout of diarrheal diseases (Adapted from www.aarogya.com.)

Diarrhea caused by infections usually results from eating or drinking contaminated food or water. Signs and symptoms of infection usually begin 12 hours to four days after exposure and resolve within three to seven days WHO, 2011).Though some diarrheas are caused by metabolic abnormalities, chemical irritation or organic disturbance, the vast majority are caused by infectious pathogens such as bacteria, viruses, protozoan and helminthes (Bui, 2006).

Diarrheagenic *Escherichia coli*	Rotavirus	*Cryptosporidium parvum*
Campylobacter jejuni	Norovirus (calicivirus)	*Giardia lambilia*
Vibrio cholerae O1	Adenovirus	*Entamoeba histolytica/dispar*
V. cholera	Astrovirus	*Isospora belli*
Shigella species	Cytomegalovirus	*Cyclospora cayetanensis*
V. parahaemolyticus		*Dientamoeba fragilis*
Bacteroides fragilis		*Blastocystis hominis*
Clostridium difficile		***Helminths***
Yersinia enterocolitica		*Strongyloides stercoralis*
		Angiostrongylus costaricensis
		Schistosoma mansoni, *Schistosoma japonicum*

1. Salmonella:

-Enteric fever -*Salmonella enteric* serovar Typhi and Paratyphi A, B, or C (typhoid fever); fever lasts for 3 weeks or longer; patients may have normal bowel habits, constipation or diarrhea.

-Animals are the major reservoir for salmonellae. Humans are the only carriers of typhoidal *Salmonella.*

-Infants and children with immune-compromised status for any reason (e.g., severe malnourishment) appear to be at the greatest risk.

2***. Shigella***

-Hypoglycemia, associated with very high case fatality rates (CFRs) occur more frequently than in other types of diarrheal diseases.

-*Salmonella flexneri* is endemic in many developing countries and causes dysenteric symptoms and persistent illness; uncommon in developed countries.

-*Salmonella dysenteriae* type 1 (Sd1) — the only serotype that produces Shiga toxin, as does EHEC(CDC, 2004).

3*.*Vibrio cholerae:

-Many species of *Vibrio* cause diarrhea in developing countries.

-Stools are watery, colorless, and flecked with mucus; often referred to as ―rice watery" stools.

-Vomiting is common; fever is typically absent (World Gastroenterology Organization, 2012).

4 .Campylobacter:

-Infection is associated with watery diarrhea; sometimes dysentery.

-Poultry is an important source of *Campylobacter* infections in developed countries, and increasingly in developing countries, where poultry is proliferating rapidly.

5. Escherichia coli

-*Enterotoxigenic E. coli* (ETEC) causes diarrhea in infants and children and traveler's diarrhea.

-*Enteroinvasive E. coli* (EIEC) causes bloody mucoid (dysentery) diarrhea; fever is common.

-*Enterohemorrhagic E. coli* (EHEC) causes bloody diarrhea, severe hemorrhagic colitis, and the hemolytic uremic syndrome in 6–8% of cases; cattle are the predominant reservoir of infection.

-*Enteroaggregative E. coli* (EAggEC) causes watery diarrhea in young children and persistent diarrhea in children with human immunodeficiency virus (HIV).

-*Enteropathogenic E. coli* (EPEC) causes disease more commonly in children < 2 years, and persistent diarrhea in children (Rajal, 2016).

Table 2. Summary of major bacteria that cause diarrheal disease

(U. S. Department of Agriculture Food Safety and Inspection Service-May 2011).

Campylobacter Jejuni	Contaminated water, raw or unpasteurized milk, and raw or undercooked meat, poultry, or shellfish.	Diarrhea (sometimes bloody), cramping, abdominal pain, and fever that appear 2 to 5 days after eating; may last 7 days. May spread to bloodstream and cause a life-threatening infection.	Cook meat and poultry to a safe minimum internal temperature; do not drink or consume unpasteurized milk or milk products; wash your hands after coming in contact with feces.
Escherichia coli	Uncooked beef (especially ground beef), unpasteurized milk and juices (e.g., –fresh" apple cider); contaminated raw fruits and vegetables, or water. Person to person contamination can also occur.	Severe diarrhea (often bloody diarrhea), abdominal cramps, and vomiting. Usually little or no fever. Can begin 2 to 8 days, but usually 3-4 days after consumption of contaminated food or water and last about 5 to 7 days depending on severity. Children under 5 are at greater risk of developing hemolytic uremic syndrome(HUS), which causes acute kidney failure and can cause death.	Cook hamburgers and ground beef to a safe minimum internal temperature of 160°F. Drink only pasteurized milk, juice, or cider. Rinse fruits and vegetables under running tap water, especially those that will not be cooked. Wash your hands with soap and warm water after changing diapers, using the bathroom, handling pets or having any contact with feces.
Salmonellae sp.	Raw or undercooked meat, poultry, and eggs; unpasteurized milk and juice; cheese and seafood; and contaminated fresh fruits and vegetables.	Diarrhea, fever, and abdominal cramps usually appear 12 to 72 hours after eating; may last 4 to 7 days. In people with weakened immune system, the infection may be more severe and lead to serious complications, including death.	Cook raw meat, poultry, and egg products to a safe minimum internal temperature. Do not eat raw or undercooked eggs. Avoid consuming raw or unpasteurized milk or other dairy products. Produce should be consumin

-In both industrialized and developing countries, viruses are the predominant cause of acute diarrhea, particularly in the winter season.

-Accounts for one-third of diarrhea hospitalizations and 500,000 deaths worldwide each year.
-Associated with gastroenteritis of above-average severity.
Leading cause of severe, dehydrating gastroenteritis among children.
The incidence of clinical illness peaks in children between 4 and 23 months of age.

-Belong to the family *Caliciviridae*—the noro viruses and sapoviruses (previously called ―Norwalk-like viruses" and ―Sapporo-like viruses."
-Noroviruses are the most common cause of outbreaks of gastroenteritis, affecting all age groups.
Sapoviruses primarily affect children. This may be the second most common viral agent after rotavirus, accounting for 4–19% of episodes of severe gastroenteritis in young children.
(Katherine, 2012)

C.
The major protozoan parasites that have been associated with diarrhea are *G. lamblia* and *E. histolytica/dispar* while *Cryptosporidium, Isospora belli,* and *Cyclospora* species have been increasingly recognized in association with diarrhea, especially in patients with AIDS (Rayhan *et al*., 1996).
These agents account for a relatively small proportion of cases of infectious diarrheal illnesses among children in developing countries. *G. intestinalis* has a low prevalence (approximately 2–5%) among children in developed countries, but as high as 20–30% in developing regions (Farthing, 2012).

are protozoa that are found worldwide and manifest as chronic, voluminous, watery diarrhea (related to villous atrophy and increased intestinal permeability) in 90% of patients affected. The diarrhea can be relapsing thought to be related to autoinfection and can

lead to dehydration, abdominal cramping and weight loss. It is more common in those with CD4 counts below100 cells/mm3 and can present as fulminant in those with CD4, 50cells/mm3 (Wingfield et al., 2011). Its hardy, chlorine-resistant oocysts, tiny size, low infectious dose, fully infectious development when shed and zoonotic potential make it a threat in drinking and recreational water (Dilingham et al., 2002).

is one of the major causes of parasitic diarrhea worldwide. In the developing world giardiasis is pandemic, with peak prevalence rates of up to 20% in children less than 10 years of age. Giardiasis often occurs in the setting of waterborne outbreaks. It is an important cause of chronic diarrhea in travelers returning from developing countries. Most studies estimate infection rates of 1-3% in short-term visitors to endemic area (Rayhan et al; 1996).

Entamoeba histolytica/dispar/moshkoviski

Several members of the genus *Entamoeba* infect humans. Among these *E. histolytica* is considered pathogenic and the disease it causes is called amebiasis or amebic dysentery. It is estimated that up to 10% of the world's population may be infected with either by *E. histolytica/ dispar* and in many tropical countries the prevalence may approach 50%. There are an estimated 50 million cases of amebiasis per year and up to 100,000 deaths (Yeshimebet, 2013).

Several environmental and host factors are associated with increased incidence, severity, or duration of diarrhea. They include: lack of safe water supply, Contaminated food, Overcrowding, Poor sanitation, Malnutrition… (Katherine, 2012).

- Under nutrition The frequency, severity, duration, and risk of death from diarrhea are increased in undernourished children, especially those with severe under nutrition.
- Current or recent measles. Diarrhea and dysentery are more frequent or severe in children with measles or who have had measles in the previous four weeks. This presumably results from immunological impairment caused by measles.
- Immunodeficiency or immune suppression. This may be a temporary effect of certain viral infections (e.g., measles), or it may be prolonged, as in persons with the acquired immunodeficiency syndrome (AIDS). When immune suppression is

severe diarrhea can be caused by unusual pathogens and may also be prolonged (Tefera, 2001).

The other factors that increase susceptibility to diarrhea include

Most diarrheal episodes occur during the first two years of life. Incidence is highest in the age group 6-11 months, when weaning often occurs. This pattern reflects the combined effects of declining levels of maternally-acquired antibodies, the lack of active immunity in the infant, the introduction of food that may be contaminated with fecal bacteria and direct contact with human or animal feces when the infant starts to crawl. Most enteric pathogens stimulate at least partial immunity against repeated infection or illness, which helps to explain the declining incidence of disease in older children and adults.

Distinct seasonal patterns of diarrhea occur in many geographical areas. In temperate climates, bacterial diarrheas tend to occur more frequently during the warm season, whereas viral diarrheas, particularly disease caused by rotavirus, peak during the winter. In tropical areas, rotavirus diarrhea tends to occur throughout the year, increasing in frequency during the drier, cool months, whereas bacterial diarrheas tend to peak during the warmer, rainy season. The incidence of persistent diarrhea follows the same seasonal pattern as that of acute watery diarrhea.

Most enteric infections are asymptomatic, and the proportion that is asymptomatic increases beyond 2 years of age owing to the development of active immunity. During asymptomatic infections, which may last for several days or weeks, stools contain infectious viruses, bacteria, or protozoan cysts. Persons with asymptomatic infections play an important role in the spread of many enteric pathogens, especially as they are unaware of their infection, take no special hygienic precautions and move normally from place to place (Richard, 2015).

Two enteric pathogens, *Vibrio cholerae* 1 and *Shigella dysenteriae* type 1, cause major epidemics in which morbidity and mortality in all age groups may be high. Since 1961, cholera spread to countries in Asia, the Eastern Mediterranean, and Africa, and to some areas in Europe

and North America. During the same period, *S. dysenteriae* type 1 has been responsible for large epidemics of severe dysentery in Central America, and more Typhoid fever occurred in many parts of the world like Far East Asia, Middle East, Central in South America, Zimbabwe, Australia, West French Guiana, Thailand, Ivory coast, India, Florida, Spain, Turkey and Nigeria as reported by the corresponding author (Khan et al., 2008).

Common symptoms of food borne illness are diarrhea and/or vomiting, typically lasting 1 to 7 days. Other symptoms might include abdominal cramps, nausea, fever, joint/back aches, and fatigue. (Minnesota Dept. of Health, 2015).A person with diarrhea may be mildly to severely ill. A person who has mild illness may have a few loose bowel movements but otherwise feels well. By contrast, a person with severe diarrhea may have 20 or more bowel movements per day, happening up to every 20 or 30 minutes. In this situation, a significant amount of water and salts can be lost, seriously increasing the risk of dehydration (WHO, 2011).

Due to rapid loss of fluids (up to 20 liters daily), severe dehydration and shock can occur in these individuals. Signs of dehydration include loss of skin plasticity, sunken eyes, fast heart beat, low blood pressure, and rapid weight loss. Diarrhea may be accompanied by fever (temperature greater than 100.4ºF or 38ºC), abdominal pain, or cramping (WHO, 2011).The symptoms of diarrhea may include frequent loose or watery stools, abdominal cramps and tenderness, fever, generally not feeling well or blood in the stool. Individuals can be infected and can pass the germs to others with minimal signs or symptoms. Most people who die due to diarrheal illness actually die from severe dehydration and fluid loss. Children who are malnourished or have impaired immunity are most at risk of life-threatening diarrheal illness. Besides this there are clinical signs of diarrhea like rapid and feeble pulse poor skin sunken eye ball, dry tongue, Fever, restlessness, drinking eagerly / poor interest to drink…(Oklahoma State Department of Health, 2014).

Table3. Episodes of diarrhea (World Gastroenterology Organization, 2012).

Acute diarrhea	Presence of three or more abnormally loose or watery stools in the preceding 24 h
Dysentery	Presence of visible blood in stools
Persistent diarrhea	Acutely starting episode of diarrhea lasting more than 14 days

2.3.2.1 Stool tests:

- A bacterial culture is used to identify bacterial species responsible for your infection.
- These stains can distinguish between the two major classes (gram-positive or gram-negative) bacteria and aid in narrowing down what kind of infection you have.
- A stool sample is examined for the presence of parasites and/or their eggs.
- Identification of these white blood cells in your stool will inform your doctor that you have an inflammatory disease.
- Some infections can be detected through these substances (CDC, 2015).

2.3.2.2 Blood tests:

- This method consists of drawing a blood sample and evaluating your antibodies to identify microbes with which you have recently been infected.
- A blood sample is used to culture bacteria that may be responsible for our infection (CDC, 2004).

- The goals of treatment are to maintain hydration, treat the underlying causes and relieve the symptoms of diarrhea. Rehydration and its correction of any electrolyte imbalance are critical in the treatment of diarrhea. Symptomatic relief is a second therapeutic goal.
- Not all diarrheal episodes in the developing countries are associated with dehydration and, consequently, do not require rehydration therapy. However, promotion of the basic

concept that diarrhea and vomiting are likely to results in life threatening dehydration continues to be of great importance.

- Oral rehydration therapy (ORT) was introduced in 1979 and rapidly became the cornerstone of the Control of Diarrheal Diseases (CDD) programme. Consisting of the oral administration of sodium, a carbohydrate and water, ORT was potentially the most significant medical advance of the 20th century. It has contributed substantially to reducing childhood deaths from diarrheal disease because it is extremely effective in treating acute watery diarrhea. ORT, using the WHO formula, is suitable for the management of all types of dehydration. ORS-WHO (oral rehydration salts) can be regarded as a universal, all-purpose, solution; but does not mean that is the optimal solution. However, it is important to have a single acceptable formula that can be recommended and promoted worldwide.
- ORS-WHO is an extremely safe therapeutic tool. More than two billion units of ORS have been administered without serious complications. Symptomatic anti-diarrheal drugs are usually not recommended for the treatment of acute diarrhea in children. Antimicrobials are not effective in uncomplicated acute diarrhea and their use should be discouraged. In contrast, antimicrobials are indicated in dysentery, cholera, typhoid fever and diarrhea caused by parasites, such as *Giardia lamblia, Cyclospora* and *E. hystolytica/ dispar* (Bui, 2006).

The treatment of diarrhea must therefore be based on the major features of the disease and an understanding of the underlying pathogenic mechanisms. The main principles of treatment are as follows:

- Watery diarrhea requires fluid and electrolyte replacement - irrespective of its etiology.
- Feeding should be continued during all types of diarrhea to the greatest extent possible, and should be increased during convalescence so as to avoid any adverse effect on nutritional status.
- Antimicrobials and anti-parasitic agents should not be used routinely: most episodes, including severe diarrhea and diarrhea with fever do not benefit from treatment with antimicrobials or antiphrastic agents. The exceptions are:
    - , which should be treated with an antibiotic effective for *Shigella*; cases not responding to this treatment should be studied for possible amoebiasis;

- ; and
- , when trophozoites or cysts of *Giardia lambilia* are seen in feces or intestinal fluid, or when pathogenic enteric bacteria are identified by stool culture (Health Grades Inc., 2015).

There are several medication classifications available to control loose stools.
They fall into several categories which include:

-medications that have been shown to slow transit time within the intestine to permit more re-absorption of fluid (Kent & Banks, 2010). Metronidazole 500 mg by mouth every 8 h for 10-14 days is used to treat mild to moderate diarrhea (Alexa, 2016).

are indicated for infectious diarrhea but should be used with caution due to the increasing problem with resistant bacteria (Kent & Banks 2010).

Use antibiotics only when appropriate (i.e. bloody diarrhea), and abstain from administering anti-diarrheal drugs.

Ciprofloxacin is the most appropriate drug for treatment of bloody diarrhea, rather than nalidixic acid, which leads to rapid development of resistance. Ciprofloxacin should be used at an oral dose of 15 mg/kg twice daily for 3 days (WHO, 2010).

Vaccination is the best way to prevent severe rotavirus disease and the deadly, dehydrating diarrhea that it causes. Improvements in water quality, hygiene, and sanitation stop bacteria and parasites that cause other forms of diarrhea but do not prevent the spread of rotavirus. Lifesaving rotavirus vaccines should be introduced as part of a comprehensive approach to control diarrhea, along with other interventions including oral rehydration therapy, breastfeeding, zinc treatment, and improvements in water and sanitation.

There are currently two orally administered rotavirus vaccines available: Rotarix®, manufactured by GlaxoSmithKline, and RotaTeq®, manufactured by Merck & Co., Inc. Both vaccines have been shown to be safe and effective in large-scale clinical trials in Africa, Asia, Europe, Latin America, and the US. Clinical trials in Africa (South Africa, Ghana, Kenya, Malawi, and Mali) found that rotavirus vaccines reduced severe rotavirus disease by more than 60 percent during the first year of life, when children are at greatest risk of severe rotavirus disease (Vaccine access and delivery global program, 2013).

This thesis was undertaken in Kamash town located in Benishangul Gumuz Regional State, Kamash Zone, Kamash Woreda with average temperatures and average annual rainfall 32.4 ^{0}c and 604 mm. respectively (Kamash Woreda Metrology Annual Report 2011-2015).The current population of the town is estimated at 8,740. In the town, there is one Health Centre with 22 health practitioners (Kamash Woreda Administrative office Annual Report, 2014).

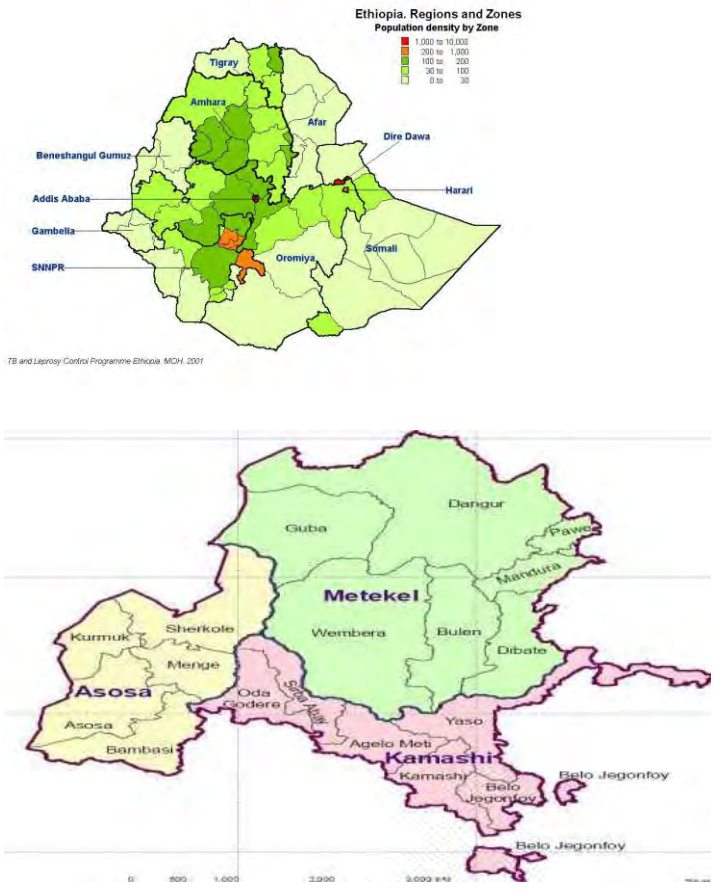


Fig.2 Map of Kamash in Benishangul Gumuz region Ethiopia;
(Adapted from Thomas et al., 2014).

The design of this study was a retrospective survey of consequences of diarrheal diseases based on a secondary data on in and out patients visiting the Kamash Health Center from 2011-2015. The population that is employed for the study consisted of 25129 in and out patients visited the Kamash Health Centre for diagnosis and treatment of plausible gastrointestinal infarctions.

By taking official letter from Addis Ababa University, permission was taken from Kamash Woreda Health Center and Kamsh Woreda Administrative Office about the objective of the work with the commitment that the information taken from the Health Centre would be used only for academic purpose and remained confidential. The purpose of the study was made clear and understandable for all participants.

In this study, total population of 25129 outpatients visited Kamash Health Centre for abdominal complaints from 2011-2015, of which 10591 (42%) were males and 14538 (58%) were females (Table 4). The lowest and the highest prevalence of diarrhea at different years was 27.3% in 2014 to that of 28.2% in 2011 with an average prevalence of 27.8% over the years. Although fewer males visited the Health Centre in all years, the prevalence of diarrhea was slightly higher in males (30.8%) than in females (25.5%) with overall male to female ratio of 1.2:1 showing males were more vulnerable to diarrhea than females. The percentage distribution of diarrhea between the sexes did not show significant differences in 2012 and 2013, with a 1:1 ratio between males and females. However, the distribution in 2011, 2014 and 2015 showed a male to female ratio of 1:1.2, 1.7:1 and 1.5:1respectively.

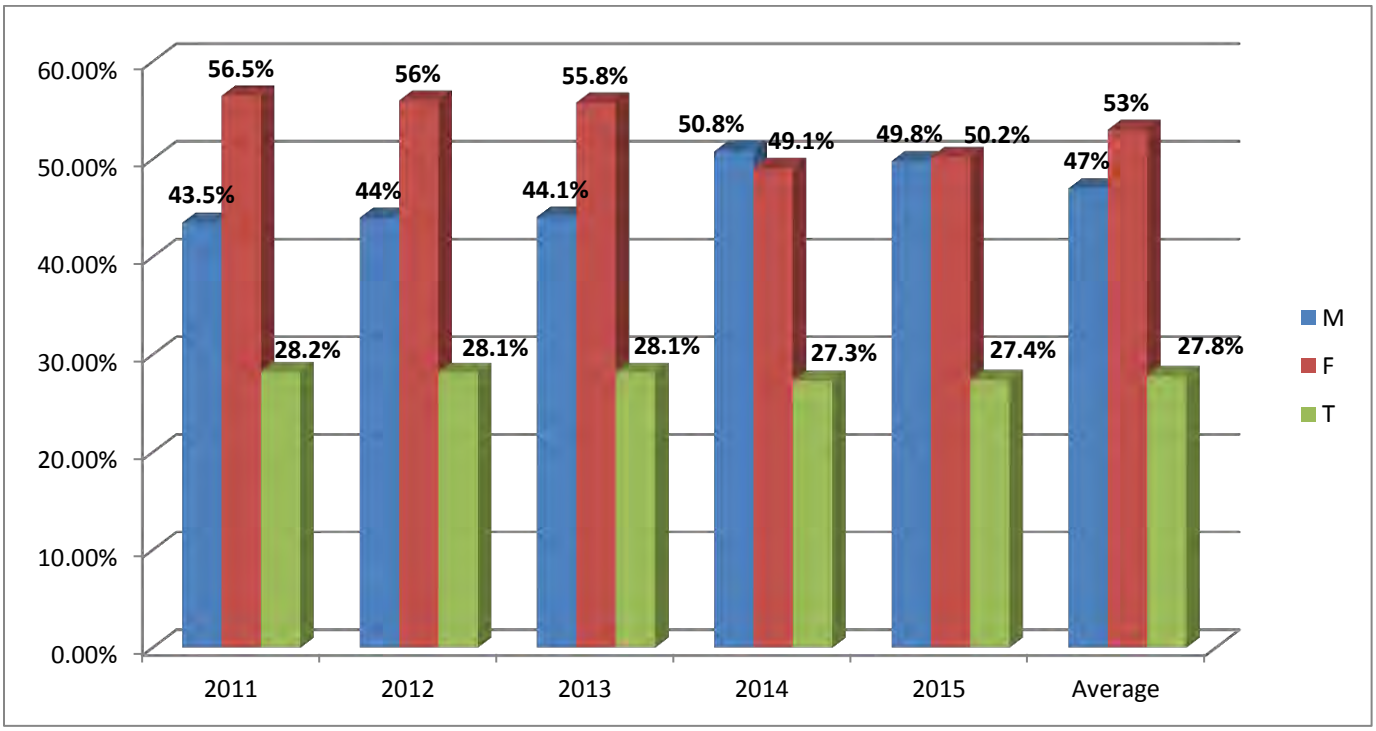
	Male			Female						
years	Tested	Diarrhea Infected	Prevalence %	Tested	Diarrhea Infected	Prevalence %	Total Tested	Total Diarrhea Infected	Average	M:F ratio
2011	1902	512	26.9	2278	666	29.2	4180	1178	28.2	1:1.2
2012	2079	572	27.5	2545	728	28.6	4624	1300	28.1	1:1
2013	2070	573	27.7	2550	725	28.4	4620	1298	28.1	1:1
2014	2213	802	36.2	3569	775	21.7	5782	1577	27.3	1.7:1
2015	2327	808	34.7	3596	815	22.7	5923	1623	27.4	1.5:1
Total	10591 (42%)	3267 (47%)	30.8	14538 (58%)	3709 (53%)	25.5	25129	6976	27.8	1.2:1

M: F, Male to Female ratio

The prevalence of diarrhea computed over the years was within the range of 28.2% in 2011 to 27.3% in 2014 showing a progressive decrease between the two years (Fig 4). This indicates that there was a little bit improvement in diarrheal infection as a function of time, and the target of reducing the prevalence of diarrheal disease in the area for the last five years show some succeed with different interventions such as adequate clean water supply to the community.

The prevalence of 27.8% diarrhea in the area within 5 years was higher than 17% of diarrheal cases reported from Dire Dawa town (Senait, 2014), but slightly lower than the diarrheal cases detected from Debre Birhan Town 31.7% (Ayele, 2014), and also it was less than 32.3% recorded from the study done in Debre Markos Hospital within the same period (Amlakie, 2016).

Although Kamash Town was not as big city as Debreberhan, the pattern of diarrheal infection did not show significant difference that may indicate a flow of outpatients from rural areas that were not relatively conscious in personal hygiene or did not have safe water supplies that exposed them to diarrheal diseases. The male to female ratio (1:1.2) in this study was lower, but not significantly different from the report from the ratio of 1:1.1 (more in females) recorded from Debre Markos Referral Hospital (Amlakie, 2016).



M-Male, F-Female, T- Total

With regard to the age-wise occurrence of diarrhea, the highest infection was recorded from the age group of 6-15 with prevalence of 24.4%, followed by 20.1% infection on each of the two age groups 46-60yrs, and >61age group. The lowest prevalence of 5.9% was recorded from the age group of under five children (Table 5).

Table 5 Distribution of diarrheal disease by age groups.

Age in year	Total tested (%)	Total infected (%)	Prevalence (%)
Under five	1650(6.6)	418(5.9)	25.3
6-15	5933(23.6)	1703(24.4)	28.7
16-30	3835(15.3)	990(14.2)	25.8
31-45	4477(17.8)	1064(15.3)	23.8
46-60	4345(17.2)	1400(20.1)	32.2
≥61	4889(19.5)	1401(20.1)	28.7
Total	25129(100%)	6976(100%)	27.8%

The consequences of low diarrhea on children less than 5 was similar with the results (6.17%) in Uganda (Clark et al., 2015) and lower than 11.4% obtained from Gondar (Tessema et al., 2011), and 17.7% recorded from Tigray (Teklit, 2015). However, it was significantly lower than the report from Tiko- Cameron with a prevalence of 23.8% on the same age groups (Ayuk, 2015).

Although it has been long established that diarrhea affect children under five years more than the other age groups (WHO, 2010), the current data did not indicate the value which support the above idea. Similar research done in Ethiopia by Stockholm University confirmed that the socio-demographic characteristics, the child's age was found to be negatively associated with childhood diarrhea. This means that infant children are less likely to experience childhood diarrhea compared with older children. This may be attributed partly to breastfeeding practice that could protect a certain population of the same age group from childhood diarrhea (Sukaina, 2014). In general, the disparity in prevalence of diarrheal in different place may be due to the difference in the geographical location, sanitation, and socio-demographic status of the study subjects.

The data also showed slight fluctuations with respect to prevalence of causative agents of diarrheal disease in the male to female ratio or the vice versa along the years (Table 6). Accordingly slightly more males (1.1:1) and 1.4:1 male to female ratio were infected in 2011 and 2014 respectively; whereas more females (1:1.3) were infected in 2015 by the parasite by the same margin. Although male to female ratio (1.4:1) infections with diarrheal diseases was higher in the years 2014, and higher female to male ratio of 1.3:1 was recorded in 2015, the overall male to female prevalence was 1.3:1 indicating that males were more infected than females (Table 6).

Within the limited microscopic identification of the causative agents undertaken at the Health Centre, amoebiasis was the dominant diarrheal disease caused by *E histolytica* (Table 6). It accounts for more than 50% of the diarrheal infections in the Kamash Town. The data showed that slightly more females (53.4%) were infected by amoebiasis compared to 46.6% of males. The detection of *E. histolytica* was lower than the ones (60.2%) reported from South East of Lake Langano (Mengistu, 2004), and much higher than reported from Jimma (1.1%) by Amare et al., (2007). The data also showed slight difference in that more males (1.1:1) were infected in

2011 and slightly more females were infected in 2013; However, males and females showed significant percentage of infection by *E hystolytica* (2.2:1) in 2014 and (1:1.5) in 2015 respectively. The overall male to female ratio was 1:1.13 showing slightly more infections on females than males (Table 6).

Table6 Distribution (%) of associated factors of diarrhea: 2011-2015.

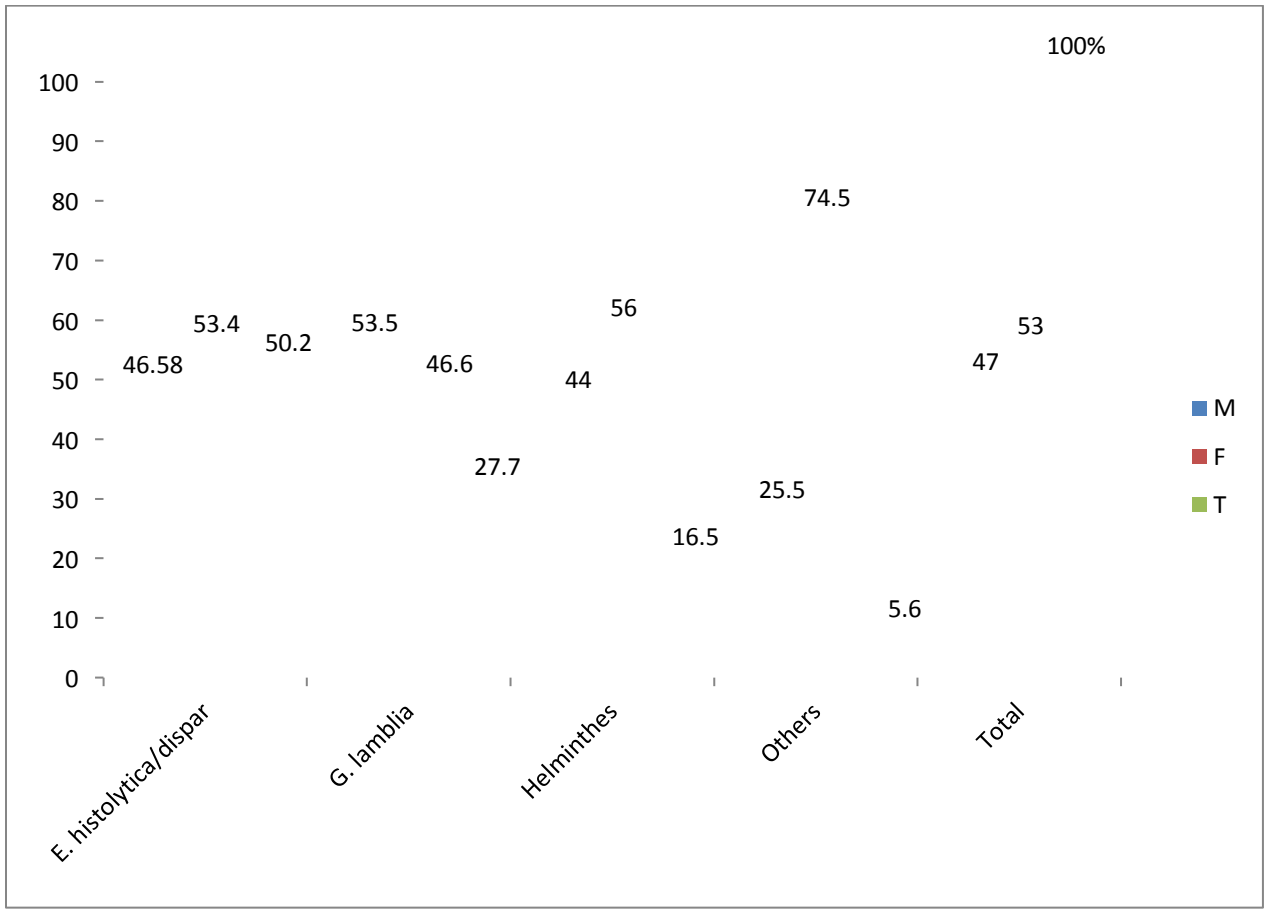
E. histolytica/ dispar	21.2	20.6	19.3	21.9	16.6	16.8	22	10.1	20.8	30.5	3501	50.2	23.4:26.8
G. lamblia	19.2	19.9	20.5	17.9	19.4	23.4	19.6	20.4	21.2	18.3	1925	27.7	14.8:12.8
Helminthes	23.2	15.2	20.6	22.3	19.4	20.2	24	19.8	12.9	22.5	1150	16.5	7.2:9.2
Others	15.7	20.5	22.5	23.5	24.5	18.8	17.6	17.4	19.6	19.8	400	5.6	1.5:4.3
Total	20.7	19.5	20	21.2	18.2	19.2	21.5	14.9	19.7	25.3	6976		
Total M:F Ratio	1.1:1		1:1.1		1:1.1		1.4:1		1:1.3				

Key: M-Male, F-Female

The data also showed *Giardia lamblia* was the second dominant protozoan parasite contributing to of diarrhea in Kamash Town of which 46.5% and 53.5% were males and females, respectively (Fig. 3). The prevalence of Giardiasis (27.7%) was similar to the work done in Pawi Special District where diarrheal patients harbored the parasite (Eyasu, 2010). The infection with *G. lambilia* in the present finding was higher than 13.8% infection reported from North Shewa Zone (Teklu et al., 2013). Similarly the research conducted at Hawassa Teaching and Referral Hospital showed prevalence of *E hystolytica/dispar* which was 26.5%, and *G. lambilia* 9.5% (Shimelis, 2009). These findings were lower than the present study and the differences might be by the differences in environmental conditions of the two areas.

On the other hand, 15.4% males and 17.3% of females with an average of 16.3% infection were attributed to helminthic diseases. This was almost twice as much as the prevalence in Debre Markos which was 9.28% (Amlakie, 2016). Apart from the protozoan and helminthic infections,

5.6% of diarrheal disease was implicated with "others" that could include bacterial, viral infections and other non-parasitic disorders.



In general, the data showed that the majority of diarrheal diseases were caused by *E. histolytica/dispar* and *G. lamblia* in the area. The data also showed that females were more infected with all types of infections, except with *G lamblia*. Given the limitation of laboratory microscopic diagnosis of bacteria, and the diverse group of bacteria and other protozoan parasites causing diarrhea and food poisoning, it may be an understatement to undermine their contribution to such disease.

The occurrence of diarrheal disease showed different pattern in that the highest prevalence of 29.4% was recorded from June-August season followed by 27.5% recorded from March-May seasons. The lowest prevalence of 20.6% was reported in September-November season (Table 7). Although the prevalence of diarrhea showed that pattern in the trimester of three months, the different types of infections by parasites showed different trend in their infection along seasons but the result in p value <0.09 is not statistically significant (Table 7).

Table Distribution of associated factors of diarrhea season wise.

Causative agents	Months				P Value
	Sep-Nov	Dec-Feb	Mar-May	June-Aug	
E.histolytica/dispar	629	733	981		
G. lamblia	471		460	495	
Helminthes	241	246		308	
Others	98	95		82	
Total	1439(20.6%)	1573(22.5%)	1921(27.5%)	2043(29.4%)	

Accordingly, infection by *E histolytica/dispar* was dominant in the June-August seasons; whereas the highest *G lamblia* infections were recorded in December-February seasons. Interestingly, the highest helminthes and other infections were recorded from the months between March and May.

This episode of diarrhea (22.5%) from Dec. to Feb. was a little bit higher than the study done in Ahmadabad (India) with the value of 17.4% episodes in winter and 29.4% from June to Aug is less than 36.3% episodes in summer season (Shailesh et al., 2011).

The other research done in Cape Town Metropolitan Sub-Districts on the relationship of seasons and diarrhea showed that an increase in temperature leads to an increase in daily diarrheal cases by 0.80% to 3.8% (Gentille et al., 2016).

The co-infection of diarrheal diseases with HIV was also analyzed from secondary data from Kamash Health Center (Table 8). Accordingly, the prevalence of co-infection was in the range of 13.9% in 2011 to that of 17.6% in 2015 with the overall mean infection of 16.3%. The data showed a progressive increase of co-infection by 4% with time. Although the male to female diarrheal infection was 47%:53% (1:1.2), the male to female HIV co-infection was 68%:32% (2.13:1) where males were more infected than females. The co infection showed a steady increase over the years between the sexes especially in females ranging from 74%:26% in 2011, 2012, and 2014, to 59%:41% and 61%:39% in 2013 and 2015 respectively although the diarrheal infection between males and females leveled of (1:1) from 2012 to 2013 by the result of p value <0.002 the co infection between males and females was statistically significant (Table 8).

Table8. Diarrheal disease and HIV/AIDS in Kamash town from 2011-2015

Year	Diarrheal patients						HIV positive						Ratio	
	M	%	F	%	T	%	M	%	F	%	T			
2011	512		666		1178		121		43		164	13.9	2.8:1	
2012	572		728		1300		146		52		198	15.2	2.8:1	
2013	573		725		1298		130		89		219	16.9	1.5:1	
2014	802		775		1577		198		70		268	17	2.8:1	0.002
2015	808		815		1623		174		112		286	17.6	1.6:1	
Total	3267		3709		6976		769		366		1135	16.3	2.1:1	

Within the five years of document analysis, although the total percentage of HIV positive diarrheal patients was 16.3%, the highest number of HIV positive diarrheal patients was recorded in the year 2015 which was 17.6% and the least number was recorded in 2011 which was 13.9%. The total prevalence of HIV positive diarrheal patients (16.3%) was much more lower than the study done at Hawassa Teaching and Referral Hospital, which was 44.6% (Shimelis, 2009) and in Narketpally (India) which was 41.7% (Anant et al., 2012). The present finding was also slightly lower than the research done in Mamata General Hospital (India) which was 17.3% (Venkateswarlu et al., 2013).

In this study the reported cases of diarrheal diseases was 27.3% in 2014 to that of 28.2% in 2011 with average prevalence of 27.8%. The highly infected patients were found in the age groups of 6-15 years with prevalence of 24.4%.

Among associated cases of diarrheal diseases, *E. histolytica* contributed to 50%. Although the male to female ratio in diarrheal infections varied over the years, the overall male to female infection was 1.3:1 indicating males were slightly more infected than females.

The occurrence of diarrheal diseases showed different pattern along seasons in that the highest prevalence of 29.4% and the lowest prevalence of 20.6% were recorded in June-August and September-November seasons. Apart from that the pattern of infections by the infectious agents was different in that infection by *E. histolytica/dispar* was high in the June-August seasons; whereas the highest *G. lamblia* infections were recorded in December-February seasons; not the least the highest helminthes and other infections were recorded from the months between March and May. The prevalence of HIV co-infection was in the range of 13.9 in 2011 to that of 17.6% in 2015 with the overall mean infection of 16.3%. The data showed a steady increase of co-infection with time. Generally the male to female diarrheal infection was 1.2:1; and in the same manner the male to female HIV co-infection was 2.1:1 where males were more infected than females in both cases.

The study was retrospective; it is imperative to have year-long monitoring using primary data to truly reveal the occurrence of diarrheal disease in Kamash Town.

The study was based on Health Center data using microscopic observation. This may have exaggerated the occurrence of helminthes and protozoan parasites, where as bacterial and viral infections could not be accurately diagnosed under the circumstances. Thus, the method could have underestimated the other most important bacterial and viral diseases which are implicated with a number of water borne and food borne diseases and intoxications (food poisoning).

It appears that diarrheal diseases and HIV/AIDS co-infections were increasing; thus, interventions have to be redressed to reduce diarrheal diseases in the area.

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Table 4.1 Prevalence of diarrhea in Kamash Health Center by sex (2011-2015).

Year	Age in year	Male		Female		Total tested	Total diarrhea Infected (%)
		No of tested	Diarrhea Infected (%)	No of tested	Diarrhea Infected (%)		
2011	Under 5	146	42	181	38	327	80
	6-15	280	96	944	234	1224	330
	16-30	401	119	368	104	769	223
	31-45	319	91	595	134	914	225
	46-60	301	204	346	92	647	296
	≥61	488	141	421	98	909	239
	Total	1935	693	2855	700	4790	1393
2012		128	34	160	39	288	73
	6-15	320	89	712	201	1032	290
	16-30	389	97	364	129	753	226
	31-45	341	102	525	136	866	238
	46-60	412	142	550	121	962	263
	≥61	470	162	513	101	983	263
	Total	2060	626	2824	727	4884	1353
2013		170	39	175	46	345	85
	6-15	298	122	840	249	1138	371
	16-30	360	114	380	82	740	196
	31-45	289	98	472	98	761	196
	46-60	300	170	461	103	761	273
	≥61	479	134	530	132	1009	266
	Total	1896	677	2858	710	4754	1387
2014		160	40	209	56	369	96
	6-15	436	99	853	240	1289	339
	16-30	398	90	402	81	800	171
	31-45	336	81	654	134	990	215
	46-60	478	168	497	135	975	303
	≥61	504	150	492	147	996	297
	Total	2312	628	3107	793	5419	1421
2015		121	34	200	50	321	84
	6-15	377	121	873	252	1250	373
	16-30	396	100	377	74	773	174
	31-45	316	80	630	110	946	190
	46-60	523	140	477	125	1000	265
	≥61	448	168	544	168	992	336
	Total	2181	643	3101	779	5282	1422
	Final total	10384	3267	14745	3709	25129	6976

	M	%	F	%	M	%	F	%	M	%	F	%	M	%	F	%	M	%	F	%	M	%	F	%	T	%
E. histolytica	346	21.2	386	20.6	315	19.3	410	21.9	271	16.6	315	16.8	360	22	189	10.1	339	20.8	570	30.5	1631	49.9	1870	50.1	3501	50.2
G. lamblia	198	19.2	178	19.9	211	20.5	161	17.9	200	19.4	210	23.4	202	19.6	183	20.4	218	21.2	164	18.3	1029	31.5	896	24.2	1925	27.7
Helminthes	117	23.2	98	15.2	104	20.6	144	22.3	98	19.4	130	20.2	121	24	128	19.8	65	12.9	145	22.5	505	15.4	645	17.3	1150	16.5
Others	16	15.7	61	20.5	23	22.5	70	23.5	25	24.5	56	18.8	18	17.6	52	17.4	20	19.6	59	19.8	102	3.1	298	8	400	5.3
Total	677	20.7	723	19.5	653	20	785	21.2	594	18.2	711	19.2	701	21.5	552	14.9	642	19.7	938	25.3	3267	46.8	3709	53.2	6976	100

Seasonal data distribution of diarrheal cases in Kamash Health Center (2011-2015).

Causative agents	Sex	Months			
		Sep-Nov	Dec-Feb	Mar-May	June-Aug
E.histolytica/ dispar	M	331	277	360	663
	F	298	456	621	495
	Total	629	733	981	1158
G. lamblia	M	203	309	230	287
	F	268	190	230	208
	Total	471	499	460	495
Helminthes	M	112	98	149	146
	F	129	148	206	162
	Total	241	246	355	308
Others	M	16	24	32	30
	F	82	71	93	52
	Total	98	95	125	82
	Total	1439(20.6%)	1573(22.5%)	1921(27.5%)	2043(29.4%)

Document analysis to be filled by health center

The main purpose of these questionnaires is to gather relevant data for the research entitled –Reported diarrheal cases among patients including HIV/AIDS visiting Kamash Health Centre between 2011 and 2015". You are one of stakeholders required to involve in the study by providing adequate response for the questions in the questionnaire. The response you provide will have a constructive and paramount importance for the successful accomplishment of this study. So, you are kindly requested to give your genuine response for each and every question.

Your response will be used only for academic purpose and remained confidential.

Thank you in advance for your cooperation!

Instruction:

1. Don't write your name on the questionnaire.
2. Use a thick mark for close-ended questionnaire .
3. Write briefly your response for open-ended questionnaire.
4. Please, give appropriate response based on your health center experience.

Part one: General Information and Respondents' Personal Data

1. Region_____ Zone_____ Woreda_____
2. Name of the health center_____
3. Age 16-25 ☐ 26-30 ☐ 31-40 ☐ 41-50 ☐ >50 ☐
4. Sex Male ☐ Female ☐
5. Level of Education Diploma Holder ☐ 1st Degree (BA/BSc) ☐
   2nd Degree (MA/ MSc) ☐ Any other _____
6. Area of Specialization: _____7. Work Experience: _____

What is the extent of diarrheal diseases within five years in the health center?

No	Year	Sex			Remark
		M	F	T	
1	2001				
2	2002				
3	2003				
4	2004				
5	2005				

I undersigned and declare that this Thesis is my original work and all sources of materials used are duly acknowledged.

Name Nigusu W/Giorgis

Signature _____

Date _____

This Thesis has been approved for submission to the Department of Zoological Sciences for public defense.

Name Fassil Assefa (PhD)

Signature _____

Date _____