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PREVALENCE OF DIARRHEA AND ITS ASSOCIATED FACTORS AMONG UNDER-FIVE CHILDREN VISITING BAHIR DAR HEALTH CENTER, BAHIR DAR CITY, NORTH WEST, ETHIOPI

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GRADUATE STUDIES OFFICE

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BY

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JUNE, 2021

BAHIR DAR, ETHIOPIA

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A THESIS SUBMITTED TO THE DEPARTMENT OF BIOLOGY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTERS OF SCIENCE DEGREE IN BIOLOGY (BIOMEDICAL SCIENCES)

BY
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JUNE, 2021
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Approval sheet of thesis for defense in Advisor's

As the thesis advisor, I hereby certify that I have supervised, read, and evaluated this thesis entitled "prevalence of diarrhea and its association with nutritional status among under-five children visiting Bahir Dar Health Center, Bahir Dar town, North West, Ethiopia" prepared by Lidiya Bekele prepared under my guidance. I recommend that it can be submitted as fulfilling the thesis requirement.

Sissay Menkir (Ph.D.) ---------- ------/----/----

Advisor's name Signature Date

Lidiya Bekele Atara ---------- ----/------/----

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Approval sheet of thesis for defense result in Examiners

As members of the Board of Examiners of the MSc. Thesis opens Defense Examination, we certify that we have read, evaluated the thesis entitled "prevalence of diarrhea and its association with nutritional status among under-five children visiting Bahir Dar Health Center, Bahir Dar town, North West, Ethiopia" prepared by Lidiya Bekele , and examined the candidate. We recommended that the thesis be accepted as fulfilling the thesis requirement for the degree of Master of Science in Bio-Medical Science.

Board of Examiners

_____ _____ ___/____/____

Internal Examiner I Signature Date

_____ _____ ___/_____/____

Internal Examiner II Signature Date

_____ _____ ___/____/____

External Examiner Signature Date

DEDICATION

I dedicate this thesis to my family for their love, affection, and unrestricted encouragement during this research work and my success in life. A special feeling of gratitude to my loving parents, Bekele Atara and Dinknesh Diki whose words of encouragement and push for tenacity ring in my ears. My sisters Fasika Bekele and Mintwab Bekele have never left my side and are very special.

DECLARATION

For this thesis first, I declare that this thesis is the result of my work and that all sources or material used have been duly acknowledged (cited). This thesis is submitted for partial fulfillment of the requirements of an MSc. in Biology (Biomedical sciences) degree at Bahir Dar University and to be made available at the university's Library under the rules of the Library. I confidently declare that this thesis has not been submitted to any other institution anywhere for the award of any academic degree or certificate.

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Date of submission

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LIST OF ABBREVIATIONS/ACRONYMS

AOR	Adjusted odd ratio
CDC	Center for Disease Control and prevention
CI	Confidence interval
COR	Crude odd ratio
CSA	Central Statistical Agency
EDHS	Ethiopia Demographic and Health Survey
ETEC	Enter toxigenic Escherichia Coli
GBD	Global Burden of Diseases
HEP	Health Extension program
HIV	Human Immune Virus
JMP	Joint monitoring program
MDG	Millennium Development Goal
MMT	Morbidity-Mortality and Treatment
MOFED	Ministry of Finance and Economic Development
NGOs	Non-governmental organization
OD	Open defecation
SD	Standard deviation
SPSS	Statistical Package for Social Science
UNICEF	United Nations International Children's Emergency Fund
WHO	World Health Organization

ABSTRACT

Diarrhea is a major health problem in Ethiopia. Most importantly, burden of diarrhea is disproportionately high among under-five children. Therefore, the objective of this study was to assess the prevalence of diarrhea and its associated factors among under five children visiting Bahir Dar Health Center, Bahir Dar city, Northwest, Ethiopia, 2021. A hospital-based cross-sectional study was conducted among under-five children from February to march 2021. Simple random sampling method was used to select the 200 participants. The socio-demographic data were collected by using structured and pretested questionnaire survey. Both univariate and multivariate logistic regression analyses were employed to identify predictor variables. Factors with a p-value of < 0.05 were considered as independently associated with diarrhea. Anthropometric measurements were used to collect height and weight following the standard measurement tools and procedures. Data was entered into SPSS version 23 and anthropometric measurements were converted into Z-score by WHO Anthro version 3.2.2 Software. The prevalence of diarrhea among under five children was 38% and intestinal protozoan parasite found to be 4% and intestinal helminthes 1%. In univariate analysis age group of child 7-12 were found to be (COR=2.429, CI: 0.849, 6.945), Maternal age group 18-24 (COR = 2.641 CI: 0.768, 9.074), wasting (COR= 2.769 CI: 0.748, 10.257) and hand washing only with water (COR = 4.667 CI: 0.374, 58.248) were predictors of the occurrence of diarrhea. In multivariate analysis ten of the risk factors found were not significantly associated with diarrhea infection (P<0.05). Complementary feeding at 6 month and putting complementary feeding in covered shelf were found to be protective against diarrhea.

Keyword: Bahir Dar Ethiopia, Children, Diarrhea, Nutritional status Prevalence, Under-five.

1. INTRODUCTION

1.1. Background of the study

Diarrhea is the passage of liquid stools three or more times per day, or many times than normal for the individual. It is usually a symptom of gastrointestinal infection, which can be caused by different types of bacterial, viral and parasitic organisms (WHO, 2013). Around 2.5 billion of diarrhea cases each year, occurring among under five children, and estimates suggest that overall incidence has remained relatively stable over the past two decades (UNICEF, 2009). Diarrheal diseases account for 9% of child deaths worldwide, making diarrhea the second leading cause of death among under five children (CDC, 2013). The acute diarrhea causes high loss of water and salts from a body which results in both severe dehydration and death within a short period of time or predisposes malnutrition to the children and makes them more susceptible to related infections. Infectious diarrhea is acquired by fecal-oral transmission route, by person to person contact, through water and food or directly to the mouth. The lack of a proper water supply, with rubbish and dirty surroundings and an abundance of flies, are the typical situation in which diarrheal diseases are transmitted. Diarrheal diseases have been a major public health concern of low-income countries leading to high morbidity and mortality among under-five children (WHO, 2015).

Globally, there are nearly 1.7 billion cases of childhood diarrheal infection every year (WHO, 2017). Diarrheal diseases are one of the leading causes of morbidity and mortality and accounts for more deaths in early childhood after the neonatal period. 525,000 children of under-5 years old die due to diarrhea every year, roughly 2195 every day (UNICEF, 2016). Diarrheal infections are associated with an estimated 1.3 million deaths yearly with most occurring in resource – limited countries (Mokomane *et al*., 2018). In Africa diarrhea account for the largest cause of disease and death among young children and nearly 50% of deaths due to diarrhea among young children occurs in Africa (Walker *et al*., 2012).

Sub-Saharan Africa is still with the highest rates of under-five child mortality where 1 in 9 children dies before age five that is more than 16 times the average for developed regions (1 in 152) and Southern Asia (1 in 16). Under-five mortality are highly concentrated in Sub-Saharan Africa and Southern Asia regions, while in the rest of the world dropped from 31 percent in 1990

to 17 percent in 2011. About 11% of under-five mortality was attributed to diarrhea in Sub-Saharan Africa regions (Liu *et al.*, 2017).

In Ethiopia, diarrheal disease is a major public health problem. The 2010 report of the Ministry of Finance and Economic Development (MOFED) showed that 20% of childhood deaths in the country were due to diarrhea. The 2011 Demographic and Health Survey of Ethiopia (EDHS) findings also indicated that 13% of the children had diarrhea in the 2 weeks preceding the survey at the national level. The incidence of illnesses contributing to avoidable death's diarrhea is higher in Ethiopia compared to other Sub Saharan African countries partly due to living conditions, high incidence level of illness, lack of safe drinking water, sanitation and hygiene; as well as poorer overall health and nutritional status (Wondwoson Woldu *et al*., , 2016; Genet Gedamu *et al*., 2017). 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).

Malnutrition and diarrheal mortality have a bidirectional association (Azandjian *et al*., 2009), Malnutrition causes immune-deficiency and increased susceptibility to infections such as diarrhea. Diarrhea in turn causes malnutrition through reduced food appetite, energy intake, nutrient loss and mal-absorption (Neumann *et al*., 2004).

In Ethiopia, several studies were conducted to estimate the prevalence as well as to identify modifiable factors of under-five diarrheal diseases. However, the prevalence reflected in these small and fragmented studies varied widely and remained inconclusive. Besides prevalence, identifying modifiable risk factors is a critical step in identifying potential interventions. The lack of a nationwide study that determines the prevalence and determinants of diarrhea among under-five children is a significant gap. Therefore the current study was conduct to assess the diarrheal cases and its association with nutritional status in under five children visiting Bahir Dar Health Center.

1.2. Statement of the problem

Diarrheal diseases are still the major cause of morbidity and mortality among children worldwide and mainly in sub-Saharan Africa. Different studies in Ethiopia indicate that, socioeconomic status, monthly income, number of under-five children, methods of complementary feeding, types of water storage equipment, mother's poor hand washing practices, lack of hand washing facilities, duration of breastfeeding and improper waste disposal practices were significant factors for diarrhea occurrences (Wakigari Regassa and Seblewengel Lemma, 2015).

Children with poor nutritional status and overall health, as well as those exposed to unsafe drinking water are more susceptible to severe diarrhea and dehydration than healthy children. Children are at greater risk than adults of life-threatening dehydration since water constitutes a greater proportion of children's bodyweight. In Ethiopia, still the national open defecation (OD) rate in 2014 was 34.1% (37.9% in rural and 8.7% in urban) (CSA, 2014). This practice facilitates the transmission of diarrheal diseases, and one of the leading causes of mortality in under-five children in sub-Saharan Africa (Abireham misganaw *et al*., 2018). Households in rural part of the city monthly income, failure to use separate container for storing drinking water, presence of human excreta in the compound were found to be predictors of childhood diarrhea (Molla Gedefaw *et al*., 2015).

A research conducted in Bahir Dar town indicate that lack of hand washing facility, lack of separately feeding materials for children, no breastfeed exclusively and hand washing practice were predictors of occurrence of diarrhea (Amare Belachew *et al*.,2019). Therefore, it is important to assess diarrhea cases and its association with nutritional status among under five children visiting Bahir Dar Health Center.

1.3. Objectives

1.3.1 General Objective

- To assess the level of diarrhea and its association with nutritional status of under-five children visiting Bahir Dar Health Center, Northwest Ethiopia.

1.3.2. Specific Objectives

- To determine the prevalence of diarrhea among under-five year old children visiting Bahir Dar Health Center
- To determine the major intestinal parasite species that causes diarrhea among under-five children visiting Bahir Dar Health Center
- To identify the determinants of diarrhea in under-five children visiting Bahir Dar Health Center

1.4. Significance of the study

The results of this study is important to inform decision makers on factors associated with diarrhea among children and they may set adequate and suitable strategies to address diarrhea diseases among under five children. Furthermore, the health professionals such as nurses may use results of this study to design and implement responsive health program targeting to tackle morbidity and mortality related to diarrhea disease among children and the communities aware of diarrhea especially mothers and caregivers. In addition the study contributes to the field of knowledge in diarrheal diseases and serves as a basis for further investigations. Finally, the study provides and establishes much information about the prevalence of diarrhea infection and association with nutritional status for other researcher interested to conduct on the same issue in the study area.

1.5. Limitation of the study

The study was limited to only wet mount method. Despite this, a bigger picture of the prevalence of major intestinal parasites leads to diarrhea in the study area was not being found. Including other techniques like formol ether concentration and other techniques could help to get a bigger picture of the prevalence of major intestinal parasite species in the study area. As being cross-sectional in the design, this study shared the drawbacks of similar cross sectional studies. In cross-sectional studies, it was difficult to entertain the seasonal differences in the occurrence of diarrheal diseases.

2. LITERATURE REVIEW

2.1. Definition of diarrhea

Diarrhea is the passage of three or more loose or liquid stools per day, or many times than normal for the individual (WHO, 2013). It is usually a symptom of gastrointestinal infection, which can be caused by different types of bacterial, viral and parasitic organisms. Infection is spread via contaminated food or drinking water, or from one person to another as a result of poor hygiene. Severe diarrhea leads to fluid loss, and may be life threatening, particularly in young children and people who are malnourished or have impaired immunity (WHO, 2013). 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 and Dinesh, 2015).

Diarrheal diseases can be classified according to their clinical pattern as: persistent diarrhea (i.e. diarrhea lasting 14 days or more) and acute watery diarrhea (i.e. diarrhea without blood lasting less than 14 days) (UNICEF, 2009).

Acute diarrhea characterized by abrupt onset of frequent, watery, loose stools without visible blood, lasting less than two weeks. Acute bloody diarrhea (i.e. diarrhea with blood lasting less than 14 days).Usually, acute watery diarrhea episodes subside within 72 hours of onset. Acute diarrhea, dehydration is the main contributor to mortality. It may be accompanied by flatulence, malaise and abdominal pain. Nausea, vomiting may occur and also fever may be present. The common causes of acute watery diarrhea are viral, bacterial, and parasitic infections. Bacteria also can cause acute food poisoning. The enteric pathogens causing this diarrhea in developing countries are largely the same that are encountered in developed countries, but their proportions are different (Jay, 2013). However, persistent diarrhea is defined as diarrheal episodes of presumed infectious etiology that have an unusually long duration and last at least 14 days (Jay, 2013). persistent diarrhea is associated with malnutrition, delayed growth and development, vitamin A deficiency and systemic infections such as respiratory infections and urinary tract infection which makes treatment more complex (Das *et al*., 2012).

2.2. Epidemiology

2.2.1. Global burden of diarrheal diseases

Diarrhea is a leading cause of children, accounting for approximately 8 percent of all deaths among children under age 5 worldwide in 2017. This translates to over 1,300 young children dying each day, or about 480,000 children a year, despite the availability of a simple treatment solution (UNICFE, 2017)

Pneumonia, diarrhea and malaria remain leading causes of death among children under age five, accounting for about 1.3 million about 40 percent of under-five deaths in Sub-Saharan Africa and roughly half a million about 25 percent in Southern Asia. Diarrhea killed roughly 2 million children in 2013 and accounted for almost a third of global under-five deaths (UNICEF/WHO, 2014). The youngest children are most vulnerable with the incidence of severe gastroenteritis being highest in the first 2 years of life (Oloruntoba *et al*., 2014). Morbidity due to diarrhea is further concentrated in marginalized communities within resource-limited countries (Bulled *et al*., 2014). Despite improvements in standard of living, advances in sanitation, water treatment and food safety awareness, diarrheal disease still accounts for significant economic and societal losses (Reddington *et al*., 2014).

2.2.2. Epidemiology of diarrheal diseases in under five children

As indicated in World Health Organization there are about two billion cases of diarrheal disease worldwide every year, and 1.9 million children younger than 5 years of age die from diarrhea each year, mostly in developing countries. This accounts 18% of all the deaths of children under the age of five and means that more than 5000 children are dying every day because 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 five children. Sub-Saharan Africa is still with the highest rates of under-five child mortality where 1 in 9 children dies before age five that is more than 16 times the average for developed regions (1 in 152) and Southern Asia (1 in 16). Under-five mortality are highly concentrated in Sub-Saharan Africa and Southern Asia regions, while in the rest of the world dropped from 31 percent in 1990 to 17 percent in 2011. About 11% of under-five mortality was attributed to diarrhea in Sub-Saharan Africa regions (Liu *et al.*, 2017).

A study from Pakistan shows child's own characteristics (age and sex), total number of children born, mothers characteristics (age and education) and economic characteristics (ownership of agricultural land and housing) were significant predictors of under-five's diarrheal morbidity. Similar study from Iran revealed that diarrhea was associated with age of child, area of residence, maternal education (Asma and Rukshana , 2012), in Cameron 23.8% (Tambe *et al*.,2015), Tanzania 32.7% (Jean *et al*.,2017), Senegal 26% (Kakulu,2012), Rwanda 26.7% (Sokhna *et al*.,2014), Egypt 19.5% (Yassin,2000) Ghana 19.2% (Boadi and kuitunen,2005), Iraq 21.3% (Siziya *et al*.,2000), India 25.2% (Siraj *et al*.,2010), Burundi, 32.6% (Diouf *et al*.,2014).

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 indicate 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).

2.2.3 Prevalence of diarrhea in under five children in Ethiopia

The 2016 Demographic Health Survey of Ethiopia finding showed that 12% of the children had diarrhea in the 2 weeks preceding the survey at the national level (CSA, 2016). In 2017 Ethiopia also showed that two weeks period prevalence of diarrhea among under-five children was 20%. In Ethiopia studies have indicate that the prevalence of diarrhea both in urban and in rural areas was 13%. The prevalence of diarrhea was relatively high among children aged from 6 to 23 months. In southern Ethiopia, 25.5% of children experience diarrhea, but three-fourths occurred among rural children (CSA and ORC Macro, 2011).

Similarly, a community-based cross-sectional study conducted in Jabitehnan district, West Gojjam Zone, Amhara Region, Ethiopia, reported a 21.5% two-week period prevalence of diarrhea (Desalegn Tesfa *et al*., 2017). But in most remote and pastoralist areas, the prevalence is

expected to be higher because of shortage of drinking water, poor sanitation, and low educational and awareness levels. For example, a study in Somali Region, Eastern Ethiopia (a predominantly pastoralist area), has shown the two-week period prevalence of diarrhea among under-five children to be more than two times that of the national level prevalence (Hashi Abdiwahab *et al.*,2017). Benna Tsemaye District is one of a pastoralist districts in the South Omo Zone of Southern Ethiopia. According to the District Health Office 2016/17 report, 28.5% of all under five outpatient department visits in the district were due to diarrheal diseases and diarrheal disease was the first leading cause of morbidity in the district. Laelay Michew District of Tigray Region, North Ethiopia (17.7%) (Angesom, 2015). In another study conducted in Debre Berhan Town, the prevalence of diarrheal illness among under five children was found to be 12.2% indicating storage of water in a pot, observation of feces on the latrine hole, lack of maternal education and age of mothers/guardians as a risk factors for the disease. The overall prevalence of diarrhea among under-five children in the study conducted in predictors of under-five childhood diarrhea in Mecha District, West Gojam, was 18 %, i.e.12.5% in urban and 20.6% in the rural of the study area(Muluken Dessalegn *et al.*,2011).

The prevalence of diarrhea among under five children was 14.5% among under-five children in Kamashi district, western Ethiopia (Adugna Fenta *et al*., 2020), in Dire Dawa city 20% (Ephrem Tefera *et al*., 2020), In Hadaleala district, Afar region 26% (Bikes Destaw *et al.,* 2017), in tigray region Mekelle zone (Serawat, Harena, Maynebri & Tsuwanet) 27.7% (Araya Gebreyesus *et al*., 2018), in Addis Ababa Gullele & Lideta Sub-City's District 11.9% (Metadel Adane *et al*.,2017). In somali region Jigjiga District 27.3% (Hashi *et al*., 2016) and in Jigjig Town 14.6% (Bizuneh *et al*., 2017).

The prevalence of diarrhea in SNNPR among under five children 30.9% in Worabe Town (Aseb Arba *et al*., 2020), in Wonago district 30.9% (Tinsae Shemelise *et al*., 2020), in Benna Tsemay District 23.5 % (Mulusew Alemayehu *et al*., 2020), in Sidama zone, Dale District 13.6% (Behailu Melese *et al*., 2019), in Wolitta Soddo Town 11% (Alambo Kedir, 2015),in Arba-Minch district 30.5% (Shikur Mohammed & Dessalegn Tamiru, 2014).

The prevalence of diarrhea in amhara region among under five children 14.5% conducted in Bahir Dar city (Amare Belachew *et al*., (2019), in Bahir Dar City 21.6% (Molla Gedefaw *et al*., 2015), In farta wereda 16.7% (Genet Gedamu *et al*., (2017), in Bahir Dar Zuria district 20% (Desalegn

Tesfa *et al*., 2017), North Gondar Zone 22.1% (Atalay Getachew *et al*.,2018), Debrebirehan Town 31.7% (Ayele Mamo & Awraris Hailu ,2014), Dejen District 23.8% (Demeke Getu *et al*.,2013), Jamma district, South Wello zone 23.1% (Getachew Yismaw,2019), Debre Berhan town 16.4% (Sisay Shine *et al*., 2020), Jabithennan District 21.5% (Zelalem Alamrew *et al*.,2017), Central Gondar Zone 30.09% (Zewudu Andualem *et al*.,2019).

Prevalence of diarrhea in oromia region among under five children 28.4% the study conducted in Harena Buluk Woreda (Solomon Getahun and Abulie Takele, 2018), in Serbo Town 14.9% (Legefa Futa *et al*.,2018), and (14.5%), in Kersa 22.5% (Bezatu Mengistie *et al*.,2013), in nekemte town 28.9% (Girma Regassa, 2008), in Adama district rural kebeles 14.5% (Wakigari Regassa and Seblewengel Lemma,2016),in Sebeta 9.9% (Mohammed Abdulwahid and Li Zungu), district of diarrhea prevalence conducted in different parts of Ethiopia

2.3. Etiology- The main causative agents of diarrhea

Diarrhea is a symptom of infections caused by a host of bacterial, viral and parasitic organisms, most of which are spread via faeces-contaminated water. Infection is more common when there is a lack of adequate sanitation and hygiene and safe water for drinking, cooking and cleaning. Rotavirus and *Escherichia coli* are the two most common etiological agents of moderate-to-severe diarrhea in low-income countries. Other pathogens including *cryptosporidium* and *shigella* species may also be important. Location-specific etiologic patterns also need to be considered (WHO, 2017).

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, 2012). The major bacterial pathogens that are associated with diarrheal diseases are; *Shigella*, *Salmonella, Campylobacter*, *Vibrio cholera,* and *Enterotoxigenic Escherichia coli* (ETEC) (Afroza *et al*., 2013).

2.4. Clinical presentation, symptoms and clinical signs of diarrheal illness

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, 2012).

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 heartbeat, 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, 2012).

2.5. Transmission routes of diarrheal disease

Diarrhea infection is acquired via fecal-oral transmission that includes consumption of contaminated water or food, direct contact with person-to-person or direct contact with faecal matter. Considering water-borne-diarrhea, transmission can occur when in-household there is storage of contaminated water (WHO, 2010). There are four routes of transmission of diarrheal illnesses through which infectious agents reach human hosts. Among them are person to person via the environment; person to person multiplying in the environment; human to animal to human via the environment; and animal to human via the environment. In situations where faecal matter contamination of the domestic environment is high, the majority of cases of endemic disease probably occur either by person to-person transmission, or from the person-to-person transmission of pathogenic agents that have multiplied in the environment (Bain *et al*., 2015).

2.6. Risk factors of diarrheal disease among under five years children

Childhood mortality rates in general and infant mortality in particular, are often used as broad indicators of social development or as specific indicators of health status. Child mortality reduction by two-third is one target of Millennium Development Goal (MDG) (International ICF: 2011). Worldwide diarrheal disease is the second leading cause of death in under-five year children. It is responsible for 1.7 million morbidity and 760, 000 mortality of children every year (WHO, 2013). In Ethiopia diarrhea kills half million under-five children annually secondary to pneumonia. Poor sanitation, lack of access to clean water supply and inadequate personal hygiene are responsible for 90% of diarrheal disease occurrence, these can be easily improved by

health promotion and education (UNICEF, 2004). In effect, Ethiopia introduced a new initiative Health Extension program (HEP) in 2002/03 as a means of providing a comprehensive, universal, equitable and affordable health service for the rural population on the base of promotive, preventive and basic curative services. The program was provided as a 16 packages focusing on health promotion and education supported by demonstration targeting households, particularly mothers and women through house to house visits (Argaw, 2007).

2.6.1. Demographic factors

The potential factors identified were in several studies have recognized that the diarrhea prevalence is increased in younger children especially in children ranged between 6-11months. Child age (36–47 months) (Araya Gebreyesus *et al*., (2018), age of the child (Aseb Arba *et al*., (2020). Same of findings showed that the diarrhea rate was greater in boys than girls. Other demographic factors, like low level of mother's education, mothers' younger age, birth order, and high number of siblings were notably associated with diarrhea in children below five years (Agustina *et al*., 2013), Educational level (Behailu Melese *et al*., (2019), living in rural area (Bezatu Mengistie *et al*.,2013).

2.6.2. Socio-economic factors

Economic factors associated with diarrhea in under five children were, crowded conditions, poor housing, low income; and elevated rate of diarrhea was statistically significant. For example, the socio-economic determinants of health, such as low socioeconomic status, lack of education among mothers or care givers, insufficient safe drinking-water, and inadequate sanitation, are likely to be leading factors of diarrheal disease, which continues to affect millions of children below 5 years, in low- and middle-income countries (Agustina *et al*., 2013).

2.6.3. Lack of safe drinking water, sanitation and hygiene

Sanitation factors: evidence showed that sanitation plays a major role in reducing diarrhea morbidity. Some sanitation factors, like improper disposal of children's stool and no existence of latrine or unhygienic toilet, sharing latrine and house without sewage system. These elements were reported as the risk factors for diarrhea in children under five years (Teklemichael Gebru *et al*., 2014).

Water-related factors: According to the 2014 update study report of JMP (joint monitoring programme) to estimate global exposure to fecal contamination in drinking water. The study

estimates that 1.8 billion people globally use a source of drinking water that is fecal contaminated (UNICEF, 2014). The water-storage containers used in developing countries households which are often not cleaned and opened are exposed to contamination due to children who put their hands into the water, unhygienic handling of the storage containers, use of dirty utensils to withdraw water, dust, animals, birds and various types of insects. Most of the time children are the first line of victims for the problem associated to it (WHO, 2009).

Hygiene practices: various studies noticed that children who did not wash hands before eating or after defecation, mothers who don't wash hands before feeding children or mothers who don't clean foods before cooking, children who eat with their hands rather than with a spoon, eating of cold leftovers, dirty feeding bottles and utensils, unhygienic domestic places (kitchen, living room, yard), improper food storage, living with animals inside the house, lack of strategies to limit flies inside the house, were associated with greater risk of diarrhea occurrence in children (Teklemichael Gebru *et al*., 2014). Poor latrine hygiene, had no hand washing facilities near latrines, poor hand washing practice at a critical time, who stored water at home (Adugna Fenta *et al*., 2020)

2.6.4. Malnutrition

Diarrhea and malnutrition are associated with water, sanitation, and hygiene through different mechanisms. For example, faecal exposure through contaminated water, unimproved sanitation and poor hygiene, leads to diarrhea which affects physical and mental growth of a child (Ngure *et al*., 2014).

Malnutrition: the relationship between diarrhea and malnutrition is so common in low-income societies that the concept of a vicious circle is appalling, with diarrhea leading to malnutrition and malnutrition predisposing to diarrhea. Children whose immune systems have been weakened by malnutrition are the most vulnerable to diarrhea. Diarrhea, especially persistent and chronic diarrhea weakens nutritional status, leading to mal-absorption of nutrients or the inability to use nutrients properly to maintain health. A number of studies have reported a higher incidence of diarrhea in malnourished children. A tendency of increased incidence of diarrhea was also found in children with low weight-for-age, or, in particular, in stunted children (Teklemichael Gebru *et al*., 2014).

Globally, more than 3 million children under the age of 5 years die per year due to malnutrition (Black *et al.*, 2013). Malnourished children are negatively and irreversibly affected in their school performance, physical growth and cognitive development (Guerrant *et al*., 2008)

2.6.5. Breastfeeding

Exclusive breastfeeding of babies is described by WHO (2017) as feeding a baby on breast milk only without giving any other liquids or solids including water, with the exception of oral rehydration solution or drops of medicine from birth up to six months of age. Studies have shown that it reduces the risk of childhood illnesses such as respiratory and gastrointestinal infections (Demewoz Haile and Sibhatu Biadgilign, 2015). The morbidity of diarrhea is lower in exclusive breast-fed children; it is higher in partially breast-fed children, and highest in fully-weaned-children (Teklemichael Gebru *et al*., 2014).

2.7. Prevention and Control of Diarrhea

The prevention of diarrheal disease is first and foremost based on access to safe drinking-water sources; use of improved sanitation; hand-washing with soap; exclusive breastfeeding for the first six months of life; personal and food hygiene. Health professionals like nurses could make more effort in health education talks on how diarrheal infections spread, and sensitize all mothers of children under five years to immunize them with rotavirus vaccine (Tate *et al*., 2016). All major cases of diarrheal diseases in children under five years old can be prevented by proper household practices of water, sanitation and hygiene (Diouf *et al*., 2014).

3. MATERIAL AND METHODS

3.1. Description of the study area

The study was conducted in Bahir Dar City, which is the capital city of Amhara Regional State, which is located in west Gojjam Amhara region, Northwest of Ethiopia. It is 565km far away from capital city of Addis Ababa (Figure1). Bahir Dar is located at 11°36' North and 37°23' East and has an average elevation of 1801m above sea level (CSA, 2017).The city has nine sub cities and with a total of 17 kebeles. Bahir Dar's climate is classified as warm and temperate. The summers here have a good deal of rainfall, while the winters have very little. In Bahir Dar, the average annual temperature is 19.6 °C | 67.2 °F. The rainfall here is around 1419 mm | 55.9 inch per year. The total population of Bahir Dar City 168,899. Under five children are approximately 41,834, of which 26,238 are aged 24-59 months (from Amhara regional health bureau). The city has government and private health institutions. It has two government and private hospitals, and nine health centers. Bahir Dar Health Center is situated in Fasilo sub city in Bahir Dar town.

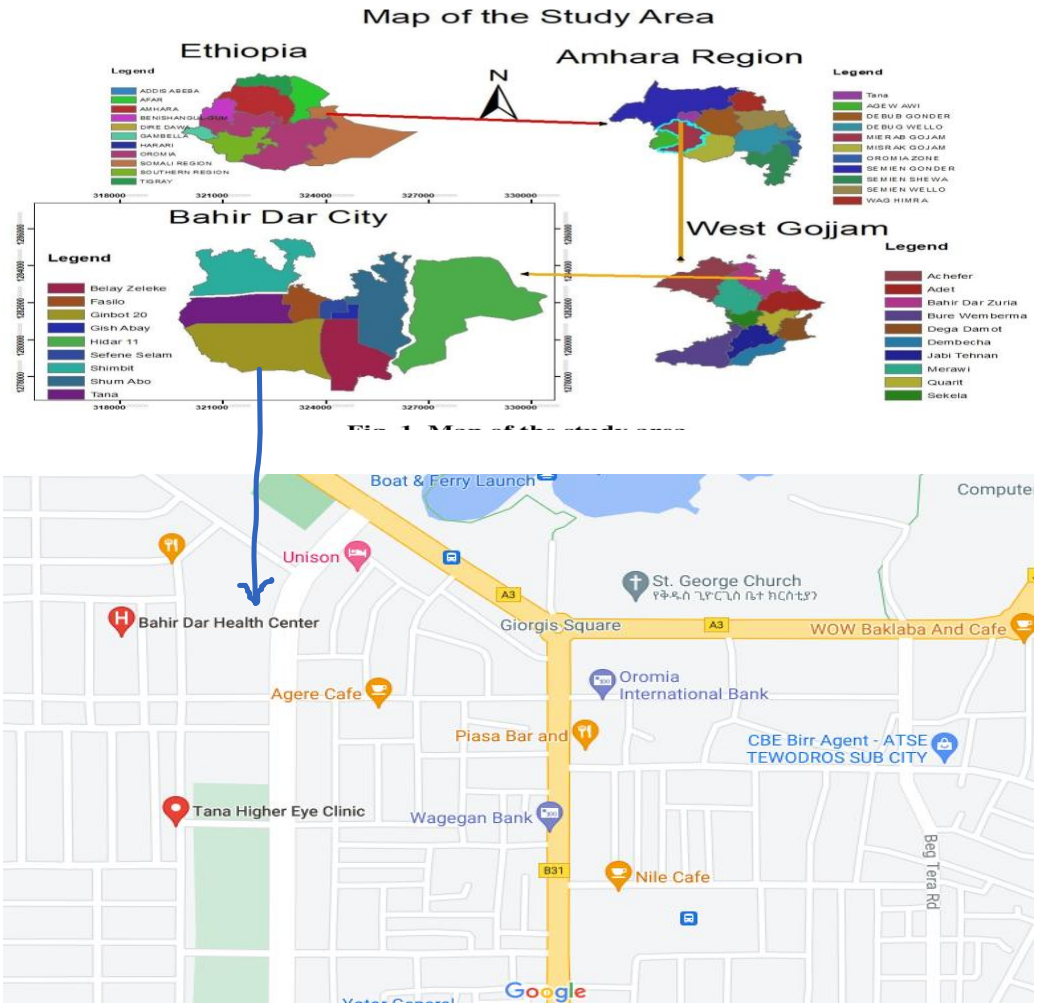

Figure 1: map of study area

3.2 Study design

A hospital-based cross sectional survey was conducted from February to March 2021 to determine the prevalence of diarrhea and its association with nutritional status among under five children visiting Bahir Dar Health Center, Northwest Ethiopia

3.3 Study Population

All the under-five children who came Bahir Dar Health Center in the specified period of time from February to March 2021and full fill the inclusion criteria of the study are considered as study population.

3.4 Source Population

All the children who visited Bahir Dar Health Center from February to March 2021.

3.5. Sample Size Determination

The sample size to this study was determined based on 14.5% prevalence report of other study (Amare Belachew *et al*., 2019).

The sample size is estimated using the following statistical formula (Naing *et al.,* 2006).

$$n = \frac{z^2 p(1-p)}{d^2} \text{ Or } \frac{z^2 pq}{d^2}, \frac{(1.96)^2 \times 14.5(1-14.5)}{(0.5)^2} = 191$$

Where: n = sample size required

Z = 95% confidence interval (1.96)

d = Marginal error between the sample and populations (0.05)

P = prevalence rate (14.5%)

Since the overall prevalence of rate (p) of diarrheal cases and its association with nutritional status in the study area was known the sample size of the proposed study was calculated as a function of the 14.5%. For calculation, a 95% confidence interval (Z) and a 5% margin of error (d) was used. Therefore, in this study one hundred ninety one (191) under five age children was chosen to participate in the study. To compensate for non-response rate, 5% of the sample size was added and finally 200 individuals are included for the assessment of diarrheal cases and its association with nutritional status of under five children visiting Bahir Dar Health Center during the study period.

3.6. Eligibility criteria

3.6.1. Inclusion criteria

All the children aged under five who visited Bahir Dar Health Center in the specified period of time from February to March 2021. Mothers/care-givers who visited the Health Center with their under-five children and signed consent form were included.

3.6.2. Exclusion criteria

Mothers/care-givers who have visited the Health Center with their children above five year and not suspected for diarrhea are excluded. All children who are suspected for diarrhea prior to the study and take ant-diarrhea drug and vaccinated also excluded.

3.7. Sampling technique

The study was conducted by using simple random sampling technique. The data was obtained from daily admission of under five children and information was collected by using questionnaire which contained questions related to socioeconomic factors, demographic factors, child health and caring practice, behavioral habits, and environmental conditions.

3.8. Methods of Data Collections

3.8.1. Questionnaire survey

Face to face structured questionnaire was conducted on mothers or caretakers of the children who were recruiting into the study. The questionnaire was first prepared in English based on known associated risk factors, and then it was translated in to local language, Amharic, then after the response was translated back into English. The questionnaire survey was conducted on the day of admission. The respondents were informed about the purpose of the questionnaire survey and participation in the study was voluntary. The respondents were also asked for their permission to be involved in the survey and the information they provided would be handled as confidential.

3.8.2. Anthropometric measurements

Height/length and weight measurement of the child were taken by the health extension workers who are already trained by the government and work the health posts. Weight scale was used to measure weight of children. Weight was recorded to the nearest0.1 kg with the child barefoot and wearing light clothing. Children who were unable to stand on the scale, and 6–24 months were weighed with the mother or legal guardian, then the mother/ guardian was weighed alone,

and the differences were used to obtain the net weight of the children. The height of the children was measured using a calibrated height measuring board. A child who could not stand erect was measured in supine position. A child who could stand erect and above 24 month was measured standing against a calibrated height measuring board. The height measurement was taken to the nearest 0.1 cm. WHO Anthro version 3.2.2 software used to convert the anthropometric measures; age, weight, height/length values into Z-scores of the indices; Weight-for-Height (WHZ), Weight for-Age (WAZ), and Height-for-Age (HAZ) taking gender of the child into consideration using WHO 2006 standards. An anthropometric measurement was carried out by the above standard method.

3.8.3. Stool sample collection and examination

During stool collection, disposable plastic cups and spoon are used to each study subject. Mothers or caregivers were advised to fill up the disposable plastic cup about the size of the tip of the thumb (approximately 5gof stool) of fresh stool using disposable spoon that was given with the container.

Each stool sample was first examined macroscopically to determine whether it was diarrheic or not. The direct wet mount was processed by conventional iodine to identify the presence of motile intestinal parasites, cysts, eggs, and trophozoite under a light microscope at 10X and 40 X magnifications. About 2g of each stool sample was emulsified with 3-4 ml normal saline (0.85% NaCl solution). Then a drop of the emulsified sample was placed on a clean microscopic glass slide. A few drops of iodine solution were added to samples on glass slides and were covered with a coverslip. The processed stool sample was checked for the presence of intestinal parasite ova or cysts under light microscopy using objectives 10X and 40 X.

3.9. Variables of the study

The independent variables of the present study were socio-demographic factors, environmental factors, child health and caring practices, nutritional status, parasitic infections, behavioural and hygienic practices of the respondents. The dependent variable was the prevalence of diarrhea among under five children in Bahir Dar Heath Centre.

3.10. Data analysis

Statistical package for social science (SPSS) version 23.0 was used to analyze the collected data. Chi-square ($\chi 2$) test was performed to verify the possible association between the prevalence of

diarrhea and socio-demographic characteristics, behavioral factors, child health and caring practice, and environmental sanitation factors. Logistic regression was used to measure the strengths or degrees of association between the prevalence of diarrhea and the associated risk factors. In the modeling process, univariate analyses were first done and the variables having a significant value which is less than 0.25 were selected for multivariate analysis. The variables, significant at the univariate analysis, were then being included in the multivariate analysis. The results of the association were considered significant when the p-value was below 0.05. The 95% CI was used to show the accuracy of data analysis.

3.11. Ethical consideration

Before conducting the investigation, the investigator obtained ethical clearance from the ethical committee of Science College, Bahir Dar University. A letter describing the aim of the research was written to Bahir Dar Health center before the collection of required data to keep the confidentiality of the information regarding the study population. Consent forms were obtained from the parents/guardians of children after explaining the purpose and the procedures of the study. The laboratory test was conducted with strict privacy and confidentiality.

4. RESULT

4.1. Socio demographic characteristics of participants

Table 1 depicts the socio-demographic and socio-economic characteristics of the study participants. Of the 200 randomly identified participants, One-hundred seventy one (85.5%) of them resided in urban and the rest of twenty nine (14.5%) reside in rural. One hundred seven (53.5%) were males and the rest ninety-three (46.5%) females. The age of the child's ranged from 6 to 59 month. The participants were grouped into six age categories (0–6, 7–12, 13–24, 25-36, 37-48 and 49-59). Twenty-three (11.5%) individuals fall in the age group 0-6 month, thirty-seven (18.5%) in 7-12 month, sixty-five (32.5%) in 13-24 month, thirty-six (18.0%) in 25-36 month, thirty-one (15.5%) in 37-48 month and eight (4%) in 49-59 month. The age of mother or caretaker also grouped in to three age categories (18-25, 26-35 and 36-45). Fifty-eight (29.0%) of them in the age group 18-25 year, one hundred twenty five (62.5%) in the age group 26-35 year and seventeen (8.5%) of mother or caretaker in the age group 36-45.

From a total of 200 participants one hundred eighteen (59.0%) of mother or care givers attend formal education, forty-six (23.0%) of them able to read and write, thirty-three (16.5%) of them did not attended formal education and three (1.5%) of them illiterate.

Thirty three (16.5%), 29 (14.5%), 134 (67.0%) and four (2.0%) of the mothers or care takers were employed, merchant, farmer and house wife, respectively. Likewise, 81 (40.5%), 69 (34.5%), 38 (19.0%), and 12 (6%) of the fathers of the children were employed, merchants, daily labors and farmers respectively. The average monthly income ranged from <2000- 35000. Forty six (23.0%), 143 (71.5%) and 11 (5.5%) were getting monthly income <2000, 2000-10000 and 11000-35000, respectively.

Table 1: Socio-demographic characteristics of under five children visiting Bahir Dar Health Center.

Socio-demographic	Categories		Frequency	Percent
Residence	Urban		171	85.5
	Rural		29	14.5
		Total	200	100
Sex	Male		107	53.5
	Female		93	46.5
		Total	200	100
Age of child (month)	0-6		23	11.5
	7-12		37	18.5
	13-24		65	32.5
	25-36		36	18.0
	37-48		31	15.5
	49-59		8	4
		Total	200	100
Mother age	18-25		58	29.0
	26-35		125	62.5
	36-45		17	8.5
	>45		0	0
		Total	200	100
Educational status of mother	Illiterate		3	1.5
	read and write		46	23.0
	informal education		33	16.5
	formal education		118	59.0
		Total	200	100
Mothers' occupation	house wife		4	2.0
	Employed		33	16.5
	Merchant		29	14.5
	Farmer		134	67.0
		Total	200	100
Father occupation	Employed		81	40.5
	Merchant		69	34.5
	Farmer		12	6.0
	Daily labour		38	19.0
		Total	200	100
Monthly income	<2000		46	23.0
	2000-10000		143	71.5
	11000-35000		11	5.5
		Total	200	100

4.2. Behavioral and child health and caring practices of study participants

Behavioral and Child health and caring practices of the study participants stated in table 2. Of the total children 200, 193 (96.5%) were exclusively breast feed for the first six month while two (1.0%) of them didn't and the remaining five children are less than six month. One hundred thirty six (68.0%) were currently breast feed children and the rest of 63 (31.5%) of them not currently breast feed.

Eighty five (42.5%) mothers breast feed >8times, forty one (20.5%) of them breast feed 4-7 times, eleven (5.5%) of the <3times in 24 hour and two (18.0%) of them not know the frequency of the breast feed. From a total respondents one hundred thirty two (66.0%) of the children started complementary feeding in <6month in addition to breastfeed, forty (20%) in 6month, eight (4.0%) of them in >6month and twenty (10.0%) of them not started complementary feeding. With regards to cleansing material used to wash their hand 167 (83.5%) of them use water and soap, 30 (15.0%) of them use only water to wash their hands and three (1.5%) of them use water and ash. Out of a total, one hundred thirty two (66.0%) of the participants usually put child food in refrigerator, 40 (20%) of them put child food in open shelf, 20 (10.0%) of them put child food anywhere and eight (4.0%) of them usually put child food in covered shelf.

Table 2: Behavioral and Child health and caring practices of under five children visiting Bahir Dar Health Center.

Behavioral and Child health and caring practices	Categories		Frequency	Percent
Exclusive breastfeeding for first six month	Yes		193	96.5
	No		7	3.5
		Total	200	100
Currently breastfeed	Yes		137	68.5
	No		63	31.5
		Total	200	100
Breastfeeding frequency(24hr)	>8times		85	42.5
	4-7times		41	20.5
	<3times		12	6.0
	Not breastfeed		62	31.0
		Total	200	100
Complementary feeding	<6month		132	66.0
	6month		40	20

	>6month	8	4
	Not yet start	20	10.0
	Total	200	100
Cleansing material used to wash hand	Water	30	15.0
	Water and soap	167	83.5
	Water and ash	3	1.5
	Total	200	100
Place of Complementary feeding(usually put child food)	Refrigerator	28	14.0
	open shelf	33	16.5
	covered shelf	129	64.5
	Anywhere	10	5.0
	Total	200	100

4.3. Environmental characteristics of study participants

Of total respondents, 79 (39.5%) got child caring and health information from TV, radio and other sources and 121 (60.5%) didn't. Almost all respondents (99.5%) wash their hand. One hundred fifty six (78.0%) of the respondents had a pit latrine with slab, 25 (12.4%) of them had Ventilated improved pit latrine and 19 (9.5%) of them with pit latrine without slab. With regards to their drinking water source 187 (93.5%) respondents reported that they get from the public tap.

Table 3: Environmental characteristics of under five children visiting Bahir Dar Health Center.

Environmental characteristics	Categories	Frequency	Percent
Getting health information	Yes	79	39.5
	No	121	60.5
	Total	200	100
Hand wash	Yes	199	99.5
	No	1	0.5
	Total	200	100
Toilet type	Ventilated improved pit latrine	25	12.5
	Pit latrine with slab	156	78.0
	pit latrine without slab/open	19	9.5
	Total	200	100
Drinking water source	public tap	187	93.5
	protected spring	11	5.5
	dug well	2	1
	unprotected spring	0	0.0
	Total	200	100

4.4. Malnutrition among under five children visiting Bahir Dar Health Center

From the total 200 respondents 28(14.0%) of them were stunted and 21 (10.5%) were severely stunted. Whereas, 36 (18.0%) children were underweight and 8(4%) were severely underweight. the prevalence of wasting were 42 (21.0%) and 10 (5%) were severely wasted. And the prevalence of wasting is higher compared with stunting and underweight.

Table 4: Stunting, wasting and underweight among under five children visiting Bahir Dar Health Center.

Malnutrition	**Category**	**Frequency**	**Percent**
Stunting	Stunted	28	14.0
	Severely stunted	21	10.5
	Not stunted	151	75.5
Wasting	Wasted	42	21.0
	Severely wasted	10	5.0
	Not wasted	148	74.0
Underweight	Underweight	36	18.0
	Severely underweight	8	4.0
	Not underweight	156	78.0

4.5. Prevalence of diarrhea

From the 200 examined stool samples, 76 (38%) of them positive for diarrhea. Of the total 200 children examined, 11 (39.7%) of them rural residents followed by 65 (38.0%) from urban residents.

Females were more infected than males 38 (40.9%). The most infected age group was 7 to 12 (48.6%, 18), followed by the age group 13 to 24 (46.2%, 30), 25 to 36 (36.1%, 13), 0 to 6 (26.1%, 6) and the age group 49 to 59 (25.0%, 2) in descending order. Children whose mother or care taker in the age group 18 to 24 were more infected (44.8%, 26) followed by children whose mother were in the age group 25 to 35 (36.8%, 46) and children whose mother were in the age group 36 to 45 were (23.5%, 4).

Children whose mothers (45.5%, 15) attend informal education were more infected than those who were; attend formal education (38.1%, 45). Children whose mothers merchant were more infected (44.8%, 13) followed by children whose mothers farmer (38.8%, 52), children whose mothers were employed (30.3%, 10), and children whose mothers were house wife (25.0%, 1) in descending order.

Table 5: Prevalence of diarrhea among under five children visiting Bahir Dar Health Center.

Variable	Categories	Infection status		
		Positive cases (%)	Negative (%)	Total (%)
Residence	Urban	65(38.0)	106(62.0)	171 (85.5)
	Rural	11(39.7)	18(62.1)	29 (14.5)
Sex	Male	38(35.5)	69 (64.5)	107 (53.5)
	Female	38 (40.9)	55 (59.1)	93 (46.5)
Age in month	0-6	6 (26.1)	17 (73.9)	23(11.5)
	7-12	18 (48.6)	19 (51.4)	37 (18.5)
	13-24	30 (46.2)	35 (53.8)	65 (32.5)
	25-36	13 (36.1)	23 (63.9)	36 (18.0)
	37-48	7 (22.6)	24 (77.4)	31 (15.5)
	49-59	2 (25.0)	6 (75.0)	8 (4.0)
Maternal age	18-24	26 (44.8)	32 (55.2)	58 (29.0)
	25-35	46 (36.8)	79 (63.2)	125 (62.5)
	36-45	4 (23.5)	13 (76.5)	17 (8.5)
Maternal education	Illiterate	1 (33.3)	2 (66.7)	3 (1.5)
	Read and write	15 (32.6)	31 (67.4)	48(23.0)
	Informal education	15 (45.5)	18 (54.5)	33 (16.5)
	Formal education	45 (38.1)	73 (61.9)	118 (59.0)
Maternal Occupation	House wife	1 (25.0)	3 (75.0)	4 (2.0)
	Employed	10 (30.3)	23 (69.7)	33 (16.5)
	Merchant	13 (44.8)	16 (55.2)	29 (14.5)
	Farmer	52 (38.8)	82 (61.2)	134 (67.0)

4.6. Prevalence of intestinal protozoan parasites and helminthes parasites

The prevalence of protozoan parasitic infections in the study area was 4 (2%). Protozoan infections accounted 3(100%) males and 1(33.3%) females. The prevalence of helminthes infection on the other hand was 2(1.0%), of which 2 (66.7%) were females and (0.0%) males. The prevalence of protozoa was 2(100%) in females and (0.0%) males. The prevalence of

protozoan and helminthes parasitic infections among age groups was 3 (75.0%) and 1(25.0%) in the age group 25-36 months respectively, 1(100%) helminthes in the age group 7-12, 1(100%) in 49-59 and 0(0%) in other age groups.

Table 6. Major intestinal parasites.

Parasite	Frequency (%) N=200	Gender		Age group		
		Female (N=93)	Male (N=107)	7-12 (N=37)	25-36 (N=36)	49-59 (N=8)
Protozoa	4(2%)	1(25.0%)	3(75.0%)	0(0.0%)	3(75.0%)	1(25.0%)
E. histolytica	2(33.3%)	1(33.3%)	1(33.3%)	0(0.0%)	1(25.0%)	1(100%)
G. lamblia	2(33.3%)	0(0.0%)	2(66.7%)	0(0.0%)	2(50%)	0(0.0%)
Helminthes	2(1%)	2(100%)	0(0.0%)	1(50.0%)	1(50%)	0(0.0%)
A. lumbricoid	2(33.3%)	2(66.7%)	0(0.0%)	1(100%)	1(100%)	0(0.0%)
Total	6(100%)	3(100%)	3(100%)	2(100%)	4(100%)	2(100%)

4.7. Potential risk factors associated with diarrhea among under five children visiting Bahir Dar Health Center.

4.7.1. Chi-square association of the different risk factors with diarrhea

The prevalence of diarrhea among under five children and chi-square association of the different risk factors with diarrhea is presented in Table 5. Residence, sex, age, maternal educational status, paternal occupation, maternal occupation, toilet type, source of drinking water, income hand washing habit and cleansing material for hand washing, getting health information, exclusive breastfeeding and complementary feeding in addition to breastfeeding were not associated with diarrhea ($P > 0.05$).This study showed that there was significant association between place of complementary feeding of the children and risk of having diarrhea 9.628 (P, 0.022), breastfeeding frequency and risk of having diarrhea 13.689 (P, 0.003), and there was significant association between current status of breastfeeding of the child and the of having diarrhea 8.077 (P, 0.013)

Table 7: Chi-square association of different risk factors with diarrhea among under five children visiting Bahir Dar health center.

Variable	Categories	Infection status			Chi-square (χ^2)	P-value
		Positive cases (%)	Negative (%)	Total (%)		
Residence	Urban	65(38.0)	106(62.0)	171 (85.5)	0.000	0.993
	Rural	11(39.7)	18(62.1)	29 (14.5)		
Sex	Male	38(35.5)	69 (64.5)	107 (53.5)	0.604	0.437
	Female	38 (40.9)	55 (59.1)	93 (46.5)		
Age in month	0-6	6 (26.1)	17 (73.9)	23(11.5)	8.757	0.119
	7-12	18 (48.6)	19 (51.4)	37 (18.5)		
	13-24	30 (46.2)	35 (53.8)	65 (32.5)		
	25-36	13 (36.1)	23 (63.9)	36 (18.0)		
	37-48	7 (22.6)	24 (77.4)	31 (15.5)		
	49-59	2 (25.0)	6 (75.0)	8 (4.0)		
Maternal age	18-24	26 (44.8)	32 (55.2)	58 (29.0)	2.735	0.255
	25-35	46 (36.8)	79 (63.2)	125 (62.5)		
	36-45	4 (23.5)	13 (76.5)	17 (8.5)		
Maternal education	Illiterate	1 (33.3)	2 (66.7)	3 (1.5)	1.375	0.712
	Read and write	15 (32.6)	31 (67.4)	48(23.0)		
	Informal education	15 (45.5)	18 (54.5)	33 (16.5)		
	Formal education	45 (38.1)	73 (61.9)	118 (59.0)		
Paternal Occupation	Employed	30 (37.0)	51 (63.0)	81 (40.5)	0.359	0.949
	Merchant	28 (40.6)	41 (59.4)	69 (34.5)		
	Farmer	4 (33.3)	8 (66.7)	12 (6.0)		
	Daily labour	14 (36.8)	24 (63.2)	38 (19.0)		
Maternal Occupation	House wife	1 (25.0)	3 (75.0)	4 (2.0)	1.727	0.631
	Employed	10 (30.3)	23 (69.7)	33 (16.5)		

	Merchant	13 (44.8)	16 (55.2)	29 (14.5)		
	Farmer	52 (38.8)	82 (61.2)	134 (67.0)		
Getting health information	Yes	31(39.2)	48(60.8)	79(39.5)	0.085	0.770
	No	45(37.2)	76(62.8)	121(60.5)		
Hand wash	Yes	76(38.2)	123(61.8)	199(99.5)	0.616	0.433
	No	0(0)	1(100.0)	1(0.5)		
Toilet type	Ventilated improved pit latrine	9(36.0)	16(64.0)	25(12.5)	2.735	0.255
	Pit latrine with slab	63(40.4)	93(59.6)	156(78.0)		
	pit latrine without slab/open	4(21.1)	15(78.9)	19(9.5)		
Drinking water source	public tap	71(38.0)	116(62.0)	187(93.5)	1.485	0.476
	protected spring	5(45.5)	6(54.5)	11(5.5)		
	dug well	0(0.0)	2(100)	2(1.0)		
Exclusive breastfeeding for first six month	Yes	73(37.8)	120(62.2)	193(99.0)	2.233	0.072
	No	2(100.0)	0(0.0)	2(1.0)		
Currently breastfeed	Yes	61(44.9)	75(55.1)	136(68.3)	8.077	0.013*
	No	15(23.8)	48(76.2)	63(31.7)		
Breastfeeding frequency(24hr)	>8times	33(38.8)	52(61.2)	85(61.6)	13.689	0.003*
	4-7times	24(58.5)	17(41.5)	41(29.7)		
	<3times	5(41.7)	7(58.3)	12(8.7)		
Complementary feeding	<6month	44(33.6)	87(66.4)	131(65.8)	6.573	0.160
	6month	18(45.0)	22(55.0)	40(20.1)		
	>6month	11(55.0)	9(45.0)	20(10.1)		
	Not yet start	2(25.0)	6(75.0)	8(4.0)		
Place of Complementary feeding(usually put child food)	Refrigerator	39(30.2)	90(69.8)	129(66.2)	9.628	0.022*
	open shelf	17(53.1)	15(46.9)	32(16.4)		
	covered shelf	14(53.8)	12(46.2)	26(13.3)		
	Anywhere	4(50.0)	4(50.0)	8(4.1)		
Cleansing	Water	9(30.0)	21(70.0)	30(15.0)	1.922	0.383

material used to wash hand	Water and soap	65(38.9)	102(61.1)	167(83.5)		
	Water and ash	2(66.7)	1(33.3)	3(1.5)		
Monthly income	<2000	18(39.1)	28(60.9)	46(23.0)	1.941	0.379
	2000-10000	56(39.2)	87(60.8)	143(71.5)		
	11000-35000	2(18.2)	9(81.8)	11(5.5)		

Note: * Statistically significant at $p < 0.05$

4.7.2. Logistic regression analysis of the most important risk factors for diarrhea

The most important risk factors for diarrhea among under five children visiting Bahir Dar Health Center were identified using Univariate and Multivariate Logistic Regression Analyses (Table 6).

4.7.2.1. Univariable analysis

The univaraible analysis is described below on Table 6. Age(month), maternal age, maternal occupation, income, current breastfeeding status, breastfeeding frequency, complementary feeding, place of complementary feeding, toilet type, cleansing material for hand washing and wasting were the variables which have passed the cut off value (P<0.25) (Lemeshow *et al.*, 1990) for further analysis.

4.7.2.2. Multivariable analysis

The multivarable analysis is described on Table 6. In the multivariate regression, giving complementary feeding at 6 month were protective against diarrhea and putting child food in covered shelf were protective against diarrhea (P<0.05).Complementary feeding at 6 month and putting complementary feeding in covered shelf were found to be protective against diarrhea. However, Age(month), maternal age, maternal occupation, income, current breastfeeding status, breastfeeding frequency, toilet type, cleansing material for hand washing and wasting were not significantly associated with diarrhea (P > 0.05).

Table 8. Univariate and multivariate logistic regression analysis of potential risk factors associated with diarrhea among under five children in Bahir Dar Health Center Northwest, Ethiopia.

Variables	Categories	Infection status		COR, 95% CI	P-value	AOR, 95% CI	P-value
		Positive Cases (%)	Total Examined (%)				
Residence	Urban	65(38.0)	171(85)	1	0.993		
	Rural	11(39.7)	29(14.5)	0.997 (0.443,2.243)			
sex	male	38(35.5)	107(53.5)	0.797(0.450,1.413)	0.437		
	female	38 (40.9)	93(46.5)	1			
Age of the child(month)	0-6	6 (26.1)	23(11.5)	1			
	7-12	18 (48.6)	37(18.5)	2.429,(0.849, 6.945)	0.098 *	0.247(0.058, 1.043)	0.057
	13-24	30 (46.2)	65(32.5)	1.601(0.506,5.071)	0.423	0.945(0.359, 2.491)	0.910
	25-36	13 (36.1)	36(18.0)	0.826(0.236,2.889)	0.766	0.736(0.179,3.028)	0.671
	37-48	7 (22.6)	31(15.5)	0.944(0.148,6.014)	0.952	0.255(0.046, 1.398)	0.116
	49-59	2 (25.0)	8(4.0)	2.684(0.865,8.327)	0.087	0.338(0.032, 3.568)	0.367
Maternal age	18-24	26 (44.8)	58(29.0)	2.641(0.768,9.074)	0.123 *	1.747(0.373, 8.169)	0.479
	25-35	46 (36.8)	125(62.5)	1.892(0.583,1.147)	0.289	1.753(0.404, 7.613)	0.454
	36-45	4 (23.5)	17(8.5)	1			
Maternal education	Formal	45 (38.1)	118(59.0	1			
	Illiterate	1 (33.3)	3(1.5)	0.811(0.71,9.204)	0.866		
	Informal	15 (45.5)	33(16.5)	1.352(0.620,2.947)	0.488		
	Read and write	15 (32.6)	46(23.0)	0.785(0.087,12.319)	0.510		
Maternal occupation	Employed	10 (30.3)	33(16.5)	1			
	Farmer	52 (38.8)	134(67.0)	0.767(0.071,8.299)	0.827	0.453(0.109, 1.876)	0.275
	House wife	1 (25.0)	4(2.0)	1.459(0.643,3.311	0.367	0.143(0.009, 2.256)	0.167
	Merchant	13 (44.8)	29(14.5)	1.869(0.659,5.300)	0.240 *	0.620(0.199, 1.933)	0.410
Paternal	Employed	30 (37.0)	81(40.5)	1			

Occupation	Daily labour	14 (36.8)	38(19.0)	0.850(0.236,3.064)	0.804		
	Merchant	28 (40.6)	69(34.5)	0.857(0.218,3.371	0.825		
	Farmer	4 (33.3)	12(6.0)	0.732(0.201,2.667)	0.636		
Income	<2000	18(39.1)	46(23.0)	0.346(0.067,1.787)	0.205*	0.735(0.308, 1.754)	0.488
	2000-10000	56(39.2)	143(71.5)	0.345(0.072,1.657)	0.184*	0.324(0.40,2.663)	0.295
	11000-35000	2(18.2)	11(5.5)	1			
Exposure to information	yes	31(39.2)	79(39.5)	1			
	No	45(37.2)	121(60.5)	1.091(0.609,1.954)	0.770	3.673(0.207, 65.220)	0.375
Exclusive breast feeding	Yes	73(37.8)	193(99.0)	0.000	0.999		
	No	2(100.0)	2(1.0)	1			
Currently breastfeed	Yes	61(44.9)	136(68.3)	0.384(0.196,0.752)	0.005*		
	No	15(23.8)	63(31.7)	1			
Breastfeeding Frequency	>8times	33(38.8)	85(61.6)	1			
	4-7times	24(58.5)	41(29.7)	0.506(0.137,1.866	0.306	0.447(0.087, 0.970)	0.335
	<3times	5(41.7)	12(8.7)	0.450(0.210,0.960)	0.039*	0.400(0.159, 1.007)	0.052
	Not breastfeed	14 (22.6)	62 (31.0)	0.207 (0.087, 0.488)	0.000*	0.062(0.004,1.067)	0.055
Complementary feeding	>6month	44(33.6)	131(65.8)	1			
	6month	18(45.0)	40(20.1)	0.659(0.787,3.3261)	0.619	0.290(0.087, 0.970)	0.044*
	<6month	11(55.0)	20(10.1)	1.618(0.044,1.695)	0.191*	0.117(0.011, 1.272)	0.078
	Not yet start	2(25.0)	8(4.0)	2.417(0.932,6.265)	0.069*	48620.2(0.00)	
Place of complementary(usually put child food)	Refrigerator	39(30.2)	129(66.2)	1			
	Anywhere	17(53.1)	32(16.4)	1.062(0.388,2.901)	0.906	0.323(0.039, 2.694)	0.296
	Covered shelf	14(53.8)	26(13.3)	0.433(0.189,0.994)	0.048*	0.248(0.032, 1.937)	0.184
	Open shelf	2 (16.7)	12 (2.9)	0.806 (0.17, 3.817)	0.786	0.082(0.012, 0.566)	0.011*
Drinking water source	Public tap	71(38.0)	187(93.5)	0.000(0.000)	0.999		
	Protected spring	5(45.5)	11(5.5)	0.000(0.000)	0.999		

	Dug well	0(0.0)	2(1.0)	1			
Toilet type	Ventilated pit latrine	9(36.0)	25(12.5)	0.474(0.120,1.870)	0.286	0.605(0.098, 3.717)	0.587
	Pit latrine without slab/open pit	63(40.4)	156(78.0)	0.394(0.125,1.241)	0.112*	1.247(0.385, 4.038)	0.712
	Pit latrine with slab	4(21.1)	19(9.5)	1			
Hand wash	Yes	76(38.2)	199(99.5)	0.0000	1.000		
	No	0(0)	1(0.5)	1			
Cleansing material to wash hand	Only water	9(30.0)	30(15.0)	4.667(0.374,58.248)	0.232*	0.408(0.140, 1.191)	0.101
	Water and soap	65(38.9)	167(83.5)	3.138(0.279,35.313)	0.354	1.037(0.385, 4.038)	0.612
	Water and ash	2(66.7)	3(1.5)	1			
stunting	stunted	13(46.4)	28(14.0)	0.848(0.323,2.228)	0.738		
	Severely stunted	7(33.3)	21(10.5)	1.47(0.652,3.314)	0.353		
	Not stunted	56(37.1)	151(75.5)	1			
wasting	wasted	18(42.9)	42(21.0)	2.769(0.748,10.257)	0.127*	0.534(0.216, 1.323)	0.176
	Severely wasted	6(60.0)	10(5.0)	1.385(0.689,2.783)	0.361	2.248(0.391, 12.935)	0.364
	Not wasted	52(35.1)	148(74.0)	1			
underweight	Underweight	15(19.7)	36(18.0)	0.548(0.107,2.805)	0.470		
	Severely underweight	2(25.0)	8(4.0)	1.174(0.562,2.455)	0.669		
	Not underweight	59(37.8)	156(78.0)	1			

Note: * values which passed the cut off value ($p < 0.25$); * statistically significant at $p < 0.05$; 1 = Reference value; AOR = adjusted odds ratio; COR = Crude odds ratio.

5. DISCUSSION

The primary aim of this study was to determine the prevalence of diarrhea and its association with nutritional status of under five children visiting Bahir Dar Health Center Northwest Ethiopia. The overall prevalence of diarrhea in the present study was 38%. It was comparable with the studies done in Dire Dawa (37%) (Keneni *et al.,* (2016). This result found to be higher from other studies conducted in Bahir Dar city (14.5%) Amare Belachew *et al*., (2019), in Bahir Dar City (21.6%) Molla Gedefaw *et al*., (2015). The possible explanation for the difference might be socio demographic factors of the participants, the year of the study conducted and the specific study area. And also the distribution is quite different in community and health center.

In farta wereda (16.7%) Genet Gedamu *et al*., (2017), in Bahir Dar Zuria district 20% Desalegn Tesfa *et al*., (2017), North Gondar Zone 22.1%, Atalay Getachew *et al*., (2018), Debrebirehan Town (31.7%) Ayele Mamo & Awraris Hailu (2014), Dejen District 23.8% Demeke Getu *et al*., (2013), Jamma district, South Wello zone (23.1%) Getachew Yismaw, (2019), Debre Berhan town (16.4%) Sisay Shine *et al*., (2020), Jabithennan District (21.5%) Zelalem Alamrew *et al*., (2017), Central Gondar Zone (30.09%) Zewudu Andualem *et al*., (2019), Dire Dawa city (20%) Ephrem Tefera *et al*., (2020), (26%) Bikes Destaw *et al.,* (2017), Wonago district (30.9%) Tinsae Shemelise *et al*., (2020), (28.4%) Solomon Getahun and Abulie Takele, (2018), (23.5%) Mulusew Alemayehu *et al*., (2020), (14.9%) Legefa Futa *et al*., (2018), (13.6%) Behailu Melese *et al*., (2019), (30.9%) Aseb Arba *et al*., (2020), (27.7%) Araya Gebreyesus *et al*., (2018) and (14.5%) Adugna Fenta *et al*., (2020) of diarrhea prevalence conducted in different parts of Ethiopia and the current study higher than all studies stated above. The finding also was higher than those of previous studies conducted in Cameron 23.8% (Tambe *et al*.,2015), Tanzania 32.7% (Jean *et al*.,2017), Senegal 26% (Kakulu,2012), Rwanda 26.7% (Sokhna *et al*.,2014), Egypt 19.5% (Yassin,2000) Ghana 19.2% (Boadi and kuitunen,2005), Iraq 21.3% (Siziya *et al*.,2000), India 25.2% (Siraj *et al*.,2010), Burundi, 32.6% (Diouf *et al*.,2014). These differences could be attributed to the differences in the socio-economic status of the people, socio-demographic distinctions, knowledge, hygiene, and sanitary facilities, weather, climate, and environmental factors.

The current study lower than the study conducted in Tigray region by (Hailemariam Berhe *et al*., 2016) reported 54% of diarrhea prevalence. That might be because of water storage practices at home

and latrine cleanness and the availability of hand washing facilities around latrines. Starting complementary foods at six month and due to place of complementary feeding in addition to breast milk.

The odds of having diarrhea in children mother or care taker age group 18-24 were (COR= 2.641 CI: 0.768, 9.074) 2.641times infected than mothers with age group 36-45. This result lower than the study conducted in Dire Dawa city administration 1.14 times infected (Ephrem Tefera *et al*., 2020). The odds of having diarrhea were 0.346 times (0.067, 1.78) higher in children family who have monthly income less than 2000 than children family having monthly income 11000-35000 and children family who have monthly income 2000-10000 were 0.345(0.072, 1.657) times higher than children family having monthly income 11000-35000. Children who were currently breast feed 0.384 (0.196, 0.752) times infected than children do not.

The children food usually put in open shelf were 0.433 times (0.189, 0.994) infected than children food usually put in covered shelf. The odds of having diarrhea in children who have pit latrine without slab were 0.394 times higher than ventilated pit latrine. The odds of getting diarrhea in children whose family were wash their hands with water only 4.667times (0.324, 58.248) higher than who wash their hand with water and ash. The odds of getting diarrhea in children whose mother were merchant were 1.869 times (0.659, 5.300) higher than children whose mother employed. Children breast feed 3 times in 24hr (COR=0.450 CI: 0.210, 0.960) higher chance of getting diarrhea than those who breastfeed more than 8 times in 24hr. The odds of getting diarrhea in children starting complementary feeding less than 6 month 1.61 times (0.044,1,695) infected than those who started complementary feeding greater than 6 month. In the final multivariable regression, twelve factors were tested to identify the predisposing factors for childhood diarrhea. Ten of the risk factors found were not significantly associated with diarrhea infection ($P<0.05$).

Complementary feeding at 6 month and putting complementary feeding in covered shelf were found to be protective against diarrhea. Complementary feeding at 6 month (AOR=0.290 CI: 0.087, 0.970) and putting complementary feeding in covered shelf (AOR=0.082 CI: 0.012, 0.566). The differences might be due to variations in hygiene and sanitation practices and the initiation of children into supplementary feeding. Children who started supplementary food before 6 months had more chance of getting acute diarrhea than those who started supplementary feeding after 6 months.

Nutritional status in this study showed that prevalence of child stunting (14%), and underweight (18%) were lower in the study area in comparison with the study conducted in Tigray region stunting 36% and underweight 37% (Araya Gebreyesus *et al*.,2018), regional prevalence reported by Ethiopian DHS 2016 of 39.3% stunting and underweight 23% (CSA,2016). Prevalence of stunting in the current study found to be 14% was lower than the study conducted among a pastoralist community of Ethiopia 34.4% (Solomon Demissie and Amare Worku, 2013), Bule Hora district, south Ethiopia 47.6% (Mandefro Asfaw *et al*.,2015). The difference might be attributed due to difference in balance of nutrient consumption, dietary diversity, feeding habit of child and other factors.

On the contrary, prevalence of wasting and (21%) and severely wasting (5%) in the study area was very high compared to the study conducted in Tigray region 7.9% wasting and 3.6% severely wasting (Araya Gebreyesus *et al*.,2018). Prevalence of severely stunting of the current study (10%) lower than the study conducted in Tigray region (21%) (Araya Gebreyesus *et al*., 2018). Variations in nutritional status of children could be the result of socio-demographic, feeding habit of child, environmental hygiene, and cultural difference among societies. This indicates other factors may lead to malnutrition such as shortage of food, limited access to balanced diet both for the mother and the child, and child feeding practices.

The prevalence of intestinal protozoa parasitic infections in the current study was 4 (2%) and the prevalence of helminthes in the study area was 2 (1%). In the remaining 194(97.0%) participants the intestinal parasites not observed.

6. CONCLUSION

The prevalence of diarrhea among under-five children visiting Bahir Dar Health Center found to be 38.0% out of 200 participants. The findings in the present study showed that intestinal parasites that lead to diarrhea are protozoa (*E.histolytica* and tropozoite and cyst of *giardia lamblia)* and helminthes (*A. lumbercoid*), and none of other intestinal parasites observed. Start Complementary feeding, breastfeeding frequency in 24hr and current status of breastfeeding were significantly associated with diarrhea at p, 0.05 in chi-square analysis. In bivariate analysis age of the child, maternal age, maternal occupation, monthly income, current breastfeeding status, breastfeeding frequency, complementary feeding, toilet type, cleansing material for hand washing, place of complementary and wasting were significant at p, 0.25. In the final multivariable regression, twelve factors were tested to identify the predisposing factors for childhood diarrhea. Ten of the risk factors found were not significantly associated with diarrhea infection ($P<0.05$). Putting complementary feeding in covered shelf and complementary feeding at 6 month were protective against diarrhea at p, 0.05. The current study findings of diarrheal disease prevalence among under-five children were significantly higher compared to some other similar studies.

7. RECOMMENDATIONS

In the country diarrhea were the major public health problem and risk factor of under-five children mortality, identifying and understanding factors that determine diarrhea Thus, based on the finding of the study, the following recommendations are forwarded:

- In order to reduce the prevalence of diarrhea and improve child health, attention should be given to improving breast feeding frequency, create awareness especially in rural area and hand hygiene knowledge to diarrhea .
- Knowledge should be addressed to mother or care giver giving complementary feeding at 6 month and greater than six month for their children.
- Knowledge, attitude and awareness should be enhanced in the community, level by the region health office and women and youth affaires office, education office as well as NGO's working in the area through providing continuous training and information provision regarding the health care, attention should be provide to the children.

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APPENDICES

APPENDIX A: Informed Consent Declaration (English Version)

I am conducting a study to assess diarrheal cases and its association with nutritional status to understand the prevalence and associated risk factor of the diarrheal infection among under five children. Your child is being to participate in this study. If you agree, I would like to obtain a stool specimen from your child, which would be used only to detect the presence of diarrhea. He/ She will not get any risk in participating. The record's information is strictly confidential.

Your child participation in this study is completely voluntary and you/ He/ She can refuse to participate or free to withdraw from the study at any time.

Do you understand what has been said to you? If you have questions, you have the right to get a proper explanation.

I am informed of my satisfaction with the purpose of this study nature of laboratory investigation. I am also aware of my right to out of the study at any time during the study without having to give reasons for doing so. This consent form has been read out to me in my language (Amharic language) and I understand the content and I voluntarily consent to participate in the study.

Study code no. _____

Name _____Signature _____ Date _____/_____/___

Investigator Name Lidiya Bekele Atara Signature _____Date___/___/_

Informed Consent Declaration (Amharic Version)

ይህ ጥናት የሚጠናው ከአምስት አመት በታች ሕፃናት ላይ የተቅማጥ ኢንፌክሽኑን ስርጭት እና ተዛማጅ ተጋላጭነት ሁኔታ ለመረዳት የተቅማጥ በሽታዎችን እና ከአመጋገብ ሁኔታ ጋር ያለውን ቁርኝት ሲሆን ጥናቱ በሚካሄድበት ቦታ በምን ደረጃ ላይ እንዳለ ለማወቅና ከጥናቱም በኋላ የመፍትሄ አቅጣጫዎችን ለማስቀመጥም ነው፡፡

በጥናቱ ላይ ለመሳተፍ ልጅዎትም ሆነ/ነች እርሰዎ ፈቃደኛ ከሆኑ ለሚቀርብልዎት ጥያቄ መልስ እንዲሰጡና ከልጅዎ የአይነምድር ናሙና በመውሰድ የተቅማጥ ኢንፌክሽን ምርመራ ብቻ እንዲካሄድ ይደረጋል፡፡ በዚህም ጥናት ላይ ልጅዎት በመሳተፉ/ፏ ምንም አይነት ችግር የማያጋጥመዉ/ማት መሆኑን እገልፃለሁ፡ሁሉም ነገር በሚስጥር እንዲያዝ ይደረጋል፡፡ በጥናቱ ላይ ልጅዎት እንዲሳተፍ/ እንድትሳተፍ ፈቃደኛ ካልሆኑ በማንኛውም ሰዓት ማቋረጥ ይችላሉ፡፡ ይህም በመሆኑ ምንም አይነት የሚያጋጥምዎት/ የሚያጋጥመዉ/ የሚያጋጥማት ችግር አይኖርም፡፡ እንደዚሁም ግልፅ ያልሆኑ ጥያቄዎች ቢኖርዎት የመጠየቅና መልስ የማግኘት መብትዎት የተጠበቀ ሲሆን የተሟላ ማብራሪያ እንዲያገኙ ይደረጋል፡፡

ስለጥናቱ በሚገባኝ መንገድ ገለፃ ከተደረገልኝና በጉዳዩ ላይ በአግባቡ እንዳስብበት ጊዜ ከተሰጠኝ በኃላ እንደዚሁም ግልፅ ያልሆኑ ነገሮችን የመጠየቅና ከፈለኩም በማንኛውም ጊዜ ያለማሳተፍና የማቋረጥ መብቴ የተጠበቀ መሆኑን ጥናቱ ለልጅም ሆነ ለማህበረሰቡ የሚሰጠውን ጠቀሜታ በመረዳቴ የሚቀርቡልኝን ጥያቄዎች ለመመለስና ልጄ የአይነምድር ናሙና እንዲሰጥ ፈቃደኝነቴን እግልፃለሁ፡፡

ፊርማ፡----------

ቀን፡----------/----------/----------

APPENDIX B: Questionnaire (English version)

My name is Lidiya Bekele I am Student of Bahir Dar University college of Sciences and. I'm conducting a research for the partial fulfillment of masters' degree on "*Assessment of Diarrheal cases and its Association with Nutritional status of under-five Children visiting in Bahir Dar Health Center*", I am going to ask you several questions about those factors and related issues about the research.

I assure that the interview process will not bring any harm to you and your family. Whatever information you provide will be kept strictly confidential, and will not be shared with anyone other than the investigator.

THANK YOU!!!!

Interviewer Name: _____

Date: _____

SECTION ONE: Identification Information

1. Patient ID number _____
2. Place of Residence 1: Urban 2: Rural

SECTION TWO: Demographic Factors

3. Sex? 1: Female 2: Male
4. Age? (write in months) _____
5. Age of mother/caregiver _____

SECTION THREE: Socioeconomic Factors

6. Educational status of the mother/ caregiver?

1: Illiterate

2: Read and write

3: Non formal education

4: Formal education _____

7. Occupation of the mother/caregiver

1: Housewife

2: Employee

3: Merchant

4: Farmer

8. Occupation of the father

1: Employed

2: Merchant

3: Farmer

4: Daily labour

9. Average monthly income _____

1: <2000 2: 2000-10000 3 :> 11000

10. In the past six months do you get any information related to child health care, how to take care of your child or care from radio, TV, or any other sources?

1: Yes 2: No

SECTION FOUR: Child Health and Caring Practices

11. Is the child exclusively breastfeed for first six months?

1: Yes 2: No

12. When did your child start complimentary feeding in addition to breast milk?

1: < 6 months

2: At 6 months

3: > 6 months

4: Not yet start

5: Don’t know

13. Where do you usually put your baby food/drink?

1: Refrigerator

2: Open shelf

3: Covered shelf

4: Anywhere

SECTION FIVE: Environmental Factors

14. What is your main source water for drinking?

1: Public tap

2: dug well

3: Protected spring

15. What kinds of toilet facility do have?

1: Ventilated improved pit latrine (VIP)

2: Pit latrine with slab

3: Pit latrine without slab/open pit latrine

SECTION SIX: Behavioral Factors

16. Do you wash your hands?

1: Yes 2: No

17. What do you usually use to wash your hands?

1: Water only

2: Water and soap

3: water and ash

Questionnaire (Amharic version)

ስሜ ሊዲያ በቀለ እኔ የባህሪ ዳር ዩኒቨርሲቲ የሳይንስ ኮሌጅ ተማሪ ነኝ፡፡ በ *Assessment of Diarrheal cases and its Association with Nutritional status of under-five Children visiting in Bahir dar health center*”,” በማስተርስ ዲግሪ በከፊል ለመፈፀም ምርምር እያካሄድኩ ነው ፡፡ ስለ ጥናቱ ምክንያቶች እና ተዛማጅ ጉዳዮች የቃለ መጠይቁ ሂደት በእርስዎ እና በቤተሰብዎ ላይ ምንም ዓይነት ጉዳት እንደማያመጣ እርግጠኛ ነኝ ፡፡. የሚሰጡት ማንኛውም መረጃ በጥብቅ ሚስጥራዊ ሆኖ ይቀመጣል ፣ እና ከመርማሪው ውጭ ለማንም አይጋራም ፡፡

አመሰግናለሁ!!!!

የቃለመጠይቅ አቅራቢ ስም:

የተቆጣጣሪው ስም:

ቀን:

ክፍል አንድ: *መታወቂያ መረጃ።*

1. የታካሚ *መታወቂያ* ቁጥር _____

2. የመኖሪያ ቦታ 1 ከተማ 2 ገጠር ፡፡

ክፍል 2 የስነ ሕዝብ አወቃቀር ምክንያቶች ፡፡

3. *ፆታ፡* 1: ሴት 2 ወንድ

4. የልጁ ዕድሜ? (በወራት ውስጥ ይፃፉ) _____

5. የእናት ዕድሜ / ተንከባካቢ _____

ክፍል 3 -ማህበራዊ ኢኮኖሚያዊ ምክንያቶች ፡፡

6. የእናት / ተንከባካቢ የትምህርት ሁኔታ።?

1: ያልተማረች ፡፡

2: *ማንበብና መጻፍ፡፡*

3: *መደበኛ ያልሆነ ትምህርት ፡፡*

4: *መደበኛ ትምህርት*

7. የእናት / ተንከባካቢ *ሥራ ፡፡*

1: የቤት እመቤት

2: *ሠራተኛ።*

3: *ነጋዴ*

4: ገበሬ።

8. የአባት / ተንከባካቢ ሥራ ።።

1: የቤት እመቤት

2: ሠራተኛ።

3: ነጋዴ

4: ገበሬ።

9. አማካይ ወርሃዊ ገቢ _____።

10. ልጅዎን እንዴት እንደሚንከባከቡ ላለፉት ስድስት ወራት ከልጆች ጤና ጥበቃ ወይም እንክብካቤ ጋር በተያያዘ ማንኛውንም መረጃ ያገኛሉ ፣ ከሬዲዮ ፣ ከቴሌቪዥን ወይም ከሌላ ከማንኛውም ምንጮች?

1: አዎ 2: አይ

ክፍል 4. የሕፃናት ጤና እና እንክብካቤ ልምዶች።

11. ልጁ ለመጀመሪያዎቹ ስድስት ወራት ጡት ጠብቷል ።።?

1: አዎ 2: አይ

12.ልጅዎ ከጡት ወተት በተጨማሪ ማሟያ የጀመረው መቼ ነበር??

1: <6 ወር።

2: በ 6 ወር ።።

3:> 6 ወር።

4: ገና አልተጀመረም።

5: አታውቅም ።።

13.አብዛኛውን ጊዜ የሕፃን ምግብዎን / መጠጥዎን የት ያደርጉታል??

1: ማቀዝቀዣ።

2: ክፍት መደርደሪያ።

3: ሽፋን ያለው መደርደሪያ።

4: በየትኛውም ቦታ።

ክፍል 5. የአካባቢ ሁኔታዎች ።።

14.ለመጠጥ ውሃ ዋነኛው ምንጭዎ ምንድነው??

1: የህዝብ ቧንቧ

2: የተጠበቀ ምንጭ ።

3: የጉድጋድ ውሃ

15. ምን ዓይነት የመጸዳጃ አላቸው ?

1: የተስተካከለ የተሻሻለ የመተንፈሻ ቱቦ (ቪአይፒ) ።

2: የመፀዳጃ ቤቱ በመከለያ ።።

3: -የመፀዳጃ ቤቱ ያለመከለያ

ክፍል 6-የባህሪ ምክንያቶች ።።

16.እጆችዎን ይታጠባሉ??

1: አዎ 2: የለም

17.ብዙውን ጊዜ እጆችዎን ለመታጠብ ምን ይጠቀማሉ??

1: ውሃ ብቻ።

2: ውሃ እና ሳሙና።

3: ውሃ እና አመድ።

APPENDIX C: Ethical clearance

Science College
The Graduate, Research & Community Services V/Dean
Bahir Dar University
Bahir Dar – Ethiopia

79 | 251 (582) 226 6597 | Fax: 251 (582) 220- 20- 25 | e-mail: negatassie@yahoo.com | website: www.bdu.edu.et

Ref: PRCSVD/88/2013
Date: 05/02/2021

Ethical Clearance Approval Form

Applicant's Name: Lidiya Bekele

Research Title	Assessment of diarrheal cases and its association with nutritional status of under-five children visiting Bahir Dar Health Center, Bahir Dar town , northwest Ethiopia
Researcher (s) Name (s)	Lidiya Bekele

Thank you for submitting your application for ethical clearance, which was considered at the College of Science Research Ethics Committee meeting on 04 February 2021. The committee has reviewed your ethical application, issues pertaining to participants, consent form, debriefing, and relevant questionnaires.

The researcher should keep the confidentiality of the identity of research participants and data that will be obtained from them. Any serious adverse events or significant changes which occur in connection with this study and /or which may alter its ethical consideration must be reported immediately to the committee for a possible ethical amendment.

We are therefore pleased to inform you that the College's Ethical Clearance Committee has approved your study from an ethical point of view.

With kind regards,

Tsegaye Kassa (PhD)
The Graduate, Research and Community Services V/Dean
College of Science

Dr. Tsegaye Kassa Gogie
P.G.R.C.S. Vice Dean

CC//

- Dean office
- The Graduate, Research and Community Services V/Dean
- Department of Biology

College of Science