

# Review on Assessment of Knowledge, Attitude and Practices about Rabies, Associated Factors and Post Exposure Management in Ethiopia

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## Abstract

Rabies is one of the seventeen major neglected tropical diseases with the highest human case fatality rate approaching 100%. The disease is caused by an enveloped neurotropic, negative sense, non-segmented, single-stranded; a bullet shaped RNA virus that belongs to the *Lyssavirus* genus of the Rhabdoviridae family, Mononegavirale order. Rabies virus enters the body through wounds or by direct contact with mucosal surfaces, but cannot cross intact skin. The virus replicates in the bitten muscle and gains access to motor end plates and rapidly ascends the nervous system to the brain by entering the pre-synaptic nerve ending through endocytosis, and may be associated with synaptic vesicles. Dog mediated rabies is known to account for over 90% of human exposure and death cases in Ethiopia and elsewhere. The differences in KAP score among participants were dependent on Variable such as sex, educational status, and source of information, monthly income, and residence. Recommended first aid procedures for post exposure include immediate and thorough flushing and washing of the wound for a minimum of 15 minutes with soap and water, as well as disinfecting the wound with detergent or other substances of proven lethal effect on the rabies virus. It may be noted that although no specific antivirals exist at present, the combination of prompt rabies PEP, wound care, infiltration of RIG into and around the wound, and multiple doses of rabies cell-culture vaccine is 100% effective in preventing human rabies. An increasing number of stray dogs and the absence of legislation to determine and certify the status of vaccinated and non-vaccinated dogs and lack of utilization of modern anti rabies vaccines create difficulty to control the disease in the country.

**Keywords:** Human rabies • Dog bite • Folk drug • Ethiopia

## Introduction

Zoonosis is exerting a significant burden on both animal and human health, particularly in developing countries [1]. Neglected Tropical Zoonotic Diseases (NTZDs) are a subset of zoonosis that primarily affects the world's poorest population [2]. Rabies is one of the seventeen major neglected tropical diseases with the highest human case fatality rate approaching 100% [3]. The major part of the global burden of dog mediated rabies falls on Africa and Asia, where still an estimated 60,000 people die of the disease annually, of which at least 24,000 deaths per year are in Africa and 30,000 people in Asia [4,5]. Ethiopia being one of the developing countries is highly endemic for rabies [6,7]. The first rabies epidemic in Ethiopia was recorded in the capital city of Addis Ababa in 1903 [8]. The country accommodates the second largest number of rabies deaths of all African countries [9]. The disease is caused by a neurotropic, single-stranded RNA virus that belongs to the *Lyssavirus* genus of the family

Rhabdoviridae and is mainly transmitted from rabid animals to humans through close contact with infected saliva *via* bite or scratch [10,11]. The annual rabid dog exposures in some selected urban and rural districts were estimated to be 135,101 and 86 bites per 100,000 inhabitants, respectively [12].

Appropriate Post-Exposure Prophylaxis (PEP) can entirely prevent rabies [13]. Such PEP, which consists of local treatment of the wound, followed by vaccine should be initiated immediately after a suspected rabid dog bite [14]. Globally, close to 15 million people receive PEP annually which is considered as costly and not accessed in developing country like Ethiopia [15]. An estimated of US \$583.5 million; most of which is due to the cost of post exposure prophylaxis was annually spent in Africa and Asia due to rabies [16,17]. In Ethiopia individuals who are exposed to rabies virus often see traditional healers for the diagnosis and treatment of the disease [18]. Rabies victims especially from rural areas seek PEP treatment after exhausting the traditional medicinal intervention and usually after a

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loss of life from family members [19]. These widespread traditional practices of handling rabies cases are believed to interfere with timely seeking of PEP [20]. Therefore, the objectives of this study were to highlight the status of knowledge, Attitude and Practices about Rabies, Associated Factors and post exposure management in Ethiopia.

## Literature Review

### Cause and transmission ways of rabies

Rabies is almost always fatal acute viral disease of the central nervous system. The disease is caused by an enveloped neurotropic, negative sense, non-segmented, single-stranded; a bullet shaped RNA virus that belongs to the *Lyssavirus* genus of the Rhabdoviridae family, Mononegavirale order. The virus multiplies in the salivary glands of an infected host and is mainly transmitted from rabid animals to humans through close contact with infected saliva *via* bite or scratch. It is mostly transmitted by the saliva of infected animals, usually by biting and disease severity is determined by different factors like site of biting, extent of exposure, and species of the virus. The incubation period, normally ranges from 1 to 3 months, but can range from 7 days to 4 years. The risk of rabies infection by bite is 5%–80%, which is approximately 50 times more than by a licks or scratches, occurrence of which is 0.1%–1%.

### Pathogenesis and clinical findings in humans

Rabies virus enters the body through wounds or by direct contact with mucosal surfaces, but cannot cross intact skin. The virus replicates in the bitten muscle and gains access to motor end plates and rapidly ascends the nervous system to the brain by entering the pre-synaptic nerve ending through endocytosis, and may be associated with synaptic vesicles. Inside peripheral nerves, the virus is carried in a retrograde direction by fast axonal transport, centripetally to reach the central nervous system. The virus then moves centrifugally from the central nervous system to the nerves in peripheral sensory axons of the infected dorsal root ganglia, leading to infection of muscle spindles, skin, hair follicles and other tissues, such as salivary glands, heart muscle, lung and abdominal visceral organs *via* their sensory innervations. The clinical signs of salivation, indigestion and pica, paralysis of bladder and anus and increased libido all suggest involvement of the autonomic nervous system, including endocrine glands. The primary lesions are produced in the CNS and spread from the site of infection occurs only by way of the peripheral nerves. Gradually ascending paralysis of the hindquarters may be followed by severe signs of mania, which persist almost until death.

### Prevalence and seasonal occurrence of rabies

**Human rabies prevalence assessment:** Dog mediated rabies is known to account for over 90% of human exposure and death cases in Ethiopia and elsewhere. The study of showed that from a total of 96 deaths reported, nearly all human 93 (97%) fatal cases were attributed to dogs in which higher positivity was noted in owned dogs (74.2%) than ownerless (25.8%). A retrospective study of number of fatal human rabies cases studied in Addis Ababa and its surrounding from 2001-2009 were 386 with an annual range of 35 to 58 persons

dying. Most fatal cases reported are children under 14 age groups. Another retrospective study of rabies in Addis Ababa from 1990-2000 indicated that an average of 2,200 people per year received post-exposure anti rabies treatment while 95% of the reported fatal human rabies cases was due to dog bites. The result of indicated that the average of 101 people infected annually and of these total reported fatal human rabies cases 40.8% were children (less than 15 years age), 49% were adult (16-45 years age) and 10.1% were older people (above 46 years old) in southeastern parts of Ethiopia. In the current study, the majority (71.9%) of exposure cases were from rural areas. this might be related to increased number of stray dogs and the absence of a culture to administer vaccination for dogs and low level of community awareness in the rural areas as compared to the urban areas. The overall prevalence of poor rabies prevention and control practice was 56% in urban and 62% in rural dog owners.

**Seasonal occurrence of rabies:** Seasonal variation of Rabies occurrence was Assessed as of however, no seasonal influence was observed. Different from this, found rabies occurrence varying along season where, an increase of positive cases was common from June to September. Monthly variation was assessed where majority of cases were evident during April 10.5% followed February 10.2%, May 9.4% and September 9%. The remaining months had showed a slight variation indicating equal distribution. Although animal rabies throughout the year in Ethiopia, the highest seasonal occurrence was recorded at cold season. This is most probably due to mass gathering and highest reproduction of dogs during the period which increases the contact between rabid and health dogs.

### Major contributing risk factors

**Community KAP towards rabies:** More than half of the respondents had poor KAP level. Being sex, educational status, sources of information and monthly income significantly associates with KAP level of the respondents ( $p < 0.05$ ). Many questions were enquired for each respondent regarding the cause, sources, mode of transmissions, clinical signs, prevention practices and treatment measures of rabies even though the question differ from one study to the other. The number of questions for which the respondent gave correct responses was counted and scored. This score was then pooled together and the average score was computed to determine the overall KAP of respondents, respondents who score greater than the average value grouped to good KAP, equal or nearest to average were grouped to moderate and less than the average value were grouped as poor KAP level. The result of study by Ashenafi A, et al., in debretabor, northern Ethiopia showed that about 49.5% of the study participants were found to have good KAP about rabies and 50.5% were found to have poor KAP level. The data of other study carried out by Gebremeskel, et al. 2019 in kombolcha, northern part of the country revealed that about 85.7% of the study participants were found to have good KAP toward rabies and 14.3% were found to have poor KAP level. According to the study of Hagos WG, et al, 56.1%, 56.2% and 61.3% of participants had good knowledge, positive attitude and good practice towards rabies respectively in Mekelle city. The study conducted by Abraham Ali, et al., 2013 in central Ethiopia showed that 75.2%, 52.3 %, and 67.0% of the respondents had moderate level of knowledge, attitude and appropriate practices towards rabies respectively. Study conducted in western Ethiopia indicates 70% of the respondents had knowledge about rabies and There was also a statistically significant association

of KAP score ( $p < 0.05$ ) with educational rank and the work of respondents.

**Estimation of dog population and community awareness on dog management:** Dogs are the primary cause for fatal human rabies cases and responsible for maintaining and disseminating rabies. As reported from Ethiopian Health and Nutrition Research Institute (EHNRI), in Ethiopia the number of dogs to human ratio is approximately assumed to be 1:6 and 1:8 in urban and rural areas, respectively. As report of indicated many households' own dogs usually for guarding property; although there are no formal studies, it is estimated that there is one owned dog per five household nationally. Study conducted by in southern parts of the country showed that, all respondents had a single dog (47%) or more than one dog (53%), and their dogs were free to move to the surrounding area (free roaming dog). Majority of positive results associated with dogs were reported aged above 12 months (81.4%), 6 to 12 months (11.6%) followed by 3 to 6 months (7%). On contrary, higher incidence of rabies was reported in dogs less than 12 months of age. Dog abundance and management have important roles in disease transmission.

**Dog vaccination status:** Vaccinating pet animals is a good option, but it requires good quality control standards to make sure that adequate antibody titers are maintained in the serum of canines by booster doses. Evidence has shown that antibody levels gradually decrease over time after vaccination, which also depends on the dog's age and quality of the vaccine given. In Ethiopia, canine vaccination has never been enforced as compulsory nor promoted as a public good, and as such very few dog owners vaccinate their dogs in the country. An increasing number of stray dogs and the absence of legislation to determine and certify the status of vaccinated and non-vaccinated dogs and lack of utilization of modern anti rabies vaccines create difficulty to control the disease in the country.

**Ecological factors for increased spillover:** The existence of natural forests, mountains and rivers, which plays a significant role in displacing the normal habitat of wildlife for interaction and co-existence with domestic animals and peoples, has created a suitable environment for the occurrence and spread of rabies exposure. Increased interaction of wild life with dogs and high prevalence of free roaming dogs were considered as risk factors for increased exposure to rabies.

## Post exposure management

**Practices and attitudes to prevent rabies after suspected animal/dog bite:** The initial evaluation is considered to be a vital part of managing and treating bite wounds. It should include a thorough assessment of the wound itself and the patient's medical history and status, determination of the amount of time elapsed before treatment was initiated, and identification of the animal responsible and the circumstances under which the bite occurred. Recommended first aid procedures include immediate and thorough flushing and washing of the wound for a minimum of 15 minutes with soap and water, as well as disinfecting the wound with detergent or other substances of proven lethal effect on the rabies virus. Appropriate wound cleansing and disinfection can prevent one-third of rabies infections. According to study, 70.8% of the respondents washed the wound with water and soap immediately, 50.4% seek health 7 centers, 42.8% had positive

attitude for anti-rabies vaccine and 55.7% were aware of taking anti-rabies vaccine immediately after a suspected animal/dog bite.

**Anti-rabies handling and utilization assessment:** For humans, the vaccination schedule for Pre-Exposure Prophylaxis (PrEP) consists of three doses of vaccine administered on days 0, 7, and 21 or 28; these doses are usually reserved for veterinarians and laboratory personnel. The role of Pre-Exposure Prophylaxis PrEP for the community in endemic areas is not clear, although small trials have shown good immunogenicity and safety. The commonly used vaccines are Human Diploid Cell Vaccine (HDCV) and Purified Chick Embryo Cell Vaccine (PCECV). The current Advisory Committee on Immunization Practices (AICP) recommendation is to give four doses of vaccine—1 ml of either HDCV or PCECV along with Rabies Immunoglobulin (RIG) with exposure for previously unvaccinated patients. The vaccines are given intramuscularly on days 0, 3, 7, and 14. The vaccine is a 5% suspension of penalized sheep brain tissue. In the last nine years a minimum of 6,263 and a maximum of 21,832 doses of the human rabies vaccine were produced and distributed every year.

It may be noted that although no specific antivirals exist at present, the combination of prompt rabies PEP, wound care, infiltration of RIG into and around the wound, and multiple doses of rabies cell-culture vaccine is 100% effective in preventing human rabies. Also, PCECV appears to be safe during pregnancy. More males received the anti-rabies post exposure prophylaxis (52.2%). It reveals that males were more affected than females in the area. This might be explained as: males spent most of their time in field works, whereas females are engaged in indoor activities because of religious and cultural influences. Males have also more close contact with dogs than females. The majority of rabies exposure cases were children less than 15 years of age. This might be because children usually handle and play with domestic animals, including dogs and cat. Besides, nearly all Ethiopian children, especially in rural settings, play in the streets and stay in the field to control sheep, cattle and other animals. These all increase the risk of children being bitten by dogs and other animals. Moreover, youths and 8 adults are aware of the signs of rabid animals and be far away when they face but children can't protect themselves.

**Traditional medicines against rabies:** According to world health organization report most developing countries, especially those in Asia, Africa, Latin America and the Middle East, 70%-95% of their population rely on traditional medicines for treatment of different diseases. In Ethiopia Traditional Medicines (TM) have been using since time immemorial, with 90% of population dependent on Traditional Medicines (TMs) for the management of the diseases in both humans and animals. Even though attention was primarily centered on human patients, dogs and other domestic animals were also treated. Previously cures were assumed based on the purgative action of administered materials through gastro intestinal tract. Understanding the cultural context under which traditional remedies are used may facilitate collaboration of traditional healers with the modern medical system to ensure timely and appropriate use of proven therapies for prevention and clinical management of rabies.

## Discussion

The beneficial medicinal effects of folk drugs typically result from the combinations of secondary products present in the plant which

used as sources of medicines throughout history and continued to serve as the basis for many pharmaceuticals used today. However, their potential as the source of drugs is still unexplored (Table 1).

Scientific name	Local name	Part (s) used	Method of preparation and route of administration
<i>Daturastramonium L.</i>	Banjii (O: Arsi Zone) Machareqqa (ka)	Leaf	Crushed and homogenized leaves drunk with water
<i>Justitia schimperana (Hochst. ex Nees) T. ander</i>	Dhumuga ( Ejaji area (West Shoa), O) Gulbanna (ka) Smiza (A)	Buds Leaf Root	Roots and leaves are pounded together then mixed with water and <i>Salix mucronata</i> leaf and given orally for human and animals in the morning before food
<i>Dorsteniabarnimiana</i>	workBemeda (A)	Root	Powder of roots taken with skimmed milk or noug taken orally in the morning for seven days
<i>Gnidiaglauca</i>	Beto (A)	Root	Powder of roots mixed with skimmed milk and taken orally for seven days
<i>Phytolaccadodecandra</i>	Endod (A) Haranje, Shibti, (Tigray) Handode (West Shoa, O)	Root Leaf	Powder of roots or leaves mixed with water or domestic alcohol and given orally to humans and animals
<i>Salix subserrata</i>	Aeltu (O)	Leaf	Leaves are pounded and dried, then mixed with milk and taken orally
<i>Croton macrostachyus Del.</i>	Makkanisa (O)	Root, Bark and Leaf	Pound the fresh root, add water and filter then administered orally for 3 days (dog) and 7 days (other animals) and applied topically ; The Bark of <i>Croton macrostachyus</i> is dried, powdered and mixed with water: one coffee cup is given for human and 1 bottle is given to cattles and 6 bottles is given to camel once a day, for 3 day
<i>Bruceaantidysentrica</i>	Qomonyoo (O)	Fruit, Leaf and Root	Squeezed and baked with teff flour, together with <i>Croton macrostachyus</i> and <i>Rumexnervosus</i> given orally to humans and animals for 3 days.
<i>Euphorbia abyssinica J. F. Gmel</i>	Qulqwal (A)	Root and Leaf	One spoon of root powder mixed with a cup of fresh milk. Give for dog or Powder of roots or leaves mixed with water and taken orally
<i>Ricinus- communis</i>	Qoobboo (O)	Leaf and root	Fresh leaves crushed and mixed with water and taken one cup of tea for 3 consecutive days
<i>Calpurnia aurea (Ait.) Benth.</i>	Digita (A)	Leaf, Fruit, Seed and Root	Fresh or dried leaf, fruit and seeds crushed, mixed with food and given to dogs
<i>Artemisiaabyssinica Sch., Bip. ex A.Rich</i>	Qoddo (O) Chikugn (A)	Leaf	Leaf is ground in small water and given to the victim every morning for 3 days in small 'areqe' glass
<i>Momordicafoetida</i>	Saaroofofaa (O)	Root, Leaf, stem	Pounding the roots, making Solution & drinking one coffee cup at once.
<i>Zehneriascabra</i>	Korisinbira (O) Hiddareeffaa (o)	Root, Leaf	Pounded roots taken orally
<i>tephaniaabyssinica (Dillon&amp;A.Rich</i>	Hidda Hantutaa (O) Yet areg (A)	Root, Leaf	Dry root of <i>Stephaniaabyssinica</i> will be powdered and backed with teff flour and given to cattle. A crushed of leaf and root are soaked in honey for one day, decanted and one cup of juices is taken orally.
<i>Clucia lanceolata</i>	Uleefoonii (o)	Root	root crushed and taken with coffee
<i>Olea eureapa</i>	Ejersa (o)	Leaf	Fresh leaves hold in teeth

<i>Solanumgigantum Jacq</i>	Hiddii saree (o)	Root	Root crushed and taken with coffee
<i>Allium sativum</i> L	Nechshinkurt (A)	Bulb	Eat the part or Whole bulb directly
<i>Dregeaschimperi (Decne.) Bullock</i>	Shanqq (T)	Leaf Fruit	Crushed and drunk by mixing with water
<i>Euphorbia tirucalli</i> L.,	Kinchib (A) Tsedo (M)	Latex	Latex mixed with bean powder and given to eat after food
<i>Rumexnervosus</i> Vahl	Dhangaggo'o (o)	Root	The root of Rumexnervosus together with that of Phytolaccadodecandra, Bruceantidysenterica, Croton macrostachyus will be pounded together 1 teaspoon will be drunk with coffee.
<i>Scandoxusmultiflorus (Martyn) Raf</i>	Qulubi Warabesa (o)	Bulb	Bulb of Scandoxusmultiflorus will be pounded with bark of Croton macrostachyus and put in cold water for 1-night then by filtering one cup given to human.
<i>Maytenussenegalensis (Lam.) Exell,</i>	GeramAtat (A)	Leaf	Fresh young leaf is crushed and applied topically
<i>Rhynchosiaelegans</i> A. Rich	TeroAreg (A)	Leaf	Fresh or dried leaf paste or powder mixed with little water is given orally to human and livestock
<i>Salix mucronata</i> Thunb	Achaya (A)	Leaf	Fresh leaf mixed with Justiciaschimperia leaf and squeezed juice is given orally before food to human and livestock
<i>Carissa edulis</i> Vahl.	Agamsa (O)	Root	The root is powdered and mixed with food
<i>Antiaristoxicaria</i> Lesch	Dimbicho (O)	Bark	Dry/fresh stem bark is pounded and powdered then mixed with milk and given orally
<i>Combretumcollinum</i>	Abalo (A)	Seed	The seed of Combretumcollinum with seed of Solanum dasyphyllum are crushed together powdered, mixed with "tella" and drunk for 3 days
<i>Otostegiaintegrifolia</i>	Tungut (A)	leaf	The leaf of Otostegiaintegrifolia is pounded mixed with milk and drunk
<i>Clausenaanisata (Wild.) Benth</i>	Ulmaayii (o)	Bark	Bark of Clausenaanisata, leaves of Sidarhombifolia, root of Cucumisficifolius, bark root of Bruceantidysenterica powdered together and mixed in milk then drunk a cup of tea for three days in order to get cured from Rabies disease
<i>Crotalaria spinosa</i> Hochst. ex. Benth.	Shumburaa gugee (o)	Root	Root crushed, mixed with water and drunk
<i>Cyphostemmaadenocaula (Vitacea)</i> (A.Rich.)	Asserkush (A)	Root	Root boiled with milk, filtered and filtrate taken in empty stomach Full of a coffee cup daily for 3 consecutive days
<i>54 Ximeniaamericana</i> L.	Enkuay (A)	Bark	Soaking bark in water and the water is taken orally
<i>Rhoicissus tridentate</i>	Lalo (A)	Root Leaf	The root and leaf of this plant is ground together, mixed with water then 1-2 water glasses is drunk for human and 1 litter is given to cattle orally for 3 day.
<i>Senna petersiana</i> (Bolle) Lock	Sanaa maki (O)	Leaf	Squeezed and given with food to cattle Squeezed and 1/2 coffee cup is taken orally for 2-3 days
<i>Ozoroa insignis</i> Del	Gerri (O)	Bark Root	Dried bark and root of the plant is pounded then 2 teaspoonful powder

			added to 1 cup of water, administered orally for 20 days, 2 days interval
<i>Plectranthus lactiflorus</i> (Vatke) Agnew	Ayderkush (AM)		Fresh or dried leaves of <i>Plectranthus lactiflorus</i> , drink the decoction.
<i>Solanum marginatum</i> L.f.	imbuay (AM)	Root	Crush, heat/ burn or boil the part and inhale its smoke or steam

AM=Amharic; T=Tigrigna; Km=kambatgna; O=Oromigna

**Table 1.** List of anti-rabies medicinal plants.

## Conclusion

Rabies is a well-known disease in Ethiopia. In total, half percent of the respondents had poor KAP level about rabies throughout the country. The differences in KAP score among participants were dependent on sex, educational status, source of information, monthly income, and residence. The majority of rabies exposure cases were children less than 15 years of age. This might be because children usually handle and play with domestic animals, including dogs and cat. Besides, nearly all Ethiopian children, especially in rural, play in the streets and stay in the field to control other domestic animals like cattle, goat and sheep. In Ethiopia, canine vaccination has never been enforced as compulsory nor promoted as a public good, and as such very few dog owners vaccinate their dogs in the country. An increasing number of stray dogs and the absence of legislation to determine and certify the status of vaccinated and non-vaccinated dogs and lack of utilization of modern anti rabies vaccines create difficulty to control the disease in the country. Most of different study participants prefer traditional treatments by healers for the treatment of human rabies. The beneficial medicinal effects of folk drugs typically result from the combinations of secondary products present in the plant which used as sources of medicines throughout history and continued to serve as the basis for many pharmaceuticals used today. However, their potential as the source of drugs is still unexplored

Therefore, based on the above conclusions the following recommendation are forwarded

- Periodic education should be given to raise community KAP on rabies
- The total population of the dog in the country and the vaccination status both for canine and other animal need further investigation.
- More emphasis should be given for traditional practices and healers and the efficacy of folk drug used should be clearly understood by conducting clinical trial.

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