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St. Paul's Hospital Millennium Medical College**

GRADUATE STUDY PROGRAM

School Of Public Health

Ethiopian Field Epidemiology Training Program (EFETP)

**Title: Knowledge, Attitude, Practice and Associated factors towards Guinea Worm
Disease among Daily Labors of Commercial Farms of Gambella Ethiopia. 2025**

By: Grmay Hailu Fissaha (Bsc, In Environmental Health):

Email: grmayhailu78@gmail.com, Phone # +251912942349

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Addis Ababa, Ethiopia

St. Paul's Hospital Millennium Medical College

Graduate Study Program

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farms of Gambella, West, Ethiopia.2025

By

Grmay Hailu Fissaha (BSc, in Environmental Health)

Advisors: 1. Dr Fufa Hunduma (MPH in Field Epidemiology, Assistant
professor)

Co-advisor: 2. Ms. Hanna Feleke (MPH)

September, 2025

Addis Ababa, Ethiopia

St Paul's Hospital Millennium Medical College

Department of School of Public Health

Approval sheet (by Advisor and Program Coordinator)

Letter for Declaration

I, the under signed, declared that this is my original work has never presented in this or any other Universities and that all the resources and materials and used for the **THESIS search** have been fully acknowledged.

1. Name of the students: . **Grmay Hailu Fissaha** sign _____

Date of submission: September/2025

Place: Addis Ababa, Ethiopia

This THESIS research has been submitted for examination with our approval as candidate advisor

2. Advisors: **.Dr Fufa Hunduma** (MPH in Field Epidemiology, Assistant professor)

Signature _____ Date September /2025

3. Name Of : **Aman Yesuf** (MPH/Epidemiology ,Assistance Professor of Public Health)

Signature _____ Date September/2025

September,2025

Addis Ababa, Ethiopia

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Abbreviations and Acronyms

AOR	Adjusted odd ration
D. medinensis	Dracunculiasis medinensis
CDC	Center for Disease Control
CI	Confidence Level
COR	Crude odds ratio
EDEP	Ethiopia Dracunculiasis Eradication Program
EPHI	Ethiopia Public Health Institute
GWD	Guinea Worm Disease
GRHB,	Gambella Reginal Health Bureau
ICCDE	International Commission for the Certification of Dracunculiasis Eradication
IRB	Institutional Review Board
KAP	Knowledge, Attitude and Practice
MoH	Minister Of Health
NCC	National Certification Committee
NTD	Neglected Tropical Disease
NVA	Non-Village Area
SPHMMC	St. Paulo's Millennium Medical College
SPSS	Statistical Package for the Social Sciences
TCC-E	The Carter Center Ethiopia
WHA	World Health Assembly
WHO	World Health Organization

Abstract:

Introduction: Dracunculiasis, or Guinea worm disease (GWD), though nearly eradicated globally, remains a concern in parts of Africa, including Ethiopia. In 2022, only 13 cases were reported worldwide, but recent infections have emerged in Chad, South Sudan, Ethiopia, and the Central African Republic. Ethiopia's eradication program faces a challenge with persistent low-level transmission, especially on commercial farms in the Gambella Region. This study aims to assess the KAP and associated risk factors of these high-risk populations.

Method: A cross-sectional study was conducted using a multi-stage sampling method to select 595 daily laborers from the commercial farm. Data were collected using a pretested, self-administered structured questionnaire. The collected data were entered, cleaned, and analyzed using SPSS statistics software. Bivariable and multivariable logistic regression were employed to identify factors associated with Knowledge, Attitudes, and Practices (KAP) towards Guinea worm, with $p < 0.05$ considered statistically significant in the final model (95% CI).

Result: In the study of 566 daily laborers, 66.3% demonstrated good GWD knowledge, with 74.4% correctly identifying water-borne transmission. A major knowledge gap was noted as 57.2% were unaware that GWD causes disability, and only 9.2% recognized chemical water treatment as a prevention method. Primary education (grades 1–8) was a powerful predictor, making laborers over four times more likely to have good knowledge than those with no schooling (AOR=4.015). Regarding attitude, 64.5% reported a favorable outlook on GWD prevention. Being married was significantly associated with a better attitude, making these individuals nearly 1.85 times more likely to be positive than single participants (AOR=1.851). Overall, 63.4% of the laborers reported good GWD prevention practices, yet only 4.1% used safe water sources, though 88.3% treated unsafe water. More educated (AOR=4.347) were significantly associated with better prevention practices compared to no education.

Conclusion: This study found that daily laborers have moderate knowledge (66.3%), attitudes (64.5%), and prevention practices (63.4%) regarding GWD, which is lower than expected for eradication efforts (80%). Key factors like gender, education, length of stay in endemic areas, influenced prevention behaviors. The findings suggest a need for targeted interventions among mobile populations to ensure sustained GWD eradication.

Keywords: Guinea worm disease Daily Labors, Commercial Farms, Gambella Region, Ethiopia,

1. Introduction

1.1 Background

Dracunculiasis also known as Guinea worm disease is a neglected tropical disease (NTD) and a crippling parasitic disease caused by *Dracunculus medinensis*. This disease is crippling its victims develop large ulcers, swell and burst to release spaghetti-like parasite worms ranging in length 60-100cm victims experience pain and disability(1) and has afflicted humanity for centuries, and is transmitted exclusively when people drink water contaminated with parasite-infected water fleas(1, 2). Although it is not a killer disease, it is a disease of high morbidity and complications found mostly in farming populations(2).

Guinea worm disease negatively affects health, agricultural productivity, school attendance, and overall quality of life in the communities where it is prevalent. In Africa Guinea worm disease is understood to be both a disease of poverty and a cause of poverty(3). The main signs and symptoms of these diseases are swelling in an area where the worm will emerge formation of a blister with local itching, severe burning pain and emergence of a white worm through skin lesion with an incubation period of 10 to 14 months(4).

The most recent report in 2022 included only 13 cases of dracunculiasis worldwide; the lowest annual incidence ever reported (13% decrease from 2021). Globally 21 countries in Africa and Asia that were affected by dracunculiasis in the 1980s. The overall number of cases has been reduced tremendously by more than 99.9% from the 3.5 million cases estimated to have occurred in 1980s(5, 6), the disease is now endemic only in Africa(7). As a matter of fact, in 2023 six human cases of Guinea worm disease were reported in Chad, five in South Sudan, one in Ethiopia and one in the Central African Republic(7, 8).

The target dates for eradication have been postponed several times and were usually over-optimistic and difficult to achieve. This is because target dates were mainly set up for political reasons as it can strengthen the advocacy efforts of the eradication program in endemic countries, rather than choosing a realistic evidence-based target date guided by estimates of the impact of interventions(9).

In Ethiopia, the dracunculiasis eradication program(EDEP) was also established in 1994. During that time 1,129 GW cases were identified in 113 endemic villages 8 districts located in Gambella one district in the South Omo Zone of Southern Ethiopia and one district in the West Omo Zone of Southwest Ethiopia Regions (10). The EDEP made a remarkable move towards the interruption disease transmission the indigenous transmission of the disease was interrupted in Nyangatom and Surmu districts of South and West Omo Zones respectively in 2001. However still a small number of cases and low level of indigenous transmission continued in the Gog and Abobo districts of the Gambella Region(10).

The national program improved efforts to ensure an adequate level of surveillance to detect and contain imported cases in high-risk districts and refugee camps, and enhanced the sensitivity of the surveillance system in all districts across the country to verify the absence of the disease and meet certification requirements(5). Given a substantial reduction in the annual incidence of GWD cases and infection, it seems that eradication would be realistic by 2030.

However, there is still a need for heightened intervention. Such an end phase of the eradication program demands extensive effort to search for the last GWD cases and infections, as well as to trace all sources of infection. Moreover such heightened intervention should be maintained for reasonable period at least three years after transmission interruption to make sure that the re-establishment of the disease is unlikely. Currently an increase in infection, repeated sources of infections, a lack of safe drinking water and a low level of awareness in most commercial farm endemic areas. These are the significant challenges at this final stage of GWD eradication in Ethiopia.

1.2 Statement of the problem

Globally 21 countries in Africa and Asia that were affected by dracunculiasis in the 1980s.The disease is now endemic only in Africa. In 2023 GWD were reported in Chad, in South Sudan, in Ethiopia and in the Central African Republic are countries that are currently endemic and were formerly endemic due to the transmission not being interrupted. Therefore global eradication remains elusive.

In Ethiopia, since 1994 a total of 4,697 Guinea worm cases have been reported. About 80% of the disease burden was reported from the Gambella region(11). The program has shown a reduction of more than 99% in the indigenous transmission interruption in limited areas. However, high-intensity transmission mainly continued in commercial farms. Unfortunately in 2017 unexpected outbreak occurred with a total of 15 cases highest cases as compared to the last six to seven years and 87% of cases were the daily laborers from commercial farms in the Gambella region (10, 12).

Knowledge of disease may influence the daily laborer's attitudes and practices, and incorrect attitudes and practices directly increase the risk of infection. Understanding daily laborers' knowledge, attitudes, and practices (KAPs) and possible risk factors helps to predict the outcomes of planned behavior(12). Knowledge, attitude, and practice (KAP) is an important cognitive key in public health prevention and promotion. It involves a range of beliefs about the causes of the disease and exacerbating factors, identification of symptoms, and available methods of treatments and consequences(13). It is also a suitable way to evaluate existing programs and identify effective strategies for behavioral change in society. In many cases, the absence of knowledge, or if most of the medical-related beliefs are misconstrued, may carry a potential risk(14).

The Ethiopian government implement intensive interventions like surveillance of humans and animals, behavioral change and communication; intensifying vector control, environmental management and promotion of access to safe water supply and utilization of cloth and pipe filters to eradicate Guinea worm disease. However, the 28th national annual meeting report identified that from 2015-2023 about 86% of Guinea worm cases were daily laborers and caused repeated point sources of infection for the outbreaks from commercial farms. Due to the daily laborers' movements being from non-endemic to Guinea worm endemic areas and scarce information regarding the level of awareness of, educational status, economic factors, access to safe water supply, health seeking behavior on prevention and control for eradication of GWD some of the factors of that predicts the KAP working at commercial farms. There is no clear evidence daily laborers knowledge, attitude, practice ,and its determinants. Therefore, this study aimed to identify the current status of knowledge, attitude practice and associated factors regarding GWD among daily laborers working at commercial farms in Gambella regions which helps dracunculiasis transmission interrupt to facilitate for certification process.

1.3 Significance of the study

This study will identify knowledge, attitude, practice and associated risk factors daily laborers working at commercial farms of the regions. For interrupt transmission and source of infection in commercial farms. Due to a large number of daily laborers moving from different regions to these farms for working. For the purpose of Guinea worm disease eradication to attain certification by high degree of public awareness particularly in the commercial farms areas who are potential risk for dracunculiasis is highest areas without safe water source of drinking water daily laborers in commercial farms and other population near borders still affected by the Guinea worm disease.

The finding shall serve as base line for the MoH, EPHI , GRHB, TCC-E and WHO to develop appropriate strategic plan on GWD eradication program to enhance intervention measures on behavioral change and communication awareness and promotion of access to safe water supply distribution, utilization of cloth and pipe filters so far; though the transmission ongoing remains high and still seeks additional efforts to know the main risk factors.

Thus, this study aimed to assess factors associated with KAP of GWD daily laborers in Gambella Region, Ethiopia. Which contribute to the development of long-term sustainable program intervention that would influence the guinea worm eradication program.

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1. Literature review

Dracunculiasis or Guinea worm disease is an infection of a large nematode family caused by the parasite *Dracunculus medinensis*(15). It is an extremely rare neglected tropical disease primarily affecting remote and impoverished communities(11). It is acquired by drinking water containing copepods (water fleas) infected with *D.medinensis* larvae(15). The worm typically emerges through the skin with approximately 1 year after infection, resulting in pain, formation of blisters and disability (9,14).

Humans contract GWD by drinking unfiltered water from wells and other stagnant water sources infested with copepods, “water fleas” too small to be seen with the naked eye. Guinea worm larvae are ingested by copepods which are ingested, in turn, by people who drink the contaminated water. In the human host, the copepod is dissolved by gastric juice, releasing Guinea worm infective larvae(16, 17). Once in the stomach, the larvae penetrate the gastric or intestinal mucosa and, after a period in the abdominal cavity, migrate up to the connective tissue. Here, *Dracunculus* larvae mature into adult worms and, after mating, the male worms die, and female worms mature and acquire a cylindrical, white and smooth body. The tip of the tail is pointed forming a blunt hook.

Female worms take 9 to 14 months to reach adult form and can measure up to 1 m in length. Approximately one year after the average incubation period of infection, female worms migrate through the subcutaneous tissue, reach the surface and emerge from the skin, often at the lower extremities. Before they emerge, they create a painful and itchy blister on the skin site. Affected individuals normally seek pain relief by dipping the lower limbs in cold water, an action that leads to the rupture of the blister and the emergence of the worm from the skin. In this phase, the first-stage larvae are released into the water and are then ingested by the copepods, reaching the final stage and re-starting their life cycle((18).

Usually, patients remain asymptomatic for about a year after infection or may experience specific symptoms,(19). More than 90% of worms emerge below the knees, but they can emerge from anywhere in the body. Other common areas of worm surfacing are the head, arms, breasts, back, and scrotum (16).

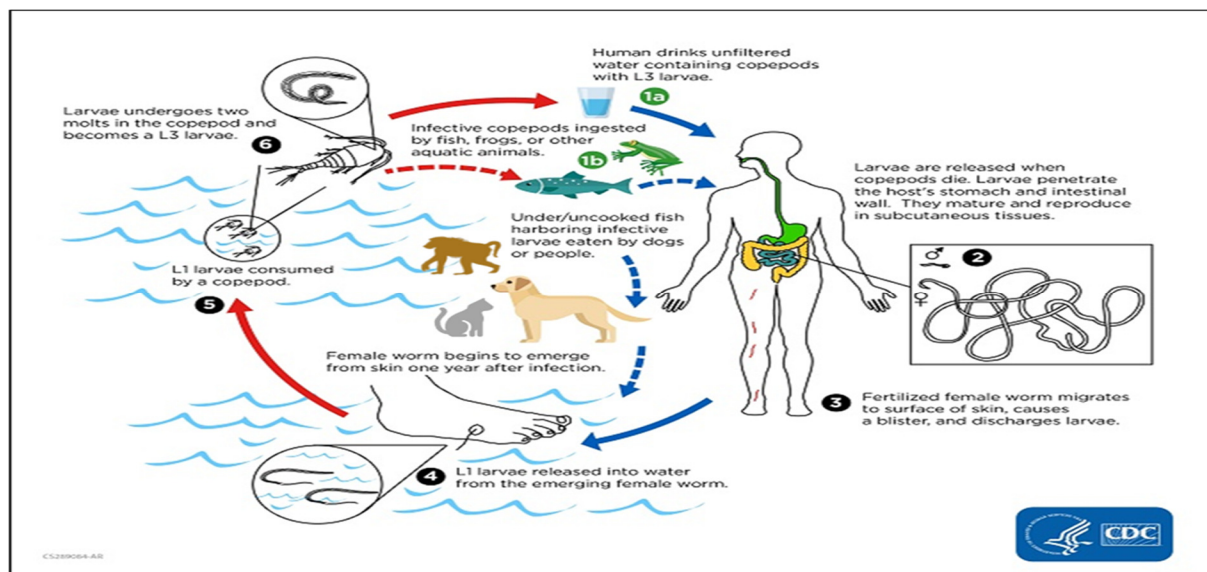


Figure 1 Life cycle of Dracunculiasis in Gambella , West Ethiopia 2025(20).

Diagnosis of GWD is mainly clinical and it consists of observation of the worm emerging from the blister(15). General treatment of Guinea worm active infection consists of removing the female worm when it comes out of the skin and pulling it out gently to avoid rupture or returning it inside the wound through control immersion (21, 22). Health care enhances the quality of human capital by improving productivity and increasing the number of days available for productive activities. But GWD is a disease of poverty and causes poverty. The time lost in production because of ill health indicates reduced output. This in part explains why guinea worm as a parasite that can cause ill health, has attracted a lot of studies(3). Another study found that the farmer's perception of the effect of guinea worm disease on the level of their agricultural production revealed that 95.8% of them perceived that guinea worm disease affected the level of agricultural production, while 4.3% of them perceived that guinea worm disease did not affect the level of their agricultural production(19).

The literature generally focuses on the relationship between community understanding, beliefs, and behaviors and the transmission and containment of the disease Mode of Transmission: A large proportion of respondents often perceive drinking infected water as a cause of infection study in South Sudan which is correct. However, significant misconceptions remain. In some areas, traditional or supernatural beliefs persist, with a large percentage of people attributing the disease to a "spiritual attack,". This lack of accurate knowledge about the parasitic nature of the disease is

a major obstacle to compliance with prevention methods(23). Many residents, especially in high-risk areas, do not know that prevention is possible, or they may be unaware of the complete life cycle of the worm(24).

Attitude towards disease is often shaped by its significant socioeconomic impact, where people recognize that an infected person has difficulty with farming and other work, leading to substantial loss of productivity. Guinea worm disease has been called the "disease of the empty granary." While some recognize drinking contaminated water as a cause, the simultaneous belief in spiritual causes demonstrates a conflicting or incomplete understanding, which can translate to apathy or non-compliance with biomedical interventions(23).

The practice of relying on unsafe water sources is a critical factor, with many communities dependent on ponds, rivers, or streams for drinking water, particularly during the dry season when transmission often peaks. Filtering of drinking water (using fine-mesh cloth filters) is a widely promoted and often-practiced preventive measure. Essential practices for eradication include prohibiting a person with a blister or emerging worm from entering a source of drinking water. The persistence of Guinea worm disease and the challenges in eradication are linked to several socio-economic, environmental, and program-related factors.

The most significant factor is the lack of sustained safe water sources. Villages dependent on open, stagnant water sources (ponds) are at the highest risk. The disease predominantly affects poor, remote, and rural populations that lack basic infrastructure. Adult farmers and farm laborers are often at the greatest risk, and the disability they suffer occurs during peak agricultural seasons, magnifying the economic loss. The education level of the community is often strongly associated with an improved understanding of the cause and prevention of Guinea worm infection. Challenges to eradication and endemicity Cross-border movement, particularly involving immigrant farm laborers or nomadic groups, makes disease surveillance and case containment difficult.

The conceptual framework for Knowledge, Attitude, Practice and factors associated of Guinea worm disease among daily laborers working at commercial farms is below

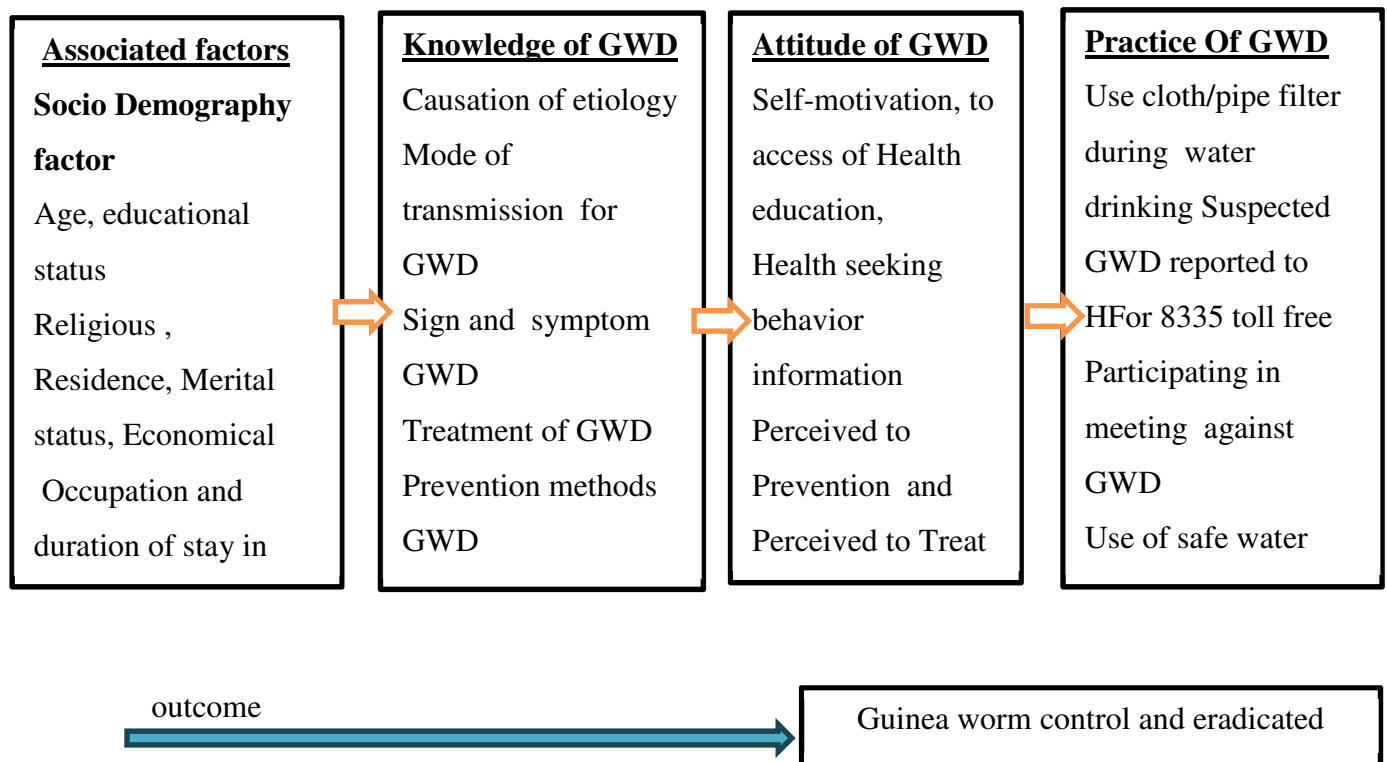


Figure 2 Conceptual framework of study of Knowledge Attitude, Practice and Associated factors towards GWD DL in Gambella, West Ethiopia, 2025

Objectives

3.1 General Objectives

- To assess Knowledge, Attitude, Practice and associated factors towards Guinea worm diseases among daily laborers working at commercial farms of Gambella Region, Ethiopia.2025

3.2 Specific Objectives

- To assess the Knowledge, Attitude and practice towards dracunculiasis prevention and control among daily laborers working at commercial farms of Gambella Region.
- To identify factors associated with the Knowledge, Attitude and practice towards dracunculiasis prevention and control among daily laborers working at commercial farms of Gambella Region.

4. Methods and Material

4.1 Study area and period

Gambella region is one of the 12 regional states of Federal democratic Republic of Ethiopia located 766 Km to the west of the capital city Addis Ababa. It shares borders with two other regions. Oromia to the North and East; the South-West to the South-East and also bordered the country of South Sudan to the west. The region has a total of 14 rural woredas and urban administration. A total of 249 Commercial Farms are available in this region Abobo, Gog and Gambella Zuria Woredas only 14(6%) of the farms access safe water supply about 86% of the cases of Guinea worms reported from these areas due to high movement of daily laborers. The study was conducted from February 2025 to May, 2025.

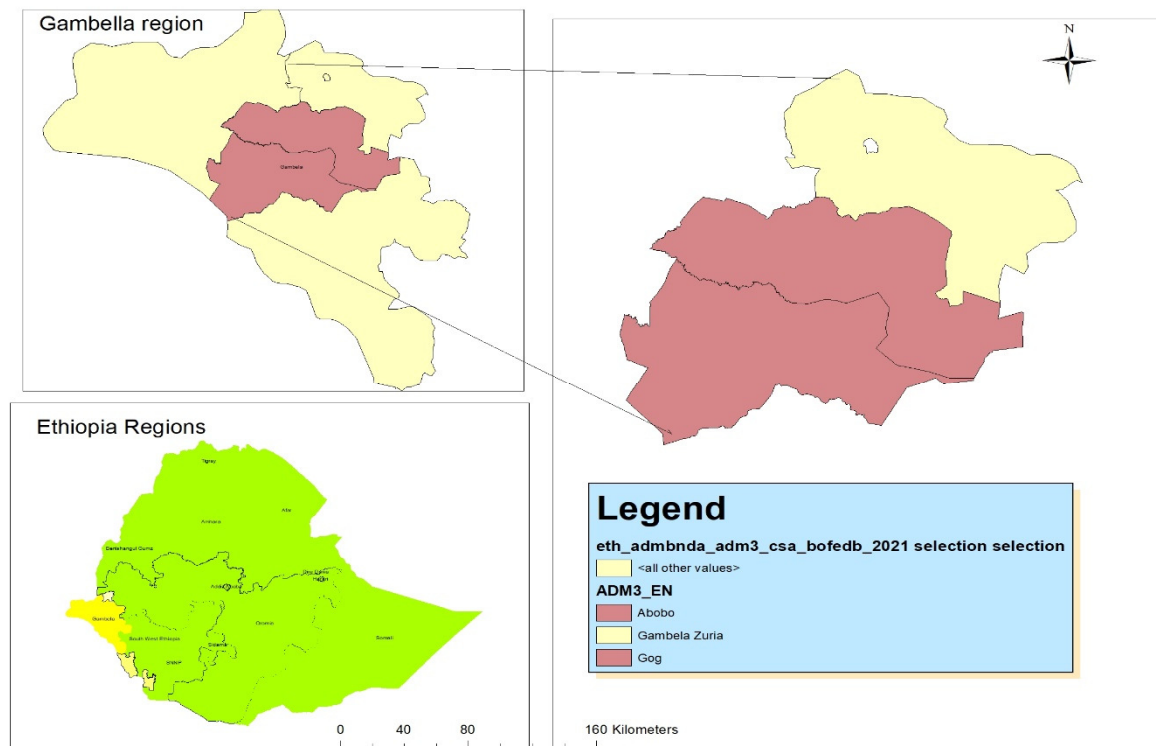


Figure 3: Map of study area Abobo, Gog and Gambella Zuria Distracts of Gambella, West Ethiopia ,2025

4.2 Study design

A cross-sectional study were conducted using a structured questionnaire on selected commercial farms in the Gambella Region, West Ethiopia.

4.3 Population Study

4.3.1 Source Of Population; All population in the Gambella Regional State were considered as the source of Population.

4.3.2 Study Population: The daily laborers worker in commercial farms within selected districts of the Gambella Regional State who were randomly selected from source of population.

4.3.3 study units: Daily laborers who were working at commercial farms in three selected districts Gambella Region using systematic sampling techniques was included in the study.

4.3.4 Sampling frame/units: List of Daily laborers who working commercial farms randomly selected from all daily laborers who were registered during working in commercial farms.

4.4 Eligibility criteria

4.4.1 Inclusion Criteria: Daily laborers who were involved in commercial farms and had willingness to respond appropriately to the questions found during the study period in the selected woredas of the region have roles to play in guinea worm disease eradication were included in the study.

4.4.2 Exclusion criteria: Daily laborers were critically sick and unable to communicate to answer questions absent during the data collection time.

4.5. Sample size determination and sampling technique

4.5.1. Sample size determination:

A total of 595 sample size (n) was calculated using a single proportion formula is $n = \frac{(Z_{\alpha/2})^2 * P(1-q)}{(d)^2}$.

By considering marginal error (d) 5%, the confidence interval of 95 % (Z = 1.96), and since there is no previous study in our country; we consider the P= 50% of the proportion of having good knowledge about Guinea worm disease. Where $q = 1 - p$, So the calculated sample size was

$n = \frac{(1.96)^2 * (0.5)(0.5)}{(0.05)^2} = 384$. Then the total population is <10,000. So it needs finite population correction.

It is corrected by using $nf = (n) / (1 + (n/N)) = (384) / (1 + (384/4019)) = 350$ where N=4019 which is total daily laborers in the commercial farms. After the finite population correction sample size

becomes 350. Adding 10% non-response rate it was 385. Also design effect is needed and calculated by the following formula is

$Deff = 1 + (m-1)p$, Where Deff = design effect

m = The average cluster size of Daily Laborers in commercial farm

p = intra-cluster correlation (ICC)

Taking $m=23$ the average cluster size of Daily Laborers in commercial farm, considering = 0.025(25). The calculated is $Deff = 1 + (23-1)0.025 = 1.55$. The final sample size was becomes $385 * 1.55 = 595$ daily laborers working at commercial farms.

The sample size for the second objective was calculated using the double population proportion. By considering variables for these objectives was proportion of good knowledge among, educated vs uneducated individuals, proportion of positive attitude among those with access to safe water vs. No Access to safe water and proportion of good practice among rural vs urban residents.

formula is $n = \frac{(Z_{\alpha/2} + Z_{\beta})^2 \cdot [p_1(1-p_1) + p_2(1-p_2)]}{(p_1 - p_2)^2}$ with the following assumptions

n = Required sample size

$Z_{\alpha/2}$ = The Z – score corresponding to the desired Confidence level = 95%,

Z_{β} = The Z-score corresponding to the desired Power = 80%

p_1 = The expected proportion of the outcome = 0 no similar study

p_2 = he expected proportion of the outcome = 50%

$p_1 - p_2$ = The minimum difference in proportions the study wants to detect

The maximum sample size that was obtained from the general objective was 595. This sample was the larger sample size than the sample size calculated from the second specific objective. As a result, the final sample size decided for this study was 595, as determined by the first objective.

4.5.2. Sampling technique and procedures

The study participants were calculated using a multi-stage sampling method. Out of 127 currently functional commercial farms, 38 (30%) were selected using simple random sampling. Next the total sample size was proportionally allocated among the selected commercial farms based on the number of daily laborers. Finally, a simple random sampling technique was used to select study participants, from each commercial farm's during the data collection as a sampling frame. The interval K-value was computed by dividing the total number of the study population by the entire sample size ($K = 4019/595 = 6.7$). The initial participant was randomly selected by the lottery method

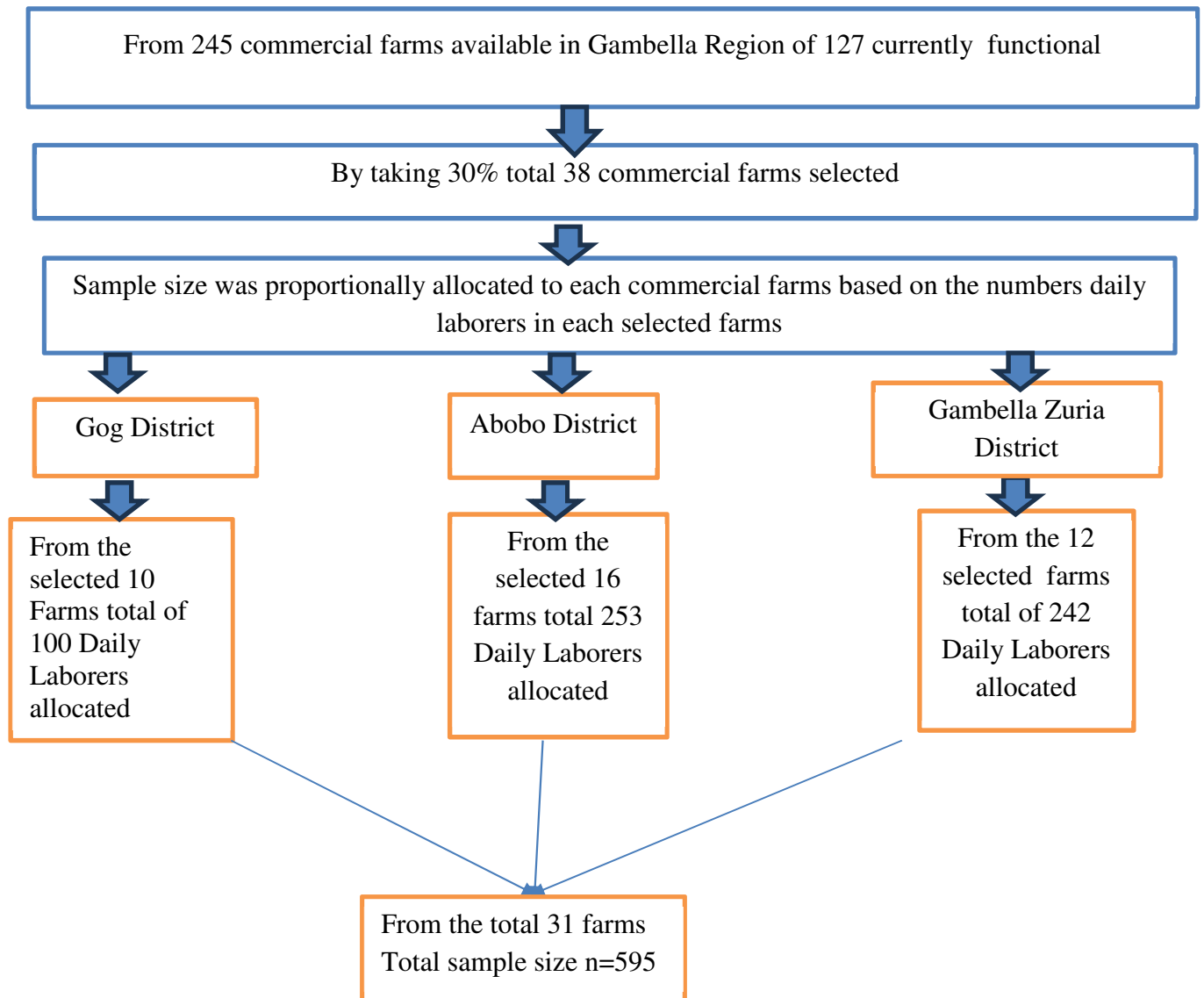


Figure 4;Schematic diagram showing sampling technique of daily laborers working at commercial farms in Gambella Region, West Ethiopia, 2025.

4.6. Study variables

4.6.1 Dependent variable:

4.6.2 Knowledge, Attitude and Practice towards Guinea Worm Disease.

4.6.3 Independent variables

- Socio-demographic variables (age, sex, occupation, educational level, marital status, ethnicity, religion, occupation, Length of stay endemic areas)
- Sign and symptoms, transmission, prevention, the cash rewards, treatment, travel history, source of information, Health seeking behavior, Self-motivation, to access of Health education, and toll free 8335 regarding to GWD.

4.7. Operational definitions

4.7.1 Case Definition

- **Knowledge:** Toward GWD prevention and control participants who answered greater than or equal to the mean value of knowledge questions (≥ 10 questions) were considered as good knowledge and those who answered less than or equal to the mean of the knowledge questions (≤ 10 questions) were categorized as poor knowledge.
- **Attitude:** Participants' attitude questions toward GWD was measured by using likart scale as agree, neutral and disagree. Measured those who answered greater than or equal to the mean value of attitude questions (≥ 5 questions) were considered as having a positive attitude. Conversely, those who answered less than or equal to the mean of the questions (≤ 5 questions) were categorized as having a negative attitude.
- **Practice:** The level of practice regarding GWD prevention and control Participants' who answered greater than or equal to the mean value of practice questions (≥ 3 questions) by the GWD questionnaire were considered as having good practice those who less than or equal to the mean of the questions (≤ 3 questions) were categorized as having poor practice.
- **Confirmed GW Case:** A case of guinea-worm disease is a person exhibiting a skin lesion with the emergence of one or more guinea worms in which the worm is confirmed in laboratory tests to be *D. medinensis*. The person is counted as a case only once during a calendar year(23).
- **Suspected Case:** A person presenting a skin lesion with itching or blister living in an endemic area or risk areas for Guinea worm, with the emergence of a worm(23).

- **GW Suspect:** A person living in /having a travel history to the endemic area/risk area exhibiting compatible GWD signs and symptoms; like localized skin lesion, itching, wound, blister, or swelling(23).
- **Community Case definition for GWD:** Any person presenting a skin wound with a worm coming out(23).

Containment: Containment is the prevention of adult Guinea worms from releasing larvae in water to prevent transmission of infectious GW larvae(23).

EDEP surveillance levels: Geographic distinction of the degree of intervention throughout Ethiopia depending on the risk of Guinea worm disease(23)

Elimination: The confirmed absence of clinical illness (the interruption of transmission of *Dracunculus medinensis* in humans and animals) for three years or longer from a country with such a low risk of re-introduction of the parasite that preventive measures could be reduced to a strict minimum(24).

Cash reward: A monetary-based incentive system provided for reporting cases and infections of GWD(23)

Eradication: The confirmed absence of clinical manifestations (the interruption of transmission of *Dracunculus medinensis* in humans and animals) for three years or longer at the global level(24).

Vector control: The process of controlling the population of vectors essential to the lifecycle of Guinea worm (copepods or "water fleas") through the application of an organophosphate chemical larvicide(26) and/or reshaping unsafe water sources to make habitats unsuitable for vector reproduction(23).

Endemic-Villages: A Village with one or more active Indigenous cases during the previous and/or current calendar year(23).

Safe Water: Includes(hand-dug-protected wells with hand pumps, boreholes, mechanized water supply, rain-water harvesting or above-ground tankers, and flowing rivers)(23).

Unsafe Water: Includes dams, ponds, marshes and unprotected wells(23).

4.8. Data collection tool, methods and procedures

The data were collected by using a structured questionnaire, which was translated into Amharic from English. Pretest was done for 10% of total sample size before the actual data collection and modification was done accordingly. The data collection questionnaire prepared in English by the principal investigator was adopted from the Ethiopia dracunculiasis eradication program(EDEP),

national certification committee(NCC) and international certification committee dracunculiasis eradication(ICCDE) checklist to address all study variables(27).The data collectors were health workers and Guinea worm focal persons who were not from the study area. The data were collect face-to-face and interviewed to daily laborers at the commercial farm site of the study subjects. To ensure the data quality pre-test the completeness and consistency of the questionnaire was checked at the time of data collection. The principal investigator controlled the overall activities through continuous supervision. All completed questionnaires were examined for completeness and consistency during entrance and data analysis.

4.9 Data quality control:

The accuracy of the tool was checked by experts who blind to the original instrument. Before starting the data collection, the pre-test were done on 10% of the total sample size. To maintain data quality training also was given for one day to all data collectors of health works, Guinea worm focal persons, Guinea worm officers and supervisors before the data collection time. During data collection close supervision and checking missed and incorrect data have done close follow-up until the data collection was completed.

4.10 Data processing and analysis:

The collected data were checked for incompleteness and inconsistency. Entered using Epi.Info 7.2.5.0 exported to SPSS statistics software for analysis. Prior to running for analysis, data were cleaned. Then, analyzed using Descriptive statistics were used to describe the sample accordingly and summarized by frequency, percentage, and mean which were characterized the study participants. Logistic regression was fitted to identify factors association KAP towards Guinea worm disease. All explanatory variables in bivariable model with $p < 0.25$ were fitted into multivariable logistic regression model to control the possible effect of confounders. Odds ratios (ORs) were generated for each variable and the independence of any association was controlled by entering all variables into the model using the backward stepwise method. The magnitude of the association between the independent variables in relation to factors association KAP was measured using adjusted odds ratios (AORs) and 95% confidence interval (CI) and p-values below 0.05 were used to determine variables significant associated with outcome variables were considered statistically significant.

Model adequacy was evaluated using the Hosmer and Lemeshow goodness-of-fit test, which yielded a chi-square value of 12.567 with 8 degrees of freedom and a p-value of 0.128. This result

indicates that the model fits the data well, as a p-value greater than 0.05 suggests no significant discrepancy between observed and predicted values.

To assess multicollinearity among the independent variables, the Variance Inflation Factor (VIF) was calculated. All variables included in the final model had VIF values below the commonly accepted threshold of 5, indicating that multicollinearity was not a concern. This supports the assumption that the independent variables were not highly correlated, thereby ensuring the stability and reliability of the estimated regression coefficients.

4.11 Ethical Consideration:

Prior to data collection appropriate ethical clearance was obtained from the ethical clearance committee of the St. Paul's Hospital Millennium Medical College. After getting ethical clearance permission formal letter was also obtained from the concerned bodies EPHI, Gambella Regional Health Bureau, Zonal Health Department, and s elected Woredas. The interviewed were carried out only with the full consent of the person being interviewed. Before each interview, a clear explanation was given about the objective of the study was not either evaluate the performance of the individual nor blame anyone for weakness but gather information that may direct to improvement in the knowledge, attitude and practice towards Guinea worm disease prevention. Each respondent was assured that the information provided by them were confidential and used only for research. The finding results will be communicated honestly, reliably, and credibly to concerned bodies.

4.12 Plan for dissemination of results

Written reports of hard and soft copies will be prepared and shared with St. Paul's Millennium Medical College/School of Public Health, **Ethiopia** Field Epidemiology Training Program resident advisors and coordinator, Ethiopia Public Health Institute, Gambella regional health bureau and key partners.

5. Result

Socio-demographic characteristics

The study involved 595 participants, of whom 566 were willing to provide an interview, response rate, 95.12%. The majority of participants were male, 548 (96.8%). A significant majority were from rural areas, 525 (92.8%). Regarding marital status, more than half of the workers were single 315(55.7%), while 221 (39.0%) were married, and 24 (4.2%) were widowed.

Educational background shows that most respondents had attained primary education, 356 (62.9%), while 91 (16.1%) had completed secondary education, and 22 (3.9%) had attended college or higher education.(Table 1).

Table 1: Socio-demographic characteristics of daily laborers working at commercial farms in the Gambella Region, West Ethiopia, 2025 (N=566)

Variables	Classification	N= 566	
		Frequency	Percentage (%)
Sex	Male	548	96.8
	Female	18	3.2
Residency	Urban	41	7.2
	Rural	525	92.8
Age category	18-24 years	109	19.3
	25-34 years	330	58.3
	35-44 years	106	18.7
	45-64	21	3.7
Marital status	Single	315	55.7
	Married	221	39.0
	Widowed	24	4.2

	Divorced	6	1.1
Ethnicity	Amhara	216	38.2
	Oromo	118	20.8
	Wolayta	68	12.0
	Tigray	37	6.5
	Dawro	34	6.0
	Kembata	48	8.5
	Others	45	8.0
Permanent place of residence	Gambela	276	48.8
	Oromiya	72	12.7
	Amhara	119	21.0
	South	19	3.4
	Others	80	14.1
Religion	Orthodox	330	58.3
	Protestant	140	24.7
	Muslim	83	14.7
	Others	13	2.3
Educational status	No education	97	17.1
	Primary (1-8)	356	62.9
	Secondary (9-12)	91	16.1

	College and above	22	3.9
Duration of stay in Gambella	1 year	46	8.1
	1-2 years	287	50.7
	3-4 Years	169	29.9
	>4 years	64	11.3
Family size	≤ 2	294	51.9
	3-4	213	37.6
	≥ 5	59	10.4

History of GWD exposure among the study participants

We presented the self-reported history of GWD infection and awareness among 566 daily laborers employed on commercial farms in the Gambella. Participants were asked whether any of their family members had previously been infected with GWD, and all respondents indicated that no family members had ever been infected with GWD. GWD (Table 2).

Table 2: History of GWD infection among daily laborers and their family members in the Gambella Region, West Ethiopia, 2025 9N=566)

Variables	Classification	N= 566	
		Frequency	Percentage (%)
Did you previously get infected by GWD?	No	566	100
Has any of your family been previously infected by GWD?	No	566	100
Did you ever see a person infected by GWD?	No	566	100

Knowledge

Regarding identification of the GWD, 348 (61.5%) were able to recognise GWD by viewing a Guinea worm identification card, while 218 (38.5%) could not. A majority of respondents, 324 (57.2%), were unaware that GWD is a waterborne disease that causes disability, while only 242 (42.8%) correctly identified this fact. However, 421 participants (74.4%) correctly stated that GWD is transmitted by drinking contaminated water.

Regarding transmission misconceptions, 285 (50.4%) knew that GWD is transmitted by eating uncooked aquatic animals or feeding them to animals, while 281 (49.6%) disagreed. Concerning clinical manifestations, 332 (58.7%) knew that localized swelling and itching are signs of GWD, 303 (53.5%) recognized blistering with burning pain as a symptom, 313 (55.3%) acknowledged skin lesions as indicative of the disease, and 316 (55.8%) correctly identified the emergence of a white worm as a symptom. Additionally, 371 respondents (65.5%) acknowledged that travelling to endemic areas increases the risk of infection.

In terms of prevention, 440 respondents (77.7%) knew that filtering water through cloth or pipe filters prevents GWD, and 404 (71.4%) were aware that the disease is preventable. However, only 260 (45.9%) recognised that prohibiting infected individuals from entering water sources helps prevent transmission. Similarly, 312 (55.1%) knew that using clean or purified water prevents GWD. The overall knowledge score indicated that 375 respondents (66.3%; 95% CI: 62.2%–70.1%) had good knowledge about GWD (Table 3)

Table 3: Knowledge about GWD among daily laborers in the Gambella Region, Southwest Ethiopia, 2025 (N=566)

Variables	Classification	N= 566	
		Frequency	Percentage (%)
Recognized GWD by viewing Guinea worm ID card check	No	218	38.5
	Yes	348	61.5
Guinea worm disease is a curable disease	No	287	50.7

	Yes	279	49.3
Guinea worm is water born disease that causes disability	No	324	57.2
	Yes	242	42.8
GWD is transmitted by drinking contaminated water	No	145	25.6
	Yes	421	74.4
GWD is transmitted by eating uncooked aquatic animals and feeding to animals	No	281	49.6
	Yes	285	50.4
Localised swelling and itching are signs and symptoms of Guinea worm disease	No	234	41.3
	Yes	332	58.7
A blister with severe burning pain is a sign and symptom of Guinea worm disease	No	263	46.5
	Yes	303	53.5
Skin lesion is a symptom of Guinea worm disease	No	253	44.7
	Yes	313	55.3
The emergence of the white worm is a symptom of Guinea worm disease	No	250	44.2
	Yes	316	55.8
Travelling to GW endemic areas has a high risk of getting the infection GWD	No	195	34.5
	Yes	371	65.5
Filtering of water using a Pipe/cloth filter prevents Guinea worm disease?	No	126	22.3
	Yes	440	77.7
Guinea worm disease is preventable	No	162	28.6

	Yes	404	71.4
Prohibiting patients from entering water sources prevents Guinea worm disease	No	306	54.1
	Yes	260	45.9
Using cleaning/purifying water prevent Guinea worm disease?	No	254	44.9
	Yes	312	55.1
Participant ever heard of a reward for reporting guinea worm disease	No	118	20.8
	Yes	448	79.2
Participants know the exact cash reward for reporting a GWD case	No	131	23.1
	Yes	435	76.9
Participant know the exact cash reward for reporting GWD animal infection	No	564	99.6
	Yes	2	.4
Participant correctly mentioned one more source of information about GWD	No	39	6.9
	Yes	527	93.1
Overall knowledge score	Good	375	66.3
	Poor	191	33.7

Attitude

We assessed the attitude of 566 daily laborers working at commercial farms in the Gambella Region regarding the prevention and control of GWD using nine three-point Likert scale questions. When asked whether GWD can be prevented by treating water ponds with an abate chemical, only 52 (9.2%) agreed, while 322 (56.9%) remained neutral, and 192 (33.9%) disagreed. A similar trend was observed regarding their perception of cloth filters: 377 respondents (66.6%) were neutral, 148 (26.1%) disagreed, and only 41 (7.2%) agreed.

Regarding the use of pipe filters for water filtration, the majority, 427 (75.4%), were neutral, while 116 (20.5%) disagreed and 23 (4.1%) agreed. A very high proportion, 454 (80.2%), were neutral on whether GWD can be prevented through surveillance, early detection, and containment, with 111 (19.6%) disagreeing and with only one respondent (0.2%) agreeing. Likewise, 394 participants (69.6%) were neutral toward the role of proper cooking and disposal of fish gut in prevention, 119 (21.0%) disagreed, and 52 (9.2%) agreed. In terms of safe water usage, 441 respondents (77.9%) were neutral, and 125 (22.1%) disagreed. The overall prevalence of a good attitude was 64.5% (n = 365; 95% CI: 60.4%–68.4%) (Table 4).

Table 4: Attitude on GWD among daily laborers in the Gambella Region, West Ethiopia, 2025 (N=566)

Variables	N = 566					
	Disagree (1)		Neutral (2)		Agree (3)	
	No.	%	No.	%	No.	%
GWD can be prevented by treating water ponds with an abate chemical	192	33.9	322	56.9	52	9.2
GWD can be prevented by filtering water using a cloth filter	148	26.1	377	66.6	41	7.2
GWD can be prevented by filtering water using a pipe filter	116	20.5	427	75.4	23	4.1
Can environmental management avoid the copepods' breeding sites?	129	22.8	403	71.2	34	6.0
GWD can be prevented by surveillance, early case detection and containment	111	19.6	454	80.2	1	.2
Proper cooking and disposing of fish guts can prevent GWD infection	119	21.0	394	69.6	53	9.2
Consistent use of safe water can prevent Guinea worm disease	125	22.1	441	77.9	0	0
The Guinea worm eradication program is useful	138	24.4	399	70.5	29	5.1

GWD can be prevented by controlling the copepods	102	18.0	441	77.9	23	4.1
Overall attitude score	Good attitude				365	64.5
	Poor Attitude				201	35.5

GWD Prevention practice

In terms of using safe water sources for drinking, only 23 (4.1%) reported doing so, whereas the vast majority, 543 (95.9%) relied on unsafe water sources. Of the participants who relied on unsafe water sources for drinking, 500 (88.3%) reported practising at least one water treatment method, such as boiling, filtering, or using chemicals for treatment before consuming water from unsafe sources.

A large majority, 429 (75.8%), consistently used a cloth filter when drinking water, while 137 participants (24.2%) did not. Similarly, 391 laborers (69.1%) reported regular use of a pipe filter, with 175 (30.9%) not using one. When asked about reporting a person suspected of GWD, 399 participants (70.5%) reported doing so through one or more methods, including the GWD call centre, reporting to a nearby health facility or GWD focal person. The overall prevalence of good GWD prevention practices was 63.4% (n = 359; 95% CI: 59.3%–67.4%) (Table 5).

Table 5:. GWD prevention practices among daily laborers in the Gambella Region, West Ethiopia, 2025 (N=566)

Variables	Classification	N = 566	
		Frequency	Percentage (%)
Utilise safe water sources for drinking	No	543	95.9
	Yes	23	4.1
Practised either boiling, using filters or treating with chemicals for unsafe water sources before drinking	No	43	7.6
	Yes	500	88.3
	Not applicable	23	4.1
Always use a cloth/filter during drinking water	No	137	24.2
	Yes	429	75.8

Always use a pipe filter for drinking water	No	175	30.9
	Yes	391	69.1
Reports GWD suspected with one or more reporting methods	No	167	29.5
	Yes	399	70.5
Participated in a meeting regarding GWD on the farm	No	278	49.1
	Yes	288	50.9
Overall, GWD prevention practice	Good practice	359	63.4
	Poor practice	207	36.6

Factors associated with GWD prevention practice

In the bivariable binary logistic regression analysis, seven variables were identified as potential candidates (p -value < 0.25) for the multivariable model. These included male sex (COR = 4.744, $p = 0.04$), age categories 18–24 years (COR = 1.897, $p = 0.182$) and 25–34 years (COR = 2.567, $p = 0.038$), educational status (Primary: COR = 3.712, $p = 0.000$; Secondary: COR = 2.266, $p = 0.006$; College and above: COR = 4.140, $p = 0.006$), duration of stay in Gambella (1–2 years: COR = 2.431, $p = 0.006$; 3–4 years: COR = 3.810, $p = 0.000$; >4 years: COR = 3.975, $p = 0.001$), family size (≤ 2 members: COR = 1.906, $p = 0.027$). These variables were selected for inclusion in the multivariable logistic regression model.

In the multivariable binary logistic regression analysis, after adjusting for potential confounders, five variables remained significantly associated with good GWD prevention practice. Male participants had significantly higher odds of good prevention practices compared to females (AOR = 5.612; 95% CI: 1.777–17.727; $p = 0.003$). Educational attainment was positively associated with prevention practices: participants with primary education (AOR = 3.308; 95% CI: 1.986–5.510; $p = 0.000$), secondary education (AOR = 1.963; 95% CI: 1.045–3.689; $p = 0.036$), and college and above (AOR = 3.814; 95% CI: 1.283–11.316; $p = 0.016$) were significantly more likely to engage in good practices compared to those with no education. Similarly, those who had stayed in Gambella for 3–4 years (AOR = 3.308; 95% CI: 1.600–6.839; $p = 0.001$) and more than 4 years (AOR = 3.187; 95% CI: 1.359–7.472; $p = 0.08$) were more likely to practice preventive measures compared to new arrivals (<1 year) (Table 6).

Table 6: Factors associated with GWD prevention practices among daily laborers in the Gambella Region, West Ethiopia, 2025(N=566)

Variables	Guinea worm disease prevention practice (N=566)		Bivariable LR		Multivariable LR	
			Crude odds ratio (COR)	P-value	Adjusted odds ratio (AOR) (95% CI)	P-value
	Good	Poor				
	N ^o	N ^o				
Sex						
<i>Male</i>	354	194	4.744	0.04	5.612 (1.777-17.727)	0.003
Female	5	13	1		1	
Age						
18-24 years	69	40	1.897	0.182	2.654 (0.965- 7.301)	0.059
25-34 years	231	99	2.567	0.038	2.992 (1.158- 7.730)	0.024
35-44 years	49	57			1.105(0.410-2.978)	0.843
45-64	10	11	1		1	
Educational status						
No education	38	59	1			
<i>Primary (1-8)</i>	251	105	3.712	0.000	3.308(1.986- 5.510)	0.000
<i>Secondary (9-12)</i>	54	37	2.266	0.006	1.963 (1.045 - 3.689)	0.036
<i>College and above</i>	16	6	4.140	0.006	3.814 (1.285 - 11.316)	0.016
Duration of stay in Gambella						
< 1 year	18	28	1		1	
1-2 years	175	112	2.431	0.006	1.662 (0.834 - 3.314)	0.149
<i>3-4 years</i>	120	49	3.810	0.000	3.308 (1.600 - 6.839)	0.001
<i>>4 years</i>	46	18	3.975	0.001	3.187 (1.359 - 7.472)	0.008
Family size						

≤ 2	208	86	1.906	0.027	1.585 (0.650 - 2.487)	0.483
3-4	118	95				
≥ 5	33	26	1		1	

NB: AOR= Adjusted Odds Ratio, COR- Crude Odds ratio, CI: Confidence Interval

Factors associated with Knowledge for GWD prevention

In the bivariable logistic regression analysis, six variables showed a potential association with knowledge of Guinea Worm Disease (GWD) prevention practices at a significance level of $p < 0.25$ and were therefore considered for the inclusion in the multivariable model. These variables included sex ($p = 0.05$), age group 25–34 years ($p = 0.074$), age group 35–44 years ($p = 0.23$), marital status (married: $p = 0.000$; widowed: $p = 0.40$), educational status (primary: $p = 0.000$; secondary: $p = 0.229$), duration of stay in Gambella (3–4 years: $p = 0.001$), and family size ≤ 2 ($p = 0.02$). These variables were considered potential predictors of knowledge for GWD prevention and were thus included in the multivariable logistic regression to control for confounding effects and identify independent associations (Table 8).

In the multivariable logistic regression analysis, five variables were found to be independently and significantly associated with good knowledge of GWD prevention practices at $p < 0.05$. First, participants aged 25–34 years were 4.2 times more likely to have good knowledge of GWD prevention practice compared to those aged 45–64 years (AOR = 4.199; 95% CI: 1.485–11.872; $p = 0.007$). Second, married individuals were significantly more knowledgeable than single participants (AOR = 1.719; 95% CI: 1.061–2.787; $p = 0.028$). Third, those with primary education (grades 1–8) had significantly higher odds of having good knowledge compared to those with no formal education (AOR = 4.015; 95% CI: 2.334–6.908; $p = 0.000$). Additionally, individuals who had stayed in Gambella for 3–4 years had significantly better knowledge of GWD prevention practice than those who stayed for less than 1 year (AOR = 2.989; 95% CI: 1.375–6.501; $p = 0.006$). Interestingly, smaller family size (≤ 2) was negatively associated with knowledge; these participants were less likely to have good knowledge compared to those with family size ≥ 5 (AOR = 0.296; 95% CI: 0.132–0.665; $p = 0.03$). These findings highlight that age, marital status, education, duration of stay, and family size are key determinants of GWD prevention knowledge among daily laborers in the Gambella region (Table 7).

Table 7: Factors associated with knowledge for GWD prevention practices among daily laborers in the Gambella Region, West Ethiopia, 2025(N=566)

Variables	knowledge for for Guinea worm disease prevention practice (N=566)		Bivariable LR		Multivariable LR	
	Good N ^o	Poor N ^o	Crude odds ratio (COR)	P-value	Adjusted odds ratio (AOR) (95% CI)	P-value
Sex						
<i>Male</i>	367	181	2.535	0.05	1.504 (0.84-4.654)	0.482
Female	8	10	1		1	
Age						
18-24 years						
25-34 years	59	50	2.249	0.074	4.199 (1.485- 11.872)	0.007
35-44 years	235	95	1.768	0.23	2.319(0.779-6.900)	0.131
45-64	70	36	1		1	
Marital Status						
Single	179	136	1			
Married	171	50	2.598	0.000	1.719 (1.061-2.787)	0.028
Widowed	19	5	2.887	0.40	1.744 (0.555-5.481)	0.341
Divorced	6	0				
Educational status						
No education	48	49	1			
<i>Primary (1-8)</i>	263	93	2.887	0.000	4.015 (2.334 - 6.908)	0.000
<i>Secondary (9-12)</i>	53	38	1.424	0.229	1.423 (0.743 - 2.726)	0.287
<i>College and above</i>	11	11				

Duration of stay in Gambella						
< 1 year	27	19	1		1	
1-2 years	169	118				
3-4 years	138	31	3.133	0.001	2.989 (1.375 - 6.501)	0.006
>4 years	41	23				
Family size						
≤ 2	164	130	0.35	0.02	0.296 (0.132 - 0.665)	0.03
3-4	165	48				
≥ 5	46	13	1		1	

Factors associated with Attitude for GWD prevention

In the bivariable logistic regression analysis, five variables showed a potential association with attitudes toward Guinea Worm Disease (GWD) prevention ($p < 0.25$) and were included in the multivariable model for further analysis. These included age group 25–34 years ($p = 0.194$), marital status (married: $p = 0.03$; widowed: $p = 0.054$; divorced: $p = 0.249$), educational status (secondary education: $p = 0.02$), duration of stay in Gambella (1–2 years: $p = 0.206$; 3–4 years: $p = 0.005$; >4 years: $p = 0.008$), and family size 3–4 ($p = 0.112$). These candidate variables were entered into the multivariable logistic regression to control for confounding and identify independent predictors of a positive attitude toward GWD prevention (Table 8).

In the multivariable logistic regression analysis, three variables were found to be significantly associated with a good attitude toward GWD prevention practices ($p < 0.05$). First, being married was significantly associated with a more favorable attitude compared to being single, with married individuals being nearly 1.85 times more likely to have a positive attitude (AOR = 1.851; 95% CI: 1.167–2.938; $p = 0.009$). Second, having secondary education (grades 9–12) was significantly associated with a lower likelihood of having a good attitude compared to those with no education (AOR = 0.430; 95% CI: 0.226–0.816; $p = 0.010$), indicating a possible inverse relationship in this group. Third, length of stay in Gambella was positively associated with attitude: individuals who had stayed 3–4 years were 2.82 times more likely to have a good attitude (AOR = 2.824; 95% CI: 1.383–5.764; $p = 0.004$), and those who had stayed more than 4 years were 3.67 times more likely

(AOR = 3.672; 95% CI: 1.555–8.667; $p = 0.003$) compared to those who had stayed less than 1 year. These findings suggest that marital status, duration of stay, and education level significantly influence attitudes toward GWD prevention among daily laborers in the Gambella region.

Table 8: Factors associated with Attitude for GWD prevention practices among daily laborers in the Gambella Region, West Ethiopia, 2025(N=566)

Variables	Attitude for Guinea worm disease prevention practice (N=566)		Bivariable LR		Multivariable LR	
			Crude odds ratio (COR)	P-value	Adjusted odds ratio (AOR) (95% CI)	P-value
	Good	Poor				
	N ^o	N ^o				
Age						
18-24 years	78	31				
25-34 years	221	109	1.887	0.194	1.606(0.621- 4.153)	0.328
35-44 years	54	52				
45-64	12	9	1		1	
Marital Status						
Single	184	131	1			
Married	157	64	1.747	0.03	1.851(1.167-2.938)	0.009
Widowed	19	5	2.705	0.054	2.588 (0.903-7.418)	0.077
Divorced	5	1	3.560	0.249	3.994 (0.419-8.047)	0.229
Educational status						
No education	69	28	1			
Primary (1-8)	233	123				
Secondary (9-12)	50	41	0.495	0.02	0.430 (0.226-0.816)	0.010
College and above	13	9				

Duration of stay in Gambella						
< 1 year	23	23	1		1	
1-2 years	172	115	1.496	0.206	1.641 (0.834-3.229)	0.151
3-4 years	122	47	2.596	0.005	2.824 (1.383-5.764)	0.004
>4 years	48	16	3.000	0.008	3.672 (1.555-8.667)	0.003
Family size						
≤ 2	176	118				
3-4	153	60	1.629	0.112	1.869 (0.963-3.628)	0.065
≥ 5	36	23	1		1	

6. Discussion

The findings showed that two-thirds of the participants demonstrated good knowledge (66.3%), nearly two-thirds had a positive attitude (64.5%), and approximately the same proportion practiced good GWD prevention behaviors (63.4%). The practice of GWD prevention was largely influenced by sex, educational status, duration of stay in Gambella, knowledge level, and attitude.

The overall prevalence of good knowledge regarding GWD among the study participants were 66.3% (95% CI: 62.2%–70.1%). This level of knowledge falls as moderately high studied shows that knowledge levels between 50% and 70% are often considered sufficient to support basic disease prevention efforts(27, 28). Although this proportion reflects a relatively favorable awareness of GWD, it remains below the optimal threshold required for disease eradication, which demands near-universal understanding of transmission and prevention strategies (21). Therefore, while the current level of knowledge is encouraging, sustained health education and community engagement remain essential to bridge remaining gaps and reinforce behavioral change.

The finding also lower than the study done in Ogun State, South-West Nigeria, where overall knowledge of participants was 76.3%, while 81.5% of participants knew GWD is transmitted from drinking infected water (24). It is also lower when compared to similar studies conducted in GWD-endemic settings such as Oyo state, South-west Nigeria and South Sudan, where knowledge levels have ranged from 70% to 85%(22, 29), with the results reflecting a gap that still needs to be addressed. The lower knowledge levels could be attributed to limited health education outreach or language and cultural barriers among seasonal laborers. Strengthening community-based health education, particularly using visual aids or multilingual materials, may help improve knowledge levels.

The prevalence of positive attitudes towards GWD prevention was 64.5% (95% CI: 60.4%–68.4%). This result aligns with a study done in Ghana, which reported almost similar level (66.8%) of positive perception towards GWD (23). Positive attitudes likely reflect the recognition of GWD as a serious health issue and trust in preventive measures. However, the findings of our study are lower than the study done in Nigeria, where 87.2% of participants believed that the GWD is a very serious disease transmitted by unsafe water sources, and 96.6% believe that any has the risk of GWD transmission (21, 24). Factors such as perceived fatalism with the disease and the presence of ongoing GWD campaign meetings in the area might contribute to these attitudes. Improving

health promotion campaigns through peer education and community engagement could be effective in fostering behavioural change.

Good GWD prevention practices were observed in 63.4% of respondents (95% CI: 59.3%–67.4%). This finding is encouraging, but still leaves a considerable proportion of the population practising ineffective or no prevention. This is lower than GWD prevention practice reported in Nigeria, where 65.8% - 88.2% of participants implemented good GWD prevention behaviour (21, 24). Similarly, in a study done at Ghana, 86.6% stated that they have a safe source of water, and 89.4% claimed to fetch drinking water from the safe sources all the time (30). Furthermore, compared to WHO benchmarks for GWD eradication strategies(31), such a level of GWD practices is suboptimal and may pose a risk for reintroduction in post-endemic regions like Ethiopia. The relatively high percentage of respondents who did not consistently use safe water or attend GWD-related meetings highlights gaps in access and ongoing education. This suggests a need to reinforce prevention measures through sustained infrastructure support, including safe water provision and farm-based outreach.

Sex was significantly associated with prevention practice. Male participants were nearly six times more likely to adopt good prevention behaviours compared to females (AOR = 5.984; 95% CI: 1.807–19.810). This gender disparity could stem from differences in labor roles, access to information, or social norms around disease prevention. It is consistent with other studies in sub-West Africa and India (32, 33) where males, often being heads of households or lead workers, have greater exposure to health interventions.

Education level was positively associated with preventive practice. Respondents with primary (AOR = 3.088), secondary (AOR = 2.143), and college-level education (AOR = 4.347) were significantly more likely to practice GWD prevention than those with no formal education. The positive correlation between educational level and GWD prevention practice was documented among households in the Gog district, Gambella region (34) and a global study(35), showing that education enhances health literacy and self-efficacy, which translates into better health behaviours. This underscores the importance of tailoring prevention messages to low-literacy populations through pictorial materials, drama, and local languages.

Duration of stay in Gambella was another significant predictor. Those who stayed for 3–4 years (AOR = 2.682) and >4 years (AOR = 2.664) had significantly better prevention practices than those who had been in the region for less than one year. This may reflect increased exposure to local health education and adaptation to preventive norms over time. Similar findings have been reported in Ethiopia (26) and Chad(36), suggesting that integration and social capital influence uptake of health practices. Incorporating GWD education into induction sessions for new arrivals could address this gap.

This study found that participants aged 25–34 years were significantly more likely to have good knowledge of GWD prevention practices compared to those aged 45–64 years (AOR = 4.199; 95% CI: 1.485–11.872). This aligns with previous findings in similar low-resource settings in Chad (37, 38), and Mali (39) where younger adults tend to be more exposed to health information and public health campaigns, particularly through community outreach and mobile-based health education programs. Younger adults are also more likely to be active participants in public awareness events and may have better cognitive retention and health-seeking behaviors than older individuals. Moreover, they often have more recent educational exposure, which could contribute to greater awareness of disease prevention strategies. These findings suggest the importance of targeting older age groups with tailored, accessible health education materials to bridge the knowledge gap in GWD prevention.

Married individuals were found to be significantly more knowledgeable about GWD prevention than single individuals (AOR = 1.719; 95% CI: 1.061–2.787). This may be due to the increased sense of responsibility and caregiving roles that often accompany marriage, especially when children are involved. Married individuals may be more likely to seek out and retain health-related knowledge to protect their families. Furthermore, they may have more opportunities to exchange health information with partners, neighbors, or within community groups, increasing exposure to public health messages. Similar associations have been observed in studies where marital status is linked with better uptake of preventive practices (38). This finding implies that public health campaigns could benefit from engaging family units and incorporating family-centered approaches in GWD education interventions.

Having a primary education (grades 1–8) was strongly associated with higher knowledge of GWD prevention (AOR = 4.015; 95% CI: 2.334–6.908). This is consistent with studies in Nigeria

(22) showing that education significantly enhances health literacy, especially for communicable diseases. Even basic literacy enables individuals to understand public health posters, participate in training sessions, and comprehend oral health messages during community outreach programs. In the context of GWD, individuals with some formal education may also better understand the biological transmission of the disease (i.e., contaminated water sources), recognize the importance of water filtration, and follow preventive instructions. These findings underscore the importance of promoting basic education, especially in rural and mobile laborer populations, and suggest that future health campaigns should integrate literacy-sensitive communication tools for populations with low or no education.

Participants who had lived in the Gambella region for 3–4 years had significantly better knowledge of GWD prevention compared to those who had stayed less than 1 year (AOR = 2.989; 95% CI: 1.375–6.501). This is consistent with studies in Ethiopia (26) and Chad (36). A longer duration of stay likely increases exposure to regional health interventions, awareness campaigns, and community dialogues about endemic diseases like GWD. In addition, residents who have been in an area for longer may have developed stronger ties with local health systems, community health workers, and traditional leaders who disseminate health information. This pattern is supported by studies on migrant or displaced populations, where health knowledge and service utilization improve over time with community integration. The implication for policymakers is that newly arrived populations especially seasonal laborers should be prioritized for intensive orientation and health education upon arrival to rapidly close the information gap.

Interestingly, participants with smaller family sizes (≤ 2 members) were less likely to have good knowledge of GWD prevention compared to those with larger families (AOR = 0.296; 95% CI: 0.132–0.665). This may appear counterintuitive, but could reflect reduced exposure to shared health information that typically circulates within larger households or extended family networks. Larger households may benefit from more frequent interactions with community health promoters, school-based health education brought home by children, or mutual learning among members. Additionally, those in larger families may face higher perceived risk of disease transmission, prompting a greater interest in preventive measures. This finding suggests that individuals in smaller or isolated households may be overlooked by community health strategies and should be

specifically targeted through one-on-one education or outreach services to ensure equitable access to health knowledge

This study found that married individuals were significantly more likely to have a favorable attitude toward GWD prevention compared to their single counterparts (AOR = 1.851; 95% CI: 1.167–2.938; $p = 0.009$). This association may reflect the greater sense of responsibility and health prioritization often observed among married individuals, particularly those with children. Marriage may encourage increased participation in community discussions and shared decision-making around health-related matters, thereby fostering more positive attitudes toward disease prevention. Previous studies in Ghana have also shown that marital status is linked with better uptake of preventive health behaviors, likely due to mutual support and shared accountability within households (23). The implication of this finding is that unmarried or socially isolated individuals might need targeted interventions to enhance their engagement and perception of GWD prevention measures. Health promotion efforts could benefit from involving families and couples in awareness campaigns to reinforce community-level support for eradication initiatives.

Unexpectedly, having a secondary education (grades 9–12) was significantly associated with a lower likelihood of having a positive attitude toward GWD prevention, compared to individuals with no formal education (AOR = 0.430; 95% CI: 0.226–0.816; $p = 0.010$). This counterintuitive finding may stem from several factors. One possible explanation is that individuals with higher education may perceive GWD as a disease of the past, or less relevant to their daily lives, especially in the context of declining incidence due to ongoing eradication efforts. This perception could lead to complacency or skepticism toward prevention campaigns. Alternatively, it might reflect a disconnect between the content or delivery of public health messages and the expectations or beliefs of more educated groups. Some studies have suggested that higher education, when not coupled with accurate and updated health messaging, can sometimes result in misinformation or disengagement. This result highlights the need to tailor communication strategies not just to low-literacy populations but also to moderately educated groups, ensuring relevance, clarity, and cultural appropriateness of messages.

Duration of residence in Gambella was positively associated with favorable attitudes toward GWD prevention. Those who had lived in the region for 3–4 years (AOR = 2.824; 95% CI: 1.383–5.764; $p = 0.004$) and more than 4 years (AOR = 3.672; 95% CI: 1.555–8.667; $p = 0.003$) were

significantly more likely to have a good attitude compared to those who had lived in the area for less than 1 year. This finding aligns with studies in Ghana, (23) Ethiopia (26) and Chad (36) and Ghana (30). This pattern suggests that increased time spent in a GWD-endemic or formerly endemic area enhances exposure to health education campaigns, community-based surveillance, and informal learning through peers. Over time, residents are more likely to engage with local health workers, attend community meetings, and experience the benefits of disease prevention, all of which may positively shape their attitudes. Similar findings have been reported in studies involving migrant workers or displaced populations, where length of stay correlates with greater integration and trust in local health systems. This underscores the need for targeted orientation and rapid sensitization programs for newly arrived laborers to foster positive attitudes early and support the long-term success of eradication programs.

This study has the following limitations. First, its cross-sectional design limits the ability to infer causality between associated factors and prevention practices. Second, the reliance on self-reported practices may have introduced social desirability bias, potentially overestimating adherence to recommended behaviours. Third, the findings are specific to commercial farm laborers in one region and, hence, it may not be generalizable to other populations or geographic contexts. Despite these limitations, the study provides critical insights that can inform targeted health promotion and surveillance efforts in GWD eradication.

7. Conclusion

The findings revealed moderate levels of good knowledge (66.3%), attitude (64.5%), and prevention practices (63.4%) among respondents, which are significantly lower than findings from existing literature and in the context of expected social behavioral change on the disease eradication program. Several factors were significantly associated with improved prevention behaviors, including being male, higher educational attainment, longer duration of stay in the region, better knowledge, and positive attitudes toward GWD prevention. These results highlight critical areas for intervention to ensure sustained GWD eradication efforts among migrant and mobile populations in endemic-prone regions. Similarly, age, marital status, education, duration stay and family size were found to be independently and significantly associated with good knowledge of GWD prevention practices. Furthermore being married, having secondary education (grades 9–12), length of stays of three years and above 3–4 in Gambella were positively associated with favorable attitude towards GWD prevention practice. These findings suggest that marital status, duration of stay, and education level significantly influence attitudes toward GWD prevention among daily laborers in the Gambella region.

8. Recommendations

Ministry of Health and Ethiopian Public Health Institute

- Strengthen health education campaigns targeting low-literacy and mobile populations, using multilingual and visual materials.
- Integrate GWD messages into broader community health programs, especially those targeting neglected tropical diseases.
- For Research and Academic Institutions: Conduct further qualitative research to explore behavioural determinants of GWD prevention among seasonal laborers.
- Ensure GWD prevention content is included in induction programs for incoming farm laborers in endemic-prone areas like Gambella.

Gambella Regional Health Bureau and Local Health Offices

- Strengthen health education and promotion programs by deploying health extension workers and community mobilizers to deliver targeted GWD education in farm settings to increase knowledge and attitude.
- Promote gender-sensitive education to increase female participation in prevention programs and meetings.
- Facilitate regular farm-based sensitisation meetings, especially for newly arriving daily labourers to reinforce surveillance and reporting practices.

Commercial Farm Owners and Employers:

- Collaborate with local health authorities to provide space, time, and support for workers to attend GWD awareness sessions.
- Encourage safe water access and distribution of filters (e.g., pipe and cloth filters) on farms as part of workplace health measures.
- Incorporate health promotion into workplace safety standards and training protocols.

Non-Governmental Organisations (NGOs) and Development Partners:

- Support community engagement strategies that build trust and culturally relevant health messaging among migrant workers.
- Provide technical and financial assistance to scale up targeted GWD eradication efforts in hard-to-reach and mobile populations.
- Monitor and evaluate behavior change interventions to identify best practices and scale effective models.

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10. Annex

10.1 Annex 1 Informed Consent Sheet

Good morning /afternoon my Name is Girmay Hailu I am a field epidemiology training resident at Saint Paul Hospital Millennium Medical College. I am here to conduct a study on

Objectives: To assess Knowledge, Attitude, Practice and associated factors towards Guinea worm diseases among daily laborers working at commercial farms of Gambella Region Ethiopia in Nov 2024.

Procedure: This study questionnaire will take about 15 minutes of your time. During the study Time, we will clearly explain to you the objective, benefits and risks of the study and then will give You have a chance to ask questions and give answers about the study. Finally, we will ask you about The Knowledge, Attitude, Practice and associated factors towards Guinea worm diseases among daily laborers working at commercial farms. All information collected during this study will be kept private.

Benefits: This study will help to enhance the Knowledge, attitude and practice to interrupt the Guinea worm disease transmission throughout the region and facilitate for certification of a Guinea worm-free country.

Risks: There is no risk to you answering the questions or participating in this study.

Privacy: We will keep information about you private. We will not collect your name. We will Do not use any information that might identify you when we present or publish the study's results.

Payment: There is no cost to you being part of the study.

Participant Agreement: The project has been explained to me. I have been given a chance to Ask questions. I feel that all my questions have been answered. Being in this study is my choice. May change my mind and leave the study any time during the interview.

We are kindly requesting you to answer the questions that we have prepared for you.

Would you be willing to participate? 1.....YES, 2 No.2

Participant Signature_____Date_____

Date of interview _____Time started_____ Time completed_____

Checked by supervisor: Name_____ Signature_____ Date_____

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10.3 Annex 3: Data Collection tool for Knowledge, Attitude, Practice and associated factors towards Guinea worm diseases among daily laborers working at commercial farms.

Region_____ Zone_____ Woreda_____ Kebele_____ Village

_____Name of Farms _____Date

of data collection _____ Area location/Latitude_____ longitude: _____

S/n	Questions	Classifications/response
1. SOCIO –DEMOGRAPHY		
1.1	gender	1. Male 2.. Female
1.2	Age (in years)	_____
1.3	Occupations	1 Farmers 2 Students 3. Hunter 4. housewife 5. Other
1.4	Educational status	1 No education 2 Primary (1-8)th 3 Secondary (9-12 th) 4 Tertiary(>12 th grade)
1.5	Total family members:	-----
1.6	Religion:	1.Orthodox 2. Protestant 3. Muslim 4 Catholic 5.other_____
1.7	Marital status :	1.Single 2. Married 3. Widowed 4. Divorced
1.8	Ethnic	_____
1.9	Place of permanent residence (region	_____

1.10	Residence	1.Urban
		2. Rural
1.11	How long live in the Gambella region	1.<1year 2. 1-2years 3. 3-4 years 4.>4year
1.12	Did you previously infected by GWD	1.Yes 2.No
1.13	Did anyone of your family previously infected by GWD	1.Yes 2.No
1.14	Did you ever seen person infected by GWD	1.Yes 2.No
1.15	Income source	_____
2. KNOWLEDGE		
2.1	Show Guinea worm id card check if the respondent can recognized it as GWD?	1.Yes 2. No
2.2	Is Guinea worm disease a curable disease?	1.Yes 2. No
2.3	Is Guinea worm water born disease that cause disability?	1.Yes 2. No
2.4	I GWD transmitted by drinking contaminated water with GW larvae copepods?	1.Yes 2. No
2.5	Is GWD transmitted by eating uncooked aquatic animals and feeding to animals?	1.Yes 2. No
2.6	Is Localized swelling and itching are sign and symptom of Guinea worm disease ?	1.Yes 2. No
2.7	Is blister with sever burning pain a sing and symptom of Guinea worm disease ?	1.Yes 2. No
2.8	Is kin lesion a symptom of Guinea worm disease ?	1.Yes 2. No
2.9	Is Emergence of white worm a symptom of Guinea worm disease ?	1.Yes 2. No
2.10	Are peoples how travel to GW endemic areas are at high risk of getting infection GWD	1.Yes 2. No
2.11	Is Filtering of water using Pipe/cloth filter Prevent Guinea worm disease?	1.Yes 2. No

2.12	Do you know that Guinea worm disease can be Preventable ?	1.Yes 2. No
2.13	Is Prohibiting patient from entering water sources Prevent Guinea worm disease?	1.Yes 2. No
2.14	Is using Cleaning/purifying water Prevent Guinea worm disease?	1.Yes 2. No
2.15	Have you ever heard of reward for reporting guinea worm disease?	1. Yes 2. No
2.16	How much is the cash reward for GWD case	1 -----
2.17	How much is the cash reward for GWD animal infection?	1.-----
2.18	What is the source information about GWD ?	1. Radio/Television 2. Health workers 3. Market day 4. Schools 5. Mosque/church 6. Other
3. ATTITUDE		
3.1	Do you think GWD can be prevented by treating water ponds with abate chemical ?	1. Disagree 2. Neutral 3. Agree
3.2	Do you think GWD can be prevented by filtering water by using cloth filter?	1. Disagree 2. Neutral 3. Agree
3.3	Do you think GWD can be prevented by filtering water using pipe filter during drinking time ?	1. Disagree 2. Neutral 3. Agree
3.4	Do you think that environmental management (assisting stagnant water to flow and filling the ponds by soil and sand)can avoid the copepods breeding sites?	1. Disagree 2. Neutral 3. Agree
3.5	Do you believe that Surveillance (early Case detection and Containment) can prevented GWD?	Disagree 2. Neutral 3. Agree
3.6	Do you believe that Proper Cooking and Dispose of Fish gut can prevented GWD infection ?	1. Disagree 2. Neutral 3. Agree
3.7	Do you believe that constant use of Safe water can prevent Guinea worm disease?	1. Disagree 2. Neutral 3. Agree

3.8	Do you think that the Guinea worm eradication program is useful?	1. Disagree 2. Neutral 3. Agree
3.9	Do you think GWD can be prevented by controlling the copepods?	1. Disagree 2. Neutral 3. Agree
4. PRACTICE		
4.1	where do you get water for drinking purposes?	1. Safe 2. Unsafe 3. Both
4.2	If you answered unsafe 2 and 3 Q What do you do with the water before drinking	1. Boils 2. Filters 3. Treat with chemicals 4. None of the above
4.3	Did you always use a cloth filter during water drinking?	1. Yes 2. No
4.4	Do you always use a pipe filter during water drinking?	1. Yes 2. No
4.5	If someone from your friends gets suspected of GWD, where do you report first?	1. Health Facility 2. Contact GWO/Focal 3. Stay at work area(Home) 4. Call 8335 5. Other(specify)_____
4.6	Have you participated in a meeting against GWD on the farm?	1. Yes 2. No
4.7	If Q not, why not	
4.8	If so, what is your experience in preventing Guinea Worm Disease?	
General 1. what do you understand from our interview _____ 2. What do you want to add? _____ 3. Do you have any suggestions to this regards? _____		

Annex 4: sampling technique for Selection of commercial Farms with daily laborers Gambella, West Ethiopia,,2025

List of Randomly selected commercial Farms and population proportion allocation

S.No	Randomly Sampling	PP allocation	S.No	Randomly sampling	PP allocation	S.No	Random sampling	PP allocation
1	Mender 8&9 Farm	20	14	Tadele Farm	12	27	Bayene Farm	24
2	Zaru farm Farm	21	15	Samire Farm	8	28	G/mariam Farm	16
3	Mender 11 Farm	17	16	Afewerki Farm	11	29	Lindane Farm	17
4	Muluken Farm	15	17	Mulat Farm	12	30	Afrotsion Farm	29
5	Tamalawu Farm	21	18	Kalayad Farm	7	31	Crc Farm	28
6	Damoz Farm	11	19	Yetiwale Farm	9	32	Okume Farm	17
7	Alemishate Farm	15	20	Temesigen Farm	10	33	Omane Farm	18
8	Mulunhe Farm	12	21	Abinet Farm	8	34	Haftamu Farm	16
9	Tarakagn Farm	12	22	Berkuma Farm	8	35	Mangasha Farm	15
10	Negash Farm	13	23	Turky Farm	15	36	Haiyelaye Farm	18
11	Bazen 1 Farm	18	24	Mekewaninte	16	37	Alemu d Farm	21
12	Bazen 2 Farm	17	25	Goyetom Farm	14	38	Bazazawu Farm	23
13	Donbosco Farm	14	26	Mender 7 Farm	17			

Note: RS: - Random sampling, PP: - population proportion allocation