Assessment of Community Knowledge, Attitude and Practices towards Rabies in Pawi District, Benishangul Gumuz Regional State, North Western Ethiopia

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ABSTRACT: Back ground: Rabies remains a major public health challenge in Ethiopia, where the country records the second-highest number of human rabies related deaths in Africa. **Objectives**: This study aimed to assess community knowledge, attitudes and practices (KAP) toward rabies in Pawi District, Benishangul-Gumuz Regional State, North Western Ethiopia. **Methods:** A community-based cross- sectional study was conducted from December 2024 to May 2025 using a structured questionnaire. A total of 384 participants were selected through a multistage sampling technique from selected kebeles. Data were analyzed using STATA version 17. Multivariable binary logistic regression models were used to identify factors with rabies-related knowledge, attitudes and practices. **Results:** The result revealed that majority of respondents(73.2%) were male, with48.7% aged 30–45years. Only52% of the participants demonstrated adequate knowledge of rabies, and 70% incorrectly believed that consumption of infected meat could transmit the disease. Most respondents (93.2%) were aware that post-exposure prophylaxis can prevent rabies following an animal bite, and 93.8% recognized dog vaccination as a key preventive measure. Regarding attitudes, 94.01%acknowledgedthat rabies is fatal if not treated promptly; however, only 40.1% demonstrated an overall positive attitude toward rabies prevention. Community practices were suboptimal, with 88.0% reporting failure to vaccinate dogs and 60.0%relyingonherbalremedies following animal bites. Overall, 52.1% had good knowledge, 40.1% had positive attitudes, and 48.2% exhibited acceptable preventive practices. Moreover, the results of multivariable logistic regression analysis indicated that good knowledge score was significantly higher in respondents from urban than rural area (OR = 0.67; $p < 0.05$), in male than female(OR=1.90;$p < 0.05$).Positive attitudes toward rabies prevention and control were significantly associated with male sex (OR = 2.40; $p < 0.05$). Good rabies prevention practicesweremorelikelyamongurbanresidents(OR=0.88;$p<0.05$),males(OR=1.95;$p< 0.05$). **Conclusion and Recommendations:** In conclusion the study revealed substantial gaps in community knowledge, attitudes, and practices toward rabies in Pawi District, particularly among older individuals, females, and those with lower educational attainment. Therefore, targeted community education, improved access to rabies vaccines, and strengthened inter-sectoral collaboration are urgently needed to enhance rabies prevention and control. These findings provide critical evidence to inform public health interventions aimed at reducing rabies-related morbidity and mortality in rural Ethiopia.

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1. INTRODUCTION

Rabies has been known since the beginning of human civilization (Bilal, 2021). It is a Central Nervous System (CNS) disease that is almost invariably fatal once a sign develops(Dietzschold *et al*., 2005). Rabies is a zoonotic, fatal and progressive neurological infection caused by rabies virus of the genus Lyssavirus and family Rhabdoviridae. It affects all warm- blooded animals and the disease is prevalent throughout the world and endemic in many countries except in Islands such as Australia and Antarctica. Over 60,000 peoples die every year due to rabies, while approximately 15 million people receive rabies post-exposure prophylaxis (PEP) annually and transmitted mostly by carnivores to humans and livestock (Singh *et al*., 2017; Reta *et al*., 2014).The cost of post-exposure prophylaxis for humans, the loss of livestock, and other rabies-related expenses made an estimated 8.6 billion US annually in global economic burden (WHO, 2023).

Rabies is a severe zoonotic disease that poses a significant public health threat, especially in developing countries where domestic dogs serve as the primary reservoir and transmitter of the disease. Despite its nearly 100% fatality rate once clinical symptoms appear, rabies is preventable through

timely post-exposure prophylaxis (PEP) and vaccination (WHO, 2018). The World Health Organization (WHO) estimates that rabies causes approximately 55,000 deaths annually, with Africa accounting for nearly 24,000 of those deaths (Knobel *et al*.,2005). In Ethiopia, rabies remains endemic, with domestic dogs being the main vector for human infections (Jemberu *et al*., 2013).

The epidemiology of rabies in Ethiopia is characterized by high incidence rates and low vaccination coverage among domestic animals, particularly dogs. Between 2018 and 2022, Ethiopia reported approximately 37,989 suspected human exposure cases, with 297 fatalities, indicating a rising trend in rabies exposure (Asfaw *et al*., 2024). The disease predominantly affects dogs, which are the primary reservoir, contributing to over 95% of human rabies cases (Ali, 2022). Globally, rabies remains a critical health issue with developing countries bearing the brunt of this burden (Abdella *et al.*, 2022).
In Ethiopia the incidence and mortality, indicated as the mean annual incidence of human exposure casesis7,598, with a mortality rate of 0.05 per 100,000 population (Asfaw *et al*., 2024). Animal Cases, a significant number of animal cases, particularly in dogs (71.2%), highlight the need for improved vaccination efforts (Asfaw *et al*., 2024).
Public awareness, the surveys indicate that while awareness exists, knowledge gaps persist regarding transmission and prevention practices (Beresa and Beriso, 2023). Rabies is a challenge both in Ethiopia and globally, with the disease-causing high human deaths annually, predominantly in Africa and Asia. In Ethiopia, rabies is a major concern due to the high prevalence of the disease in dogs, which are the primary vectors for human transmission. The country experiences a substantial number of rabies-related fatalities each year, with children being particularly vulnerable. Despite being a vaccine-preventable disease, rabies control in Ethiopia is hindered by several challenges, including outdated vaccination methods, limited access to modern vaccines, and inadequate public awareness (Alemayehu *et al*., 2023; Aga *et al*., 2023; Ali, 2022).

In Ethiopia, rabies has been recognized as a very challenging disease for a longtime(Ali *et al*., 2010). The challenges in Ethiopia includes: Vaccine Limitations, Ethiopia continues to use nerve tissue vaccines (NTV), which are less effective and have higher adverse event rates compared to modern cell culture vaccines. This outdated method contributes to vaccination failures and increased rabies cases (Aga *et al*., 2023). High dog rabies prevalence, a significant proportion of dogs in Ethiopia are unvaccinated, with studies showing that over 70% of dogs inflecting bites in Addis Ababa were rabies-positive (Abdella *et al*., 2022). Public health infrastructure, there is a lack of rabies control centers and insufficient availability of post-exposure prophylaxis (PEP) in district health centers, exacerbating the public health burden (Esmael and Ferede, 2023).

The assessment of community knowledge, attitudes, and practices (KAP) towards rabies in Ethiopia reveals significant gaps that hinder effective prevention and control of this fatal zoonotic disease. Rabies remains acritical public health issue, with thousands of infections and deaths reported annually in the country (Bahiru *et al.*, 2022). KAP level of studies in some parts of Ethiopia shown that Knowledge Levels in Welkait district found only 51.6% of participants had a good understanding of rabies, with only 24.2% aware of post-exposure prophylaxis (Dubie *et al.*, 2024). In Gomma district, 53.6% of respondents demonstrated good knowledge, with a notable correlation between personal exposure to rabies and increased knowledge scores (Kebede *et al*., 2024). Conversely, a study in West Shewa Zone reported 91.2% knowledge among respondents, highlighting regional disparities (Dilbato *et al*., 2024). Attitudes towards rabies, positive attitudes towards rabies vaccination were reported by68.5% of participants in Welkait (Dubie *et al*., 2024).In Mekelle city, 56.2% of respondents exhibited favorable attitudes, particularly among dog owners and those with prior training on rabies (Hagos *et al*., 2020). Good practices were observed in 61.3% of participants in Mekelle, with dog ownership significantly influencing these practices (Hagos *et al*., 2020). However, only 43% practiced effective prevention measures in Jimma town, suggesting a gap between knowledge and action (Rago *et al*., 2024). Conversely, a study on health professionals indicated that only 25% had adequate KAP regarding rabies management, highlighting a critical need for training (Aga *et al*., 2023). In Enderta woreda, 99% had heard of rabies, yet many still allowed children to interact with dogs, reflecting disconnect in understanding risk (Abdelkadir *et al*., 2024).

Globally rabies is characterized by its fatal nature and zoonotic transmission primarily through animal bites. Despite the availability of effective vaccines, rabies continues to pose a threat, particularly in regions with high incidences, such as Asia and Africa (Singh *et al*., 2017). Rabies is endemic in

many regions, with a disproportionate impact on low-income countries (Ali, 2022). It causes approximately 59,000 human deaths annually, with 95% of cases occurring initiand Africa (Hampson *et al*., 2015). In Shandong Province, China, 414 human rabies cases were reported from 2010 to 2020, predominantly affecting farmers over 40 years old (Zhang *et al*., 2022).

Animal reservoir, dogs are the primary transmission hosts, accounting for 71 out of 170 confirmed animal rabies cases in China (Feng *et al*., 2021). Other wildlife, such as foxes, also contributes to rabies transmission, particularly in rural areas (Feng *et al*., 2021). The vaccination rate for dogs in rabies-endemic areas is critically low, with only 8.85% of exposed individuals receiving post-exposure prophylaxis (Zhang *et al*., 2022). Effective management strategies are essential to increase vaccination coverage and improve public health responses (Samad *et al*., 2024). Effective rabies control relies on mass vaccination of dogs and public education, yet many regions struggle with implementation due to resource constraints (Ali, 2022).
Global challenges of rabies, vaccine inequity, there is a disparity in vaccine distribution, with low- and middle-income countries (LMICs) facing significant challenges in accessing affordable rabies vaccines and immunoglobulins (Alemayehu *et al*., 2023). Emerging vectors, while dogs remain the primary source of rabies transmission, other vectors such as bats are becoming increasingly significant in certain regions, complicating control efforts (Alemayehu *et al*., 2023). Addressing these issues through a coordinated one health approach could significantly reduce the rabies burden. However, achieving the World Health Organization's goal of zero human deaths from dog-mediated rabies by 2030 will require substantial international collaboration and investment (Alemayehu *et al*., 2023; Ali, 2023). Despite the alarming statistics, some argue that rabies is preventable through effective vaccination and public health strategies, emphasizing the need for coordinated efforts to combat this neglected disease (Ali, 2022).

Mode of transmission, from CNS RABV reaches the salivary glands via cranial nerves (facial and glossopharyngeal nerves) and then it is excreted in saliva, which is ready to be transmitted to a new host. Most common way of transmission for rabies (90%) is bite of infected animals like dogs and cats, because of their intimate association with human being (Chhabra and Ichhpujani, 2003; Blanton *et al*., 2010). which is generally occurs to the victims in the form of physical and emotional trauma (Dwyer *et al*., 2007). Usually, RABV gains entry into the body via the wounds or cuts, not through the intact skin. So, spread needs deposition of RABV from the saliva or infected neural tissue into the bite wounds, open cuts in the skin and mucous membranes (Wyatt, 2007; Aghahowa and Ogbevoen, 2010).

Prevention strategy, the rabies virus, a member of the Rhabdoviridae family, is transmitted through bites or scratches from infected animals, leading to severe neurological symptoms and a fatal outcome if untreated (Samad *et al*., 2024; Javed 2023). Effective prevention strategies are essential to combatth is disease, focusing on vaccination and public awareness. Vaccination Strategies: Pre-exposure Prophylaxis (PrEP), recommended for high-risk individuals, involving a three-dose vaccine series to build immunity (Kaye *et al*., 2024). Post-exposure Prophylaxis (PEP), essential after potential rabies exposure, consisting of wound washing, human rabies immunoglobulin (HRIG), and a full vaccine course (Siegel, 2024). Vaccine Development, advances in vaccine technology, including recombinant and viral vector-based approaches, aim to enhance efficacy and accessibility (Kaye *et al*., 2024). Public Awareness andEducation:CommunityEngagement,raisingawar enessaboutrabiestransmissionand prevention is crucial, especially in regions with high incidence rates (Rupprecht and Salahuddin, 2019). Healthcare Provider Training, continuous education for healthcare professionals on rabies management and PEP protocols is vital to reduce errors in treatment (Siegel, 2024). Risk Reduction Measures: Identification of Rabies Vectors, understanding the primary animal reservoirs, such as dogs and bats, helps in implementing targeted control measures (Rupprecht and Salahuddin, 2019). Special Considerations for Vulnerable Populations, children are disproportionately affected, necessitating tailored educational and preventive strategies (Siegel, 2024).

Community awareness about rabies is very crucial in rabies prevention and control. For efficiently increasing awareness, the knowledge gap among the community should be identified and targeted. Community awareness of all aspects of rabies is generally lacking or limited, such as first aid or management of animal bites, pre- and post-exposure prophylaxis, responsible pet dog ownership, dog population management. Regarding the immediate measures to be carried out after a bite exposure, there is inadequate knowledge of the crucial need to wash wounds with soap and running water and apply

antiseptics and where vaccine is available. People may also contact local traditional healers for treatment, thus losing precious time and increasing the danger of infection and death (WHO, 2004).

Poor public awareness towards rabies is considered as one of the bottle necks for the prevention and control of the disease in Ethiopia especially in canine rabies endemic cities like Pawe district of Metekel Zone. Understanding communities' perceptions of cause, mode of transmission, symptoms, treatment and possible intervention measures of rabies Isan important step towards developing strategies aimed at controlling the disease and determining the level of implementation of planned activities in the future. Therefore, this study aims to assess the level of community knowledge, attitude and practices towards rabies and associated risk factors in Pawi district, Ethiopia, addressing critical gaps in community awareness and education.

1.1. Problem Statement

Rabies remains a critical public health concern in Ethiopia, particularly in rural areas like the Paw district of Metolazone, where free-roaming dogs are prevalent and access to healthcare is limited. Despite being a preventable disease, rabies continues to inflect significant morbidity and mortality on communities, primarily due to inadequate public awareness and understanding of the disease.

The prevalence of rabies in domestic animals, especially dogs, coupled with the high incidence of human exposure cases, emphasizes the urgent need for effective community education and intervention strategies. Current studies indicate that knowledge gaps exist in the community regarding rabies transmission, symptoms, and preventive measures. Additionally, the attitudes and practices of individuals towards rabies prevention and management remain poorly understood, which may hinder effective control efforts.

Furthermore, existing public health initiatives have not sufficiently addressed theocon-cultural factors influencing community perceptions and behaviors related to rabies. Without a comprehensive assessment of community knowledge, attitudes, and practices (KAP) towards rabies, efforts to formulate targeted public health interventions may be ineffective. This research aims to fill this gap by evaluating the KAP of residents in Pawe district regarding rabies, thereby informing strategies to enhance community awareness and reduce the burden of this preventable disease.

1.2. Significance of the Study

KAP studies reveal whether the community understands that rabies is almost 100% fatal, how it is transmitted(e.g., saliva contact, bites),and that it is preventable. They often expose myths, such as believing rabies is caused by hunger/thirst in dogs rather than a virus. A key significance is identifying high-risk practices, such as a preference for traditional healers or "holy water" over formal post-exposure prophylaxis (PEP). It helps quantify the extent of, for example, washing wounds with soap and water (an effective, cheap, and life-saving first-aid measure) versus ineffective, harmful, or slow treatments. The results provide data to tailor awareness campaigns. If the study shows, for example, that people rely on traditional healers, health authorities can target those practitioners for training to encourage immediate hospital referral. In areas like Pawi, where, in many Ethiopian regions, the disease has a strong, often underreported, impact on both humans and livestock, such studies facilitate a "One Health" approach, integrating human health and veterinary services.

1.3. General Objectives

- To assess community knowledge, attitudes, and practices towards rabies and associated risk factors in Pawe District, Metekel Zone, Benishangul Gumuz Regional state, Northwestern Ethiopia

1.4. Specific Objectives

- Toevaluatethelevelofawarenessandknowledgeregardingrabiestransmission,manifestations, and preventive measures in the district.
- To assess community attitudes and perceptions toward rabies prevention and control measures.
- Toexaminecommunitypracticesrelatedtorabiespreventionandpost-exposure management.
- To identify factors associated with community knowledge, attitude and practice about rabies in the study area.

2. MATERIALS AND METHOD

2.1. Study Area

The study was conducted from December 2024 to May 2025 to assess community knowledge, attitudes and practices (KAP) toward rabies in Pawi

District, Metekel Zone, Benishangul Gumuz Regional state, Ethiopia. Pawi District, is located approximately 565km Northwest of Addis Ababa, within Metekel Zone, Benishangul-Gumuz Regional State, Ethiopia. Geographically the district lies between 11°18´40´´ to 11º19´29´´ N latitude and from 36º24´26´´ to 36º25´27´´ E longitude. The elevation of the district ranges from 1000 to 1200 meters above sea level(MASL) with slightly undulating terrain extending from hilltops toward the 'Beles' River, which is the economic growth corridor of Ethiopia (MOFED, 2007). The mean annual rainfall of the district is 1,608.8 mm, and the annual minimum and maximum temperatures are 16.7°C and 32.6°C, respectively, with maximum temperatures reaching up to 42°C.

The total population of district is estimated to be 64,431 comprising 33,302 males and 31,129 females. Approximately 90% of households are rural agricultural households by Gizachew (2018) as it is cited in Tizazu (2019). The district has a total of 23 kebels of which 20 are rural and 3 are urban Kebeles. The livelihoods of the population primarily depend on mixed crop- livestock production.. The livestock population includes 65,323 cattle, 6,690 sheep, 9,855 goats, 2,096 horses, 633 donkeys, and 43,342 poultry. (The Agricultural office of the district livestock production unpublished report, 2024).

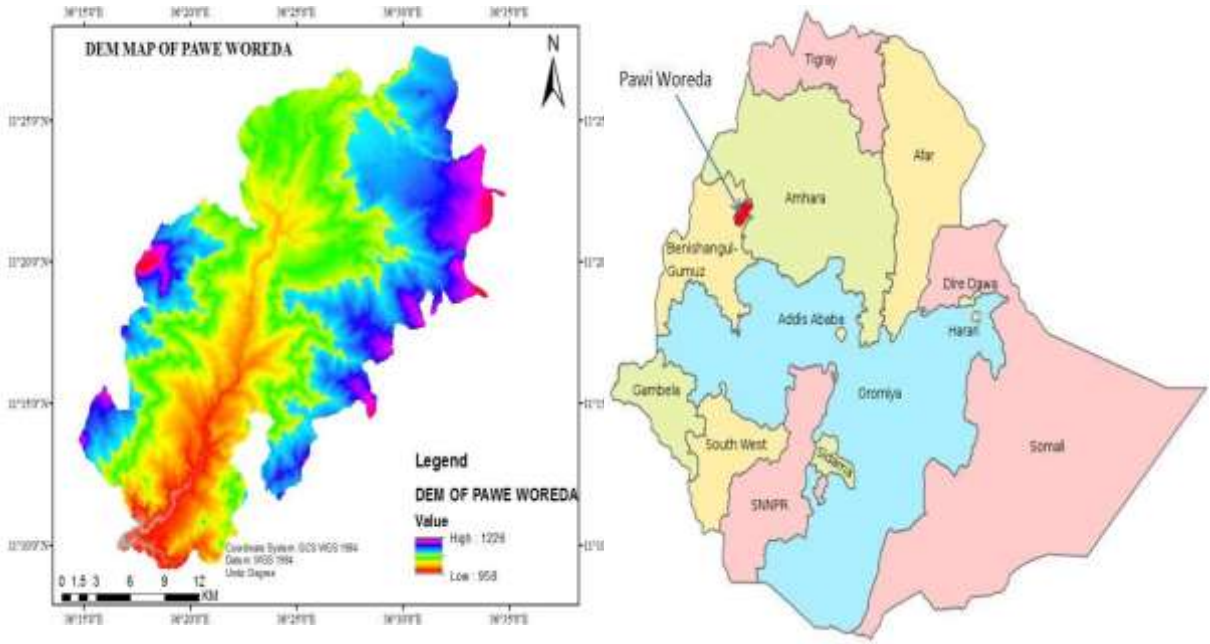

Figure 1: Map of study are a Pawi Woreda, Metekele Zone, B/Gumuz Region, Northwest Ethiopia (P.A.R.C, 2017 G.C).

2.2. Study Design

A community-based cross-sectional study design was employed to assess the community knowledge, attitudes and practices (KAP) towards rabies and associated risk factors among the community of Pawi Districts. This design was selected for its ability to provide a snapshot of population-level KAP at a specific point in time and for its efficiency in community-based research.

2.3. Study Population

The study populations were household heads or their spouses of above 15 years ages that lives in randomly selected kebeles of Paw District as permanent residents for at least six months.

2.4. Sample Size and Sampling Technique

A multi-stage sampling technique was used. Kebeles were considered primary sampling units, and households were considered secondary sampling units. From the entire primary sampling units, the kebeles were selected by simple sampling technique. The individual households from the selected kebeles were selected using a systematic random

sampling technique. Finally, from all the eligible respondents in a household, only one individual was selected randomly for the interview. Participants were chosen based on their availability at home and eligibility based on age (e.g., ≥ 15 years old with adequate communication and understanding skills). In the absence of eligible respondents in a given household, a replacement was made from the next household until the required sample size was obtained.

As no prior study on rabies awareness had been conducted in the area, the sample size was calculated by assuming a 50% expected prevalence of adequate knowledge. The sample size was determined using the formula described by Thrusfield (2005) with a 95% confidence level and a 5% margin of error:

$$n = \frac{(1.96)^2 \times P_{exp}(1 - P_{exp})}{d^2}$$

Where n = required sample size, Pexp = Expected proportion of population knowing about rabies (50%), and d^2= Desired absolute precision (0.05). Based on the formula, a total sample size of 384 was determined.

2.5. Data Collection

Data were collected using a structured, interviewer-administeredquestionnaireconsistingof34 closed-ended questions. The questionnaire comprised two sections: socio-demographic characteristics (sex, age, household size, educational status, occupation, religion, and dog ownership) and rabies-related KAP questions, including causes, modes of transmission, clinical signs, fatality nature of rabies, preventive measures, and post-exposure responses. The questionnaire was initially prepared in English, translated into Amharic, and administered through face-to-face interviews to ensure clarity and data quality.

2.6. Inclusion and Exclusion Criteria

Households with residents who had lived in the study area for six months or longer were and above 15 years old respondents included and household with residents who had lived less than six months and respondents in the household who cannot communicate and under 15 years were excluded from this study.

2.7. Data Management and Analysis

Collected data were checked for completeness and consistency, coded, and entered into Microsoft Excel, then exported to STATA version 17 for analysis. Descriptive statistics including frequencies, percentages, means, and standard deviations, were used to summarize the data. Binary and multivariable logistic regression analyses were performed to identify factors associated with knowledge, attitude, and practice scores related to rabies. Adjusted odds ratios with 95% confidence intervals were reported and p-values less than 0.05 were considered statistically significant.

2.8. Ethical Clearance

The study protocol was reviewed and approved by Institutional Review Board of Assosa University Research and Community Service Office. Oral informed consents were obtained from each participant after informing them about the purpose of the study as well as the risks, benefit and rights of the study participants. Only voluntary participants were involved in the study. All the information obtained from the study participants were kept confidential.

3. RESULTS

This section represents the findings of study in accordance to the research objectives and research questions. Data were analyzed using descriptive statistics and multivariable logistic regression in STATA version 17. Results are presented using tables, followed by concise narrative descriptions highlighting key patterns and statistically significant findings.

3.1 Socio-demographic characteristics of respondents

A total of 384 participants were interviewed in Pawe District. Most participants were male (73.2%) and aged 30–

45 years (48.7%), followed by those >45 years (29.2%) and 15–29 years (22.1%) (Table 1). Regarding education, 33.6% had a diploma or higher, 27.9% had primary education, 16.4% had secondary education, and 22.1% were non-educated. Farmers represented the largest occupational group (43.2%), while health professionals (4.2%) and veterinarians (2.3%) constituted smaller proportions. Most participants were Orthodox Christians (58.3%), followed by Muslims (34.4%) and Protestants (6.8%). Dog ownership was common, with 59.4% of respondents reporting owning at least one dog.

Table 1:Socio-demographiccharacteristicsofrespondents(n=384)

Variable	**Category**	**Frequency**	**Percent(%)**
Residence	Urban	211	54.9
	Rural	173	45.1
Age(years)	15–29	85	22.1
	30–45	187	48.7
	>45	112	29.2
Sex	Male	281	73.2
	Female	103	26.8
Education	Non-educated	85	22.1
	Primary	107	27.9
	Secondary	63	16.4
	Diploma and above	129	33.6
Occupation	Farmer	166	43.2
	Health professional	16	4.2
	Veterinarian	9	2.3
	Merchant	71	18.5
	Other	122	31.8
Religion	Orthodox	224	58.3
	Muslim	132	34.4
	Protestant	26	6.8
	Other	2	0.5
Dog ownership	Own dog	228	59.4
	Do not own dog	156	40.6
Total		**384**	**100**

3.2 Knowledge of respondents toward rabies

Most respondents(98.7%) were aware of rabies, butonly36.97% correctly identified a virus as the cause, while 40.88% incorrectly believed psychological problems were responsible, and 19.5% did not know the cause (Table 2). Summer (65.4%) was identified as the most common season of rabies occurrence, and dogs and wild canines (75%) were recognized as the main source. Most respondents knew that dogs can be vaccinated (93.8%) and identified bites from infected animals as a key mode of transmission. Knowledge gaps were observed in some clinical signs of rabies in humans and animals.

Table2:Responseofstudyparticipantspertainingtoknowledgetowardrabies(n=384)

Questions concerning Knowledge of the participants	**Response**	**Frequency**	**Percent (%)**
Are you areographies	Yes	200	52.08
	No	184	47.92
Have you ever heard of rabies	Yes	379	98.7
	No	5	1.3
Where you heard of rabies	From media	24	6.33
	Animal health workers	132	34.82
	Family	108	28.49
	Religious leaders	3	0.79
	Teachers	112	29.55
	Other	0	0
What do you think causes the disease	Virus	142	36.97
	Psychological problem	157	40.88
	Hereditary	5	1.30
	Witchcraft	1	0.26
	Do not know	75	19.53
	Other	4	1.04
Season rabies is more common	Summer	251	65.4
	Autumn	6	1.6
	Winter	76	19.8
	Spring	51	13.3
What is the source of Rabies	Dog	63	16.40
	Dogan Cat	20	5.20
	Dogan wild canine	288	75

	I do not	13	3.38
Species affected by rabies	Dog only	54	14.06
	Dogan human	124	32.29
	Human and other domestic animals	206	53.64
Rabies transmitted from animal to human	Yes	362	94.27
	No	22	5.72
How rabies is transmitted	Bite by any rabid animal	129	35.63
	Contact with saliva	209	57.73
	Raw meat and milk	10	2.76
	Rabid animal respiration	6	1.65
	Do not know	8	2.21
Signs and symptoms inhuman	Paralysis	31	8.07
	Stop eating and drinking	37	9.64
	Hypersalivation	43	11.19
	Movement in abdomen	273	71.10
Sign and symptoms rabies in animal	Paralysis	8	2.08
	Salivation	173	45.05
	Stop eating and drinking	10	2.60
	Behavioral change	78	20.31
	All	115	29.94
Fatality nature of rabies	Yes	361	94.01
	No	23	5.98
The incubation period of rabies	Immediate	50	13.02
	Between3to90days	289	75.26
	Do not know	45	11.72
Management of your dogs	In a cage	192	50
	Free to roam in side	4	1.04
	Freetooutsidecompound	4	1.04
	Tiedoutsidethecage	151	39.32

	Cohabitwithowner	1	0.26
	Free roam sometimes in compound	32	8.33
Health care of your dog	Vaccination	360	93.75
	Visittovet. clinic	12	3.12
	Home treatment traditionally	7	1.82
	Don't know	5	1.30

3.3 Attitude of respondents toward rabies

Regarding attitudes, 96.4% believed rabies can be prevented by dog vaccination, whereas only 40.4% recognized the importance of post-exposure prophylaxis (PEP). Most respondents (78.6%) considered free-roaming dogs are important in rabies transmission, and 91.7% believed that eliminating or confining stray dogs could prevent rabies. Misconceptions remained, as 37.2% believed that eating meat of rabid animals could cure rabies (Table 3).

Table3:Descriptionsofattitudeofrespondentstowardrabies(n=384)

Questions concerning attitude of the participants	**Category**	**Frequency**	**Percent(%)**
Rabiespreventable bydogvaccination	Yes	370	96.35
	No	14	3.64
Postexposureprophylaxispreventdisease	Yes	155	40.36
	No	229	59.64
Eatingroasted meatofananimaldied ofrabies couldbemedicineforrabies	Yes	143	37.24
	No	241	62.76
Free-roamingdogscontributetotransmission	Yes	302	78.64
	No	82	21.35
Rabies treatable after symptom onset	Yes	228	59.37
	No	132	34.37
	Donot Know	24	6.25
Eliminating/confiningstraydogspreventsrabies	Yes	352	91.66
	No	22	5.72
	Donot know	10	2.60

3.4 Practicesofrespondentstoward rabies

Following exposure to suspected rabid animals, the majority of respondents (54.7%) relied on traditional medicine, 31.3%washed the wound with soap and water, and 10.2%tied the wound with cloth. Most participants (93.2%) reported seeking hospital care immediately after a bite. Rabies management often involved herbal remedies (53.9%), with only 16.9% receiving PEP. Actions toward rabid animals included killing (57.6%) or tying (41.4%) (Table 4).

Table4:Descriptionsofpracticeofrespondentstowardrabies(n=384)

Questionsconcerning Practice	**Category**	**Frequency**	**Percent(%)**
Firstaidappliedafterbite	Washingwithsoapandwater	120	31.25
	Tying with cloth	39	10.2
	Usetraditionalmedicine	210	54.68
	Nothing	15	3.90
Hospitalvisittimingafterbite	Immediately	358	93.22
	Next day	4	1.04
	Between2to14days	10	2.60
	After14 days	7	1.82
	Wouldd onothing	5	1.30
Rabiessuspectedbitemanaged	Herbal remedies	207	53.90
	Postexposure prophylaxis	65	16.92
	Holy water	39	10.15
	I don’t know	73	19.01
Actiontowardrabidanimal	Tied	159	41.40
	Killed by community	221	57.55
	Do not know	4	1.04
The carcassthatdiedfromrabies	Throwitaway	24	6.25
	Buryingandburning	357	92.96
	Cutheadforinvestigation	3	0.78
Communitiesathighriskofrabies	Children	189	49.22
	Oldpeople	1	0.26
	Youngs	3	0.78
	All	191	49.74
Believeontraditionalmedication	Yes	282	73.43
	No	102	26.56

3.5 OverallKAP levels

Based on scoring, 52.1% of respondents demonstrated good knowledge, 40.1% had a positive attitude, and 48.2% reported acceptable practices toward rabies (Table 5). Poor attitude scores were most common, indicating gaps in understanding preventive measures such as PEP.

Table 5: FrequencyandproportionsofrespondentsaccordingtoKAPlevelsonrabies(n=384)

Variables	Mean	SD	Goodn(%)	Poorn(%)
KAPComponent				
Knowledge	1.98	0.87	200(52.1)	184(47.9)
Attitude	1.37	0.43	154(40.1)	230(59.9)
Practice	1.82	0.44	185(48.2)	199(51.8)

3.6 FactorsAssociatedwithKnowledge,Attitudes,andPracticestowardRabies

Multivariable logistic regression analysis showed that residence, age, sex, education, religion, and dog ownership were significantly associated with knowledge, attitudes, and practices (KAP) regarding rabies (Table 6).

Knowledge: Urban residents had higher odds of good knowledge compared to rural participants (OR = 0.67; 95% CI: 0.56–0.80; $p < 0.001$). Male participants were also more likely to have good knowledge than females (OR = 1.90; 95% CI: 1.56–2.32; $p < 0.001$). Dog owners demonstrated higher knowledge levels than non-owners (OR = 0.77; 95% CI: 0.64– 0.94; $p = 0.01$), and older age groups were more knowledgeable compared to younger participants.

Attitudes: Positiveattitudestowardrabiespreventionandcontrolweresignificantlyassociated with male sex (OR = 2.40; 95% CI: 1.91–3.00; $p < 0.001$) and higher educational attainment. Despite this, some misconceptions about rabies transmission and prevention persisted even among educated respondents.

Practices: Good rabies prevention practices were more likely among urban residents (OR = 0.88;95%CI:0.80–0.97;p=0.01),males(OR=1.95;95%CI:1.81–2.11;$p < 0.001$), and dog owners (OR = 0.82; 95% CI: 0.67–1.00; $p < 0.05$). Conversely, participants identifying as OrthodoxChristianswere less likely to demonstrate good practices(OR= 0.47;95%CI: 0.38– 0.58; $p < 0.05$).

Overall, these findings indicate that gender, residence, age, education, religion, and dog ownership are key determinants of rabies-related knowledge, attitudes, and practices in the community, highlighting priority targets for tailored public health interventions.

Table6:Multivariable logistic regression analysis of factors associated with Knowledge, Attitude, and Practice toward rabies(n=384)

Variable	Category	Knowledge OR(95%CI)	p-value	Attitude OR(95%CI)	p-value	Practice OR(95%CI)	p-value
Residence	Rural	Ref	-	Ref	-	Ref	-
	Urban	0.67(0.56–0.80)	<0.001	1.00(0.62–1.60)	1.00	0.88(0.80–0.97)	0.01
Age(years)	15–29	Ref	-	Ref	-	Ref	-
	30–45	1.10(0.95–1.28)	0.18	1.25(0.95–1.65)	0.11	1.15(0.95–1.40)	0.14

	>45	1.25(1.05–1.50)	0.01	1.75(1.20–2.55)	0.003	1.80(1.35–2.42)	<0.001
Sex	Female	Ref	-	Ref	-	Ref	-
	Male	1.90(1.56–2.32)	<0.001	2.40(1.91–3.00)	<0.001	1.95(1.81–2.11)	<0.001
Education	Primary	Ref	-	Ref	-	Ref	-
	Non-educated	0.86(0.77–0.95)	0.007	1.00(0.79–1.25)	1.00	0.85(0.72–1.01)	0.06
	Secondary	1.15(0.85–1.55)	0.37	1.95(1.10–3.45)	0.02	1.55(0.90–2.68)	0.12
	Diploma & above	0.90(0.65–1.25)	0.54	2.10(1.20–3.70)	0.01	1.70(1.05–2.80)	0.03
Religion	Muslim	Ref	-	Ref	-	Ref	-
	Orthodox	0.84(0.72–0.97)	0.02	1.00(0.85–1.16)	1.00	0.47(0.38–0.58)	<0.001
	Protestant	1.05(0.70–1.58)	0.80	1.20(0.80–1.80)	0.36	0.75(0.45–1.25)	0.27
	Other	NA[1]	NA	1.00	-	NA[1]	NA
Occupation	Farmer	Ref	-	Ref	-	Ref	-
	Health professional	NA[1]	NA	1.80(0.90–3.50)	0.09	1.95(0.85–4.50)	0.11
	Veterinarian	NA[1]	NA	NA[1]	NA	NA	
	Merchant	1.32(0.89–1.95)	0.17	1.25(0.85–1.85)	0.25	1.5	
	Other	1.10(0.78–1.55)	0.59	1.80(1.10–2.90)	0.02	1.2	
Dog ownership	No	Ref	-	Ref	-	Ref	
	Yes	0.77(0.64–0.94)	0.01	1.00(0.82–1.22)	1.00	0.8	

**NA=Notapplicableornotestimatedduetoperfectpredictionorsmallsamplesize, *Ref=Reference categories, *OR=Odds Ratio;*CI= Confidence Interval; *p < 0.05 considered statistically significant*

4. DISCUSSION

The present study highlights the critical role of rabies remains one of the most devastating yet preventable zoonotic diseases, with an estimated 59,000 human deaths annually worldwide, predominantly affecting rural communities in Africa and Asia (Hampson *et al*., 2015). The disease's near 100% fatality rate once clinical symptoms appear makes prevention through proper knowledge, attitudes, and practices (KAP) absolutely critical (World Health Organization (WHO, 2018). In the Pawi District context, our findings reveal a complex interplay between socio demographic factors and rabies prevention behaviors that mirror global patterns while deep unique local challenges that demand targeted interventions.

However, as compared to the present findings the earlier works of Adane *et al*. (2022) in Amhara region indicated that, about 31.8% of respondents believe that rabies can be treated after the onset of clinical signs. Contrary to this, Hampson *et al*., (2015) reported, once the clinical signs are seen there is no way for recovery. The respondents argue that traditional healers can diagnose the formation of puppies in the stomach of the victims due to rabid dog bites and they can treat the victims.

The study's most alarming findingwastheprofoundknowledgegap:52%ofrespondentsurban Ethiopian settings like Kombolcha (85.7%) by Addis *et al*., (2019) and Bahir Dar (64.1%) by Guadu *et al*., (2014), where better healthcare

infrastructure and education access exist. The urban-rural disparity becomes particularly concerning when examining specific misconceptions - 70% of respondents erroneously believed rabies could spread through eating infected meat, a dangerous fallacy also documented in Kersa District (Adem *et al*., 2024) and rural India (Sudarshan *et al*., 2007). These persistent myths likely stem from limited health education combined with traditional beliefs about disease transmission (Sambo *et al*., 2014), suggesting current awareness campaigns fail to penetrate rural communities effectively.

The result is consistent with previous studies of KAP on public health important issues conducted in Ethiopia (Gebeyehu *et al*., 2021;Bihon *et al*., 2022) and other countries including China (Xiang *et al*.,2016), and India (Tiwari *et al*., 2019).This is not surprising as most public health education and accessibility to health infrastructures are concentrated in urban than rural areas and this allows them to have better preventive practice measures. Urban residents have greater resources, higher density and better infrastructures to have better access to health service and education (Matibag *et al*., 2007, WHO, 2016).

As compared to the present findings, the findings of Weldegerima *et al.,* (2020) in Mekelle city indicated that, among household respondents, 88.2% had heard about rabies before exposure, suggesting that victims are aware of the presence of rabies in their area. And also majority (88.9%) of the victims had heard about rabies from informal sources (family, friends and neighbors), which is similar with study conducted in Tanzania (Sambo *et al*., 2014).

Socio-demographic analysis revealed striking disparities in knowledge distribution. Educated individuals showed a 0.86 times greater likelihood of proper understanding (OR = 0.86, *p* = 0.007; Teklu *et al*., 2017), mirroring findings from Nigeria (Okoh, 2016) and Bangladesh (Hossain *et al*., 2012) that confirm education as the strongest predictor of health literacy.

The gender gap was equally concerning, with males demonstrating 1.90 times better knowledge than females (OR = 1.90, p = 0.000; Wole law *et al*., 2022), reflecting deep-seated inequalities in education access and health decision-making power for rural Ethiopian women (Maes *et al*., 2015). Youth(15-30 years) consistently outperformed older adults across all KAP metrics, likely benefiting from Ethiopia's recent education expansion that has raised youth literacy rates to 70% compared to 40% among older generations (Central Statistical Agency [CSA] of Ethiopia, 2021).

Comparably, Weldegerima *et al*. (2020)in Mekelle city among household, revealed that female household heads were 1.5 times more likely (AOR = 1.5, 95%CI = 1.05, 2.13) to have good knowledge towards rabies as compared to male household heads.It was agreed with study conducted in Addis Ababa (Ali *et al*., 2013) and Jimma town (Kabeta *et al*., 2015). This could be due to the reason that females get awareness about rabies from house to house by urban health extension workers, women development army, giving health education in health institution and better chance of acquiring correct information about rabies.

However, Weldegerima *et al*. (2020) reported, household heads with good knowledge about rabies were 56.1%(95% CI =52.2, 59.9), whichwas lower thanstudies conducted in SriLanka (89.6%) (Widyastul *et al*., 2015), Guatemala (82%) (Maran *et al*., 2015), Tanzania (96%)(Sabo*etal*.,2014),AddisAbaba(83%)(Ali*etal*.,2013),Bahir-Dar(60.1%)(Guadu*etal*., 2014), Gondar (90.8%) (Reta *et al*., 2015) and Debretabor (65.1%) (Ali *et al*., 2015). The possible reasons forth are difference could be due to low health promotion particularly regarding rabies in this study area.

Weldegerima *et al*. (2020) reported, among the household heads, 56.2% (95%CI = 52.4, 60.1) had positive attitude about rabies, in Bahir-Dar (42.8%) (Ali *et al*., 2013), Addis Ababa (52.3%) (Ali *et al*., 2013) and Debretabor (40.6%)Ali *et al*, 2015). This difference probably might be explained by the lack of health education about rabies in the study site. Moreover, attitude of the current finding isgreaterthanthestudyconducted and the time difference which could bring a difference on awareness of study participants.

The study uncovered a disturbing paradox in risk perception: while 98% correctly identified rabies as invariably fatal without treatment - matching awareness levels in Adigrat Town(Sayid *et al*., 2021) - only 5.5% considered it a serious community concern. This complacency mirrors findings from Haiti's cholera outbreaks (Rouzier *et al*., 2013) and Liberia's Ebola epidemic (Abramowitz *et al*., 2015), where communities developed "hierarchies of fear" that prioritized immediatevisiblethreatsoverstatisticallygreaterbut lessconspicuousdangers.The prevalent reliance

on traditional remedies (60%), including practices like "koso" (local cauterization)documented inBahirDar(Guadu *etal*., 2014),representsrationalhealth-seeking behavior in contexts where biomedical care is inaccessible or unaffordable (Birhanu *et al*., 2016). This is exacerbated by the 62% uncertainty about dog vaccination's role in prevention, knowledge gap that similarly hampered Uganda's rabies control efforts (Wallace *et al*., 2017).

Preventive practicesrevealed systemic failuresatmultiple levels. The complete absence of dog vaccination in the study population reflects economic realities where the 50 ETB vaccine cost represents nearly 10% of a pastoralist's monthly income (Behnke and Metaferia, 2012). The 88% non-registration of dogs parallels challenges in Kenya (Kitala *et al*., 2002) but contrasts withTanzania's successfulregistrationprograms (Sambo *et al*., 2014), suggesting policy rather than cultural barriers. Free-roaming dogs (57.5%) create transmission dynamics identical to Nepal's Kathmandu Valley (Tiwari *et al*., 2019), where street dogs maintain rabies reservoirs despite vaccination campaigns. Post-exposure practices were particularly alarming - 60%relied on herbal treatments while only 30% soughtmedical care, rates comparable to Delhi(Lai *et al*., 2005) but far below Sri Lanka's 89% PEP compliance (Matibag *et al*., 2009).
The result is much higher compared to reports in previous studies where only 56.2% of the respondents had a positive attitude towards rabies (kabeta *et al*., 2015). This can indicate that the community has a better chance of implementing control measures if the concerned bodies are doing their bestin this regard. However, observations in this study showed that only 43% ofthe respondentshad good practicestowardsrabies. This is much lowerthanpreviousreports in Ethiopia such as 61.3% in Mekelle town (Kabeta *et al*., 2015) and also in other African country, Nigeria (74%) (Edukugho *et al*., 2018). The lower preventive practice score in the current study might be associated with the involvement of participants from rural areaswhereas in previous studies (e.g. in Mekelle, Ethiopia), participants were drawn from urban areas. Previous studies reports showed that pet care practices are better in urban than ruralareas (Matibag *et al*., 2007).

Comparably, Weldegerima *et al*., (2020) in Mekelle city, indicated, 79% of household heads had vaccinated their dogs.Similarly, with study conducted in SriLanka (76%) (Widyastul *et al*., 2015);in Kenya (35%)(Mucheru *et al*., 2014), Jimma (4.8%)(Kabeta *et al*., 2015), Gondar 42% (Reta *et al*., 2015) and Dessie (35.8%) towns in Ethiopia (Shumuye *et al*., 2016). This may be attributed to a number of factors that include availability of animal vaccines, the study time and good information sharing in this study area.

The study's most promising finding - universalPEP awareness (100%) - mayreflect Ethiopia's recent investment in rabies centers (Vigilato *et al*., 2013), though the 30% care-seeking rate shows knowledge doesn't translate to action when faced with transportation costs averaging150 ETBper hospitalvisit (Yibrahand Damtie, 2015). Thegeographicdisparityfavoring Gaba Dafino 01 residents (Adj. OR = 2.821, p = 0.011) mirrors Mozambique's experience where each kilometer from a health center reduced PEP compliance by 3% (Hampson *et al*, 2015).

These findings demand innovative, context-specific solutions. Mobile technologycould bridge knowledge gaps - SMS alerts increased vaccination rates by 22% in Malawi (Sambo *et al*., 2017). Community-based dog vaccination - successful in Chad (Mbaipago *et al*., 2020) - could overcome infrastructure limits. Most critically, interventions must address the "know-do gap" through behavioral nudges - Tanzania's "One Health" clubs improved bite reporting by 40% (Mazet *et al*., 2014). Without such multifaceted approaches, rabies will remain a tragicexample of how poverty and inequity perpetuate preventable suffering in rural Ethiopia.
Adane *et al*., (2022) amongresidents of Amhararegion, reported most of the respondents knew that rabies is a fatal disease and cannot cure without treatment. And 89.2% of them knew the availability of PEP as a treatment for rabies exposed individuals. This favorable knowledge is helpful to implement the recommendations that any individual with a bite suspected of having rabies should seek medical attention as quickly as possible (WHO, 2010). However, 63.7% of the respondents accept that traditional treatments are more effective, but this is problematic as the effectiveness of most of traditional treatments is not known. Generally, the community has good knowledge of the availability of modern medical treatment and the fatal nature of the disease if left untreated. However, this favorable knowledge is masked by their treatment options which incline to traditional treatments and there is a need to create awareness among the public to drive their demand for modern medical options.

5. CONCLUSIONANDRECOMMANDATION

The study revealed significant gaps in knowledge, attitudes, and practices related to rabies in the study area. Misconceptions about transmission, low dog vaccination rates, and reliance on traditional remedies are major concerns. Younger, educated males tend to have better knowledge, attitudes, and practices, while older individuals,

females, and those with lower education levels require targeted interventions.
Basedontheaboveconclusionthefollowingrecommendationswereforwarded:

- ✓ PublicHealthCampaigns:Developculturallytailorededucationalcampaignsto address misconceptions and improve awareness of rabies transmission, prevention, and treatment. It should focus on improving awareness, promoting dog vaccination, and encouraging proper post-bite care to reduce the burden of rabies in the community.
- ✓ Access to Healthcare and Vaccines: Improve access to PEP and dog vaccination services, particularly in rural and underserved areas.
- ✓ Community Engagement: Engagecommunityleadersandtraditionalhealersto promote modern medical practices alongside traditional remedies.
- ✓ Targeted Interventions: Focusonolder, lesseducated populationsand geographic areas with poor practices to reduce disparities in KAP outcomes.
- ✓ Research inter sectoral collaboration between, Agriculture office, Human Health and Environmental Health sectors to optimize rabies elimination Strategy.
- ✓ Collaborate withtraditional healers to One Health Approach promote post-bite medical care alongside cultural practices.

6. REFERENCES

Abdelkadir, k. S.,berhe, g.,bsrat, a.,and yohannes, g.(2024). Communityknowledge, attitude and practices about rabies prevention and control in enderta wereda, tigray. *Quantum Journal of Medical and Health Sciences*, ***3***(2), 1-14.

Abdella, S., Ahmed, K., Salim, B., Ashenefe, B., Mulugeta, Y., Girma, E., ... and Getahun, D. (2022). High rabies burden and low vaccination status among dogs inflicting bite in Addis Ababa: an urgent call for action. *The Journal of Infection in Developing Countries*, ***16***(08.1), 15S-19S.

Abera, E., Assefa, A., Belete, S. and Mekonen, N. (2015): Review on Rabies, with Emphasis on Disease Control and Eradication Measures. *International Journal of Basic and Applied Virology, 4: Pp. 60- 70.*

Admassu, P., Mekonnen, Y, (2014). Rabies and Its Folk Drugs Remedies In Ethiopia: A Review. *International Journal of Basic And Applied Virology* **3**(2): 22 – 27.

ADPH (2010): Alabama Department of Public Health. Rabies: Control and Bite. Division of Epidemiology, Branch. Available at: www.adph.org/epi/assets/Rabies Bite Manual.pdf, Accessed on February 2020. Pp. 6-28.

Aga, A. M.,Mulugeta, D.,Tesera,Y.,Hurisa, B.,Lemma, H.,Bizuneh, A.,...and Nigussie, D. (2023). Health professionals KAP study on rabies exposure assessment and NTV administration in Ethiopia. *F1000 Research*, *12*, 582.

Aga, A.M., Hurisa, B. and Urga, K. (2016): Current situation of rabies prevention and control indevelopingcountries:Ethiopiaperspective. *InfectiousDiseasePreventionMedicine, **4***(1):1–6.

Aghahowa, S. E., and Ogbevoen, R. N. (2010). Incidence of dog bite and anti-rabies vaccine utilization in the, University of Benin Teaching Hospital, Benin City, Nigeria: A 12- year assessment. *Vaccine*, ***28***(30), 4847-4850.

Alemayehu, T., Oguttu, B., Rupprecht, C.E., and Niyas, V. K. M. (2024). Rabies vaccinations save lives but where are the vaccines? Global vaccine inequity and escalating rabies- related mortality in low-and middle-income countries. *International Journal of Infectious Diseases*, *140*, 49-51.

Ali, A., Ahmed, E. Y., and Sifer, D. (2013). A study on knowledge, attitude and practice of rabiesamongresidents inAddis Ababa, Ethiopia. *EthiopianVeterinaryJournal*,***17***(2), 19-35.

Ali, A., Mengistu, F., Hussein, K., Getahun, G., Deressa, A., Yimer, E., Tafesse, K. (2010). Overview of rabies in and around Addis Ababa, in animal examined in ehnrizoonosis laboratory between, 2003 and 2009. *Ethiopian veterinary Journal **14**(2):* 91-101.

Ali, J. A. (2022).Preventionand ControlofRabiesin Animals and humans inEthiopia. *Health Sci J*, ***16***(8), 1-10.

Asfaw, G. B., Abagero, A., Addissie, A., Yalew, A. W., Watere, S. H., Desta, G. B., ... and Deressa, S. G. (2024). Epidemiology of suspected rabies cases in Ethiopia: 2018– 2022. *One Health Advances*, ***2***(1), 3.

Atuman YJ, Ogunkoya AB, Adawa DAY, Nok AJ, Biallah MB. (2014). Dog ecology, dogbites and rabies vaccination rates in Bauchi State, Nigeria. *Int J Vet Sci Med.* 2:41–45.

Bahiru A, Molla W, YizengawL, Mekonnen SA, Jemberu WT. to Rabies Knowledge, attitude, and practice related amongresidentsofAmhararegion, Ethiopia. Heliyon. 2022 Nov1; 8(11).

https://doi.org/10.1016/j.heliyon.2022.e11366PMID:36387566

Bahiru, A., Molla, W., Yizengaw, L., Mekonnen, S. A., and Jemberu, W. T. (2022). Knowledge, attitude and practice related to rabies among residents of Amhara region, Ethiopia. *Heliyon*, ***8***(11).

Beresa, T. G., and Beriso, T. E. (2023). Assessment of knowledge, attitude, and practice of respondents' towards Rabies and associated risk factors in Shone Town, Hadiya Zone, Southern Ethiopia. *medRxiv*, 2023-09.

Berhanu, A., Asfaw, Z., Kelbessa, E, (2006). Ethnobotany Of Plants Used As Insecticides, Repellents And Anti-Malarial Agents In Jabitehnan District, West Gojjam. Ethiopia. *J. Sci.*, ***29***(1): 87 – 92.

Bilal A. Rabies is a zoonotic disease: a literature review. Occup. Med. Health Aff. 2021; 9 (2.

Bishop,G.C.,Durrheim,D.N.,Kloeck,P.E.,Godlonton,J.D.,Bingham,J.,Speare,R.,and Advisory,R.(2010).GuidefortheMedical,Veterinaryandallied Professions. *Department of Agriculture, Forestry, and Fisheries, Republic of South Africa*.

Blanton, J. D., Palmer, D., and Rupprecht, C. E. (2010). Rabies surveillance in the United States during 2009. *Journal of the American Veterinary Medical Association*, ***237***(6), 646-657.

California Department of Public Health, CDPH, Veterinary Public Health Section, "Compendium of Rabies Control and Prevention," pp. 1-17, 2012.

CatherineM.andBrown,"Compendium of AnimalRabiesPreventionandControlCommittee CompendiumofAnimalRabiesPreventionand Control,"(2011).

CDCreportonrabiesinEthiopia and globalstatus,2018.

Chalchisa, D., Megersa, M., &Beyene, A. (2018). Assessment ofthe qualityofdrinking water in storage tanks and its implication on the safety of urban water supply in developing countries. *Environmental Systems Research, **6*** (1), 1–6.

Chernet, B., Nejash, A. (2016). Review ofrabies controland prevention. *Journal of Medicine, Physiology and Biophysics vol*. 23: 45 – 53.

Chhabra,M.,andIchhpujani,R.L.(2003).Animalbites:thecurrentmanagementguidelines. *IndianJournalofPediatrics*, 70,S11-6.

Cleaveland, S., Kaare, M., Tiringa, P., Mlengeya, T., and Barrat, J. (2006). A dog rabies vaccination campaign in rural Africa: Impact on the incidence of dog rabies . https://doi.org/10.1016/j.vaccine.2005.11.027

Collier, L., and Oxford, J. (2006). Introduction to the hepatitis viruses. *Human Virology. AText for Students of Medicine, Dentistry, and Microbiology*, 159-160.

Constable, D.P., Hinchcliff, W.K., Done, S.H. and GrÜnberg, W. (2017): VeterinaryMedicine: A Textbook of the Diseases of Cattle, Horses, Sheep, Pigs, and Goats. 11th ed. Elsevier, Missouri,USA, Pp. 1228-1238.

Davlin, S. L., Lapiz, S. M., Miranda, M. E., and Murray, K. O. (2013).Knowledge,attitudes, and practices regarding rabies in Filipinos following implementation of the Bohol Rabies Prevention and Elimination Program. Epidemiology and Infection, **14 (**7), 1476–1485. https://doi.org/10.1017/S0950268813000071

De Benedictis P, Sow A, Fusaro A, Veggiato C, Talbi C, Kabore A, Dundon WG, Bourhy H, Capua I. (2010). Phylogenetic analysis of rabies viruses from Burkina Faso, 2007. *Zoonoses Public Health.* ***57***(7–8):e42–e4

Deressa, A. (2012). Current rabies diagnosis and future prospect in Ethiopia. In: proceeding of national workshop on rabies prevention and control. Infectious and non – infectious disease researchdirectorate, Ethiopia healthand nutritionresearch institute, FMoH, 18 – 19 October 2012 Adama, Ethiopia, pp 113. "unpublished"

Deressa, A., Ali, A., Beyene, M., Newayesilasie, B. and Yimer, E. (2010):The status ofrabies in Ethiopia: A retrospective record review. *Ethiopian Journal of Health Development*, 24: 127–132.

DietzscholdB,SchnellM,KoprowskiH.Pathogenesisofrabies.Theworldofrhabdoviruses. 2005 Jan1:45–56.

Dilbato, T.,Desalegn, N., Negasa, T.,Mekonnin, G., Abdisa, K., Dejene, H.,... and Zewdu, E. (2024). Knowledge, Attitude, and Practice (KAP) towardsRabies, its Suspected Cases and Associated Economic Impact in West Shewa Zone, Oromia, Ethiopia. *medRxiv*, 2024-10.

Dimaano, E. M., Scholand, S. J., Alera, M. T. and Belandres, D. B. (2011): Clinical and epidemiologicalfeaturesofhumanrabiescases in thePhilippines: Areview from1987 to 2006. *International Journal of Infectious Diseases*, *15*(7), e495-e499.

Dubie, T.,Lakew,B.,andShiferaw,H.(2024).Assessmentofknowledge, attitudeandpractice towards rabies and associated factors among household heads in Welkait district, Ethiopia. BMC Public Health, 24, 3580. https://doi.org/10.1186/s12889-024-21130-3

Dwyer, J. P., Douglas, T. S., and Van As, A. B. (2007). Dog bite injuries in children–a review of data from a South

African paediatric trauma unit. *South African Medical Journal*, ***97***(8), 597-600.

Eshetu, Y., Bethlehem, N., Girma, T., Yared, M.,and Yoseph, B. (2000). Situationofrabies in Ethiopia: Aretrospective study1990–2000.*Ethiopian Journal of Health Development*, 16, 105–112.

Esmael, H., and Ferede, B. (2023). Rabies suspected human cases in and around Jimma zone, south west Ethiopia. *Asian Journal of Medical and Biological Research*, ***9***(4), 126-133.

Ethiopian Health and Nutrition Research Institute (EHNRI). (2012). National rabies control guidelines. EHNRI

EthiopianNationalRabiesControlandEliminationPlan,FAO,2020. Fekadu, M. (1993). Canine rabies.

Feng, Y., Ma,J.,Sun, S., Chi, L., Kou,Z.,andTu,C. (2021).Epidemiologyofanimalrabies— China, 2010–2020. *China CDC Weekly*, ***3***(39), 815.

Fooks, A. R., McElhinney, L. M., Horton, D., Banyard, A., Johnson, N., Marston, D. A., ... and Rupprecht, C. E. (2012). Molecular tools for rabies diagnosis in animals. In*OIE, compendium of theOIEglobal conference on rabiescontrol. Paris: World Organisation for Animal Health* (pp. 75-87).

Fullas, F., (2010). Ethiopian Medicinal Plants In Veterinary Healthcare: A Mini- Review. Ethiopia E- *Journal ForResearch AndInnovation Foresight* **2**(1):48 – 58.

Gebeyaw, S., and Teshome, D. (2016). Studyon communityknowledge, attitude, and practice of rabies in and around Dessie City. *Austin Journal of Veterinary Science & Animal Husbandry*, **3**(1), 1020.

Guadu, T., Shite, A., Chanie, M., Bogale, B., and Fentahun, T. (2014). Assessment of knowledge, attitude and practices about rabies and associated factors: In the case of Bahir Dar town. *Global Veterinaria, 13*, 348–354.

Gumi, B., Girma S., Mohamed H. and Deressa A. (2018): Rabies outbreak among livestock ina pastoralist community, southern Ethiopia. *Ethiopian Journal of Science, 28*(6):805– 808.

Hagos, W. G., Muchie, K. F., Gebru, G. G., Mezgebe, G. G., Reda, K. A., and Dachew, B. A. (2020).Assessment of knowledge, attitude and practice towards rabies and associated factors among household heads in Mekelle city, Ethiopia. *BMC public health*, ***20***(1), 57.

Hampson, K., Coudeville, L., Lembo, T., Sambo, M., Kieffer, A., Attlan, M., ... and Global Alliance for Rabies Control Partners for Rabies Prevention. (2015). Estimating the global burden of endemic canine rabies. *PLoS neglected tropical diseases*, ***9***(4), e0003709.

Hampson, K., Coudeville, L., Lembo, T., Sambo, M., Kieffer, A., Attlan, M., Barrat, J., Blanton, J. D., Briggs, D. J., and Cleaveland, S. (2015). Estimating the global burdenof endemic canine rabies. *PLoS Neglected Tropical Diseases*, **9** (4), e0003709. https://doi.org/10.1371/journal.pntd.0003709

Hanlon, C. A., Niezgoda, M., and Rupprecht, C. E. (2002). Postexposure prophylaxis for prevention of rabies in dogs. *American journal of veterinary research*, *63*(8), 1096- 1100.

Hasen, A. A., Wako, B. A., Bayecha, G. D., and Dechasa, D. S. (2021). Review on rabies: Epidemiology, prevention and control methods. *Global Scientific Journal*, **9** (6). https://www.globalscientificjournal.com

Hemachudha, T., Laothamatas, J, Rupprecht CE (2002) Human rabies: a disease of complex neuropathogenetic mechanismsand diagnostic challenges. *Lancet Neurology1*(2):101– 109.

Hemachudha, T., Ugolini, G., Wacharapluesadee, S., Sungkarat, W., Shuangshoti, S., and Laothamatas, J. (2013). Human rabies: Neuropathogenesis, diagnosis, and management. The Lancet Neurology, **12** (5), 498–513.

Hosmer,D.W.,and Lemeshow,S. (2000).*Appliedlogisticregression*(2nded.). Wiley.

Hossain, M., Ahmed, K., Bulbul, T., Hossain, S., Rahman, A., Biswas, M. N. U., and Nishizono, A. (2012). Human rabies in rural Bangladesh. *Epidemiology and Infection*, 140(**11**), 1964–1971. https://doi.org/10.1017/S095026881100272X

https://www.worldrabiesday.org(Accessed6April2020)at12:09AM.

Jackson, A. C., and Wunner, W. H. (2007). Rabies Second Edition: Scientific Basis of the Disease and Its Management.

Javed, H. S., Rehman, S. A., Mubeen, A., and Imran, M. (2023). Knowledge, attitude and practice (KAP) studies on rabies: a neglected tropical disease.

Jemberu, W. T., Molla, W., Almaw, G., and Alemu, S. (2013). Incidence of rabies in humans and domestic animals and people's awareness in North Gondar Zone, Ethiopia. *PLoS neglected tropical diseases*, ***7***(5), e2216.

Kayali,U.,Mindekem,R.,Yémadji,N.,Oussiguéré,A.,Naïssengar,S.,Ndoutamia,A.G.,and Zinsstag,J.(2003).IncidenceofcaninerabiesinN'Djaména,Chad. TropicalMedicine andInternationalHealth,**8**(8),747–753.https://doi.org/10.1046/j.1365-3156.2003.01072.

Kaye, A. D., Perilloux, D. M., Field, E., Orvin, C. A., Zaheri, S. C., Upshaw, W. C., ... and Upshaw, W. W. (2024). Rabies Vaccine for Prophylaxis and Treatment of Rabies: A Narrative Review. *Cureus*, ***16(***6).

Kebede, S., Beyene, G., Akalu, B., AbaJebel, E., and Kebede, I. A. (2024). General public knowledge, attitudes,

and practices about rabies and associated factors in Gomma districtofJimmazone,southwesternEthiopia. *PLOSNeglectedTropical Diseases*, *18*(10), e0012551.

KhanA,AyazR,MehtabA,NazK,HaiderW,GondalMA,UmerM,AfzalMI,ShahNA,AfzalMS,Yayi G. Knowledge, attitude and practices (KAPs) regarding rabies endemicity among the community mem bers, Pakistan. Acta Tropica. 2019 Dec 1; 200:105156.

Kidane A, Dessalegn S, Tesfaye B, Deressa A, Pal M (2016) Rabies in animals with emphasis on dog and cat in Ethiopia. *World's Veterinary Journal 6*(3):123–129

Kitalaa, P. M., McDermott, J. J., Kyule, M. N., and Gathuma, J. M. (2000). Community-based active surveillance for rabies in Machakos District, Kenya. *Preventive Veterinary Medicine*, 44(**1–2**), 73–85.

Klingen, Y. (2008). *Rhabdovirus envelope switching: Untersuchungen zum Tropismus und Transport von Rabies-Viren*(Doctoral dissertation, München, Univ., Diss., 2008).22 Hemachudha T., "Human rabies: neuropathogenesis, diagnosis and management," Lancet Neur., vol. **12**, pp. 498–513, 2013.

Knobel, D. L., Cleaveland, S., Coleman, P. G., Fèvre, E. M., and Meltzer, M. I. (2005). Re- evaluating the burden of rabies in Africa and Asia. *Bulletin of the World Health Organization*, 83 (**5**), 360–368. https://doi.org/10.1590/S0042-96862005000500012

Knobel,D.L.,Cleaveland, S.,Coleman,P. G.,Fèvre,E. M.,Meltzer,M.I.,Miranda, M.E.G., ...andMeslin,F.X.(2005).Re-evaluatingtheburdenofrabiesinAfricaand Asia. *Bulletin of the World health Organization*, *83*, 360-368.

Lembo,T.,Attlan, M., Bourh, y,H., Cleaveland, S., Costa, P.,deBalogh,K.,... andBriggs, D. J. (2011). Renewed globalpartnerships and redesigned roadmaps for rabies prevention and control. *Veterinary medicine international*, *2011*(1), 923149

Leslie,M.J.,Messenger,S.,Rohde,R.E.,Smith,J.,Cheshier,R.,Hanlon,C.,andRupprecht, C. E. (2006). Bat-associated rabies virus in skunks. *Emerging infectiousdiseases*, *12*(8), 1274.

Lynn,D.J.,Newton,H.B.andRae-GrantA.D(2012):The5-MinuteNeurologyConsult. LippincottWilliamsandWilkins.

Matibag, G. C., Ohbayashi, Y., Kanda,K., Yamashina, H., Kumara, W. R., and Perera, I. N.(2009).Controlofrabies.*HealthandPopulationPerspectivesandIssues*,28(**2**),50–57.

Menezes,R.(2008).RabiesinIndia.*CanadianMedicalAssociationJournal*,178(5),564–566.https://doi.org/10.1503/cmaj.071488

Moges,N.(2015).Epidemiology,preventionandcontrolmethodsofrabiesindomesticanimals. *Eur. J. Biol. Sci*, *7*(2), 85-90.

Moges,N.(2015).RabiesinEthiopia:ReviewArticle.*AcademicJournalofAnimalDisease* **4**(2):74-81.

Morbidity and Mortality Weekly Report, MMWR, "Compendium of Animal Rabies Prevention and Control: Recommendations and Reports, vol/issue: **60**(6), pp. 1-17, 2011.

Murray, J. D., Stanley, E. A., and Brown, D. L. (1986). On the spatial spread of rabies among foxes. *Proceedings of the Royal Society of London. Series B, Biological Sciences*, 229 (**1255**), 111–150.

Murray, K.O., Holmes, K.C.,and Hanlon, C. A. (2009). Rabiesin vaccinateddogsandcatsin the United States, 1997–2001. *Journal of the American Veterinary Medical Association*, ***235*(**6), 691-695.

Mustafa, M.,EllzamE. M,Sharifa, A. M, Rahman, M.S.,SienM. Mand Nang, M.K. (2015): Rabies a zoonotic disease, transmission, prevention and treatment. *Journal of Dental Medicine Science*, **14**(10): 82–87.

Nejash, **A**., and Endale, **T**. (2017). Community-based cross-sectional study on knowledge, attitudes, and practices towards rabies in Munesa district, Arsi Zone, Southeastern Ethiopia.*Journal of Public Health and Epidemiology*, *9* (6), 161–170. https://doi.org/10.5897/JPHE2017.0931

Nguyen, A. K., Nguyen, D. V., Ngo, G. C., Nguyen, T. T., Inoue, S., Yamada, A., ... and Nguyen, H. T. (2011). Molecular epidemiology of rabies virus in Vietnam (2006– 2009). *Japanese Journal of Infectious Diseases*, ***64***(5), 391-396.

Nigg,A.J.,andWalker,P.L.(2009).Overview,prevention,andtreatmentof rabies. *Pharmacotherapy:TheJournalofHumanPharmacologyandDrugTherapy*, ***29***(10), 1182-1195.

Ohara, S., Sato, S., Oyama, K., Tsutsui, K. I., and Iijima, T. (2013). Rabies virus vector transgene expression level and cytotoxicity improvement induced by deletion of glycoprotein gene. *PLoS ONE*, **8** (11), e80245. https://doi.org/10.1371/journal.pone.0080245

OIE (2017): Rabies. Chapter 2.1.13. OIE Terrestrial Manual 2017. Available at:

http://www.oie.int/fileadmin/Home/eng/Health_standards/tahm/2.01.13_RABIES.pdf(Accessed 19 May 2020) at 9:19 PM.

Okoh,A.E.(2016).Knowledge,attitudes,andpracticesofdogownersregardingrabiesin Ogun State, Nigeria. *Journal of Veterinary Medicine and Animal Health*, 8(**4**), 28–34.

Oyda, S., and Megersa,B.(2017a).Spatialdistributionofrabiesoutbreaks in Ethiopia: A retrospective analysis. *Ethiopian Veterinary Journal*, 21 (**2**), 45–58.

Pal, M. (2007): Zoonoses.2ndEd.SatyamPublishers,Jaipur, India.

Pankhurst, R. J. (1970). The geochronology of the basic igneous complexes. *Scottish Journalof Geology*, *6*(1), 83-107.

QuinnPJ,Carter ME, MarkeyBK,CarterGR(1994)ClinicalVeterinaryMicrobiology.1sted. Grafos,S.A. ArteSobrePapelPublishing, Spainp.378–465.

Quinn, P. J., Markey, B. K., Leonard, F. C., Hartigan, P., Fanning, S., and Fitzpatrick, E. (2011). *Veterinary microbiology and microbial disease*. John Wiley and Sons.

Radostits, O. M, Gay, C. C, Hinchcliff, K. W, Constable, P. D. (2007): Veterinary medicine: a textbook of the diseases of cattle, horses, sheep, pigs and goats.10thed. London. Saunders. Pp.1384-1394.

Radostits, O. M., Gay, C. C., Hinchcliff, K. W., and Constable, P. D. (2006). Veterinary medicine: A textbook of the diseases of cattle, horses, sheep, pigs, and *goats**(10th ed.). Elsevier Health Sciences.

Rago,R., Abafaji, G., and Abadura, S. Z.(2024).Investigating RabiesPreventionand Control: A Study of Knowledge, Attitudes, and Practices in Jimma Town, South-Western Ethiopia. *Small Animal Advances*, *3*(1), 8-17.

Ramos, J. M., Melendez, N., Reyes, F., Gudiso, G., Biru, D., Fano, G., Aberra, D., Tessema, A., Tesfamariam, A., and Balcha, S. (2015). Epidemiology of animal bites and other potential rabies exposures and anti-rabies vaccine utilization inaruralarea in Southern Ethiopia. *Annals of Agricultural and Environmental Medicine*, 22 (**1**), 56–60.

Regassa, B. T., Tosisa, W., Eshetu, D., Mulu, A., and Hundie, G. B. (2025). Incidence, risk factors, and control of Rabiesin Ethiopia:Asystematicreviewandmeta-analysis. *PLOS Neglected Tropical Diseases*, *19*(3), e0012874.

Regea, G. (2017). Review on economic importance of rabies in developing countries and its controls. *Archives of Preventive Medicine*, 2 (**1**), 15–21.

Reta, T., Teshale, S., Deresa, A., Ali, A., Mengistu, F., Sifer, D., and Freuling, C. M. (2014). Rabies inanimals and humans in and around Addis Ababa, the capitalcityofEthiopia: A retrospective and questionnaire based study. *Journal of veterinary medicine and animal health*, *6*(6), 178-186.

Reta, T., Teshale, S., Deresa, A., Ali, A., Mengistu, F., Sifer, D., and Freuling, C. M. (2014). Rabies inanimals and humans in and around Addis Ababa, the capitalcityofEthiopia: A retrospective and questionnaire-based study. *Journal of Veterinary Medicine and Animal Health*, 6 (**6**), 178–186.

Reta, T., Teshale, S., Deressa, A., Getahun, G., Baumann, MPO., Muller, T., Freuling, C. M. (2013). Evaluation of rapid immunodiagnostic test for rabies diagnosis using clinical brain samples in ethiopia. Journal of Veterinary Science & Medical Diagnosis 2(3):1- 3.

Richard, O. G, Olaniyi, A. J., Paul, M. P., Odinya, A. V., Adamu, D. A,Atinuke, D. M. and Audu, D. F. (2015): A Review on Human Deaths Associated with Rabies in Nigeria. Journal of Vaccines & Vaccination, Pp. 293-301.

Rupprecht, C. E. And Tumphey, A. J. (2007): The first world rabies day symposium and Exposition. Atlanta, Georgia (Conference Summary). Emerging Infectious Diseases, Available from: www.cdc.gov/EID/content/13/12/e1.htm Accessed on April 2020.

Rupprecht, C. E., and Salahuddin, N. (2019). Current status of human rabies prevention: remaining barriers to global biologics accessibility and disease elimination. *Expert review of vaccines*, *18*(6), 629-640.

Rupprecht, C. E., Hanlon, C. A., and Slate, D. (2006). Control and prevention of rabies in animals: paradigm shifts. *Developments in biologicals*, *125*, 103-111.

Rupprecht, C. E., Hanlon, C. A., and Slate, D. (2006). Control and prevention of rabies in animals: paradigm shifts. *Developments in biologicals*, *125*, 103-111.

Samad, A., Naveed, A., Alam, A. N., Atique, R., Muazzam, A., Anwar, B., and Hossain, M. J. (2024). Brief Overview on Rabies: A Fatal and Preventable Virus. *Indonesian Health Journal (IHJ)*, *3*(1), 162-170.

Semayat, **A**., and Bekele, **T**. (2017). Community-basedstrategies forrabiescontrolinEthiopia. *EthiopianJournalofPublicHealth*,35(**3**),112–120

Serebe, S. G., Tadesse, K. A., Yizengaw, H. A., and Tamrat, S. M. (2014). Study on community knowledge, attitude and practice of rabies in and nearby Gondar town, North West Ethiopia. *Journal of Public Health and Epidemiology*, 6 (**12**), 429–435.

Shite, A., Guadu, T., and Admassu, B. (2015). Challenges of rabies. *International Journal of Basic and Applied Virology*, *4*(2), 41-52.

Siegel,J. (2024). Risk Reduction Strategiesfor RabiesExposures and Prophylaxisin Children. *Medical Research Archives*, *12*(4).

Singh, R., Singh, K. P., Cherian, S., Saminathan, M., Kapoor, S., Manjunatha Reddy, G. B., ... and Dhama, K. (2017). Rabies–epidemiology, pathogenesis, public health concernsandadvancesindiagnosisand control: acomprehensivereview. *Veterinary Quarterly*, *37*(1), 212-251.

Singh, R., Singh, K. P., Cherian, S., Saminathan, M., Kapoor, S., Reddy, G. B. M., Panda, S., &Dhama,K.(2017).Rabies–epidemiology,pathogenesis,public healthconcernsand advances in diagnosis and control: A comprehensive *review. Veterinary Quarterly*, 37(**1**), 212–251. https://doi.org/10.1080/01652176.2017.1343516

Sparkes, J., Fleming, P. J. S., Ballard, G., Scott-Orr, H., Durr, S., and Ward, M. P. (2015). Rabies transmission dynamics in Ethiopia: Implications for control. *PLOS Neglected Tropical Diseases*, 9 (**4**), e0003709. https://doi.org/10.1371/journal.pntd.0003709

Srinivasan, A., Burton, E. C, Kuehnert, M. J, Rupprecht, C., Sutker, W. L., Ksiazek, T. G., Paddock, C. D., Guarner, J., Shieh, W. J, Goldsmith, C. and Hanlon, C. A (2005): Transmissionofrabiesvirusfromanorgandonortofourtransplantrecipients.New England Journal of. Medcine. 352(11): 1103 1111. https://doi.org/10.1056/NEJMoa043018.

Taame, M.H., Abrha, B.H., Yohannes, T.A., Abreha, T.G., Yisehak, T.R., Guesh, N.H. and Berihu, G.T. (2017): Contro l and prevention of rabies through dog vaccination campaig ns, public awareness creation and dog population control. Et hiopian Journal of Veterinary Science and Animal Production (EJVSAP), 1(1):9–16.

Takayama, N., (2008): Rabies: A Preventable but Incurable Disease. Journal of Infectious Chemotherapy, 14: 8-14.

Teklu, G. G., Hailu, T. G., and Eshetu, G. R. (2017). High incidence ofhumanrabies exposure in northwestern Tigray, Ethiopia: A four-year retrospective study. PLoS Neglected Tropical Diseases, 11(**1**), e0005271. https://doi.org/10.1371/journal.pntd.0005271

Tenzin, Ward, M. P., Dhand, N. K., Gyeltshen, T., Firestone, S., Zangmo, C., Dema, C., and Gyeltshen, R. (2012). Community-based studyon knowledge, attitudes and perception of rabies in Gelephu, south-central Bhutan. *International Health*, 4 (**3**), 210–219.

Tortora, G. J., Funke, B.R. and Case, C.L. (2010): Microbiology: AnIntroduction.1sted. Pearson Education Inc., SanFrancisco, USA, Pp.622-624.

Ugolini G., "Rabies virus as a transneuronal tracer of neuronal connections," Adv.Virs. Res., vol. 79, pp. 165–202, 2011.

UgoliniG., "Use of rabies virusasa transneuronaltracerofneuronalconnections: Implications for the understanding of rabies pathogenesis," Dev. Biols.(Basel), vol. 131, pp. 493– 506, 2008.

Ugolini, G. (2011). Rabies virus as a transneuronal tracer of neuronal connections. AdvancesinVirusResearch, 79, 165–202. https://doi.org/10.1016/B978-0-12-387040-7.00010-X

WHO (2004). Transport of infectious substances. Geneva, Switzerland. Available at: http://www.who.int/csr/resources/publications/WHO_CDS_CSR_LYO_2004_9/en/

WHO (2013): World Health Organization Expert Consultation on Rabies. Second report: Technical Report Series 982. Geneva, Switzerland. Pp. 8-67.

WHO (2017): WHO methods and data sources for global burden of disease estimates 2000±2015. Department of Information, Evidence and Research WHO, Geneva January. Global Health Estimates Technical Paper WHO/HIS/IER/GHE/2017.1 Accessed date 15/08/2020.

WHO, "Information Surveillance Report," Collaborating Centre for Rabies Surveillance and Research, Greifswald - Insel Riems, Germany, J.Rab.Bull.Eur.,vol. 37, pp. 2, 2013.

Wolelaw, G. A., Yalew, W. A., Azene, A. G., and Wassie, G. T. (2022). Rabies prevention practices and associated factors among household heads in Bure Zuria district, Northwest Ethiopia. Scientific Reports, 12(1), 1–10. https://doi.org/10.1038/s41598- 022-10863-z

World Health Organization, "Expert Committee on Rabies," Technical Report; series 824, Geneva, 1992.

World Health Organization. (1998). World survey of rabies No. 32. World Health Organization. https://apps.who.int/iris/handle/10665/63976.

World Health Organization. (2018). Zero by 30: the global strategic plan to end human deaths from dog-mediated rabies by 2030. In*Zero by 30: the global strategic plan to end human deaths from dog-mediated rabies by 2030*.

World Health Organization. (2021). Rabies. https://www.who.int/news-room/fact-sheets/detail/rabies
World Health Organization. (2023). *Global report on neglected tropical diseases 2023*. World Health Organization.
World Organization for Animal Health [OIE], "Manual of diagnostic tests and vaccines for terrestrial animals," OIE, Rabies, 2008.
Wyatt, J. (2007). Rabies—update on a globaldisease. The Pediatric infectious disease journal, 26(4), 351-352.
Yibrah, M., and Damtie, D. (2015). Incidence ofhumanrabies exposure and associated factors at the Gondar Health Center, Ethiopia. BMC Infectious Diseases, 15, 239. https://doi.org/10.1186/s12879-015-0988-7
Yimer,E.(2001).RabiesinEthiopia:Aretrospectivestudyofhumanandanimalcases. EthiopianJournalofHealthDevelopment,16(**3**),105–112
Yousaf, M. Z., Qasim, M., Zia, S., Rehman Khan, M. U., Ashfaq, U. A., and Khan, S. (2012). Rabies molecular virology,diagnosis, preventionandtreatment. *Virologyjournal*,*9*,1- 5.
Zhang, X., Tian, X., Pang, B., Wang, Z., Zhai, W., Jiang, X., and Wang, X. (2022). EpidemiologicalCharacteristics of HumanRabies—Shandong Province, China, 2010– 2020. *China CDC Weekly*, *4*(35), 793.