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Effect of rabies education programs on rabies awareness, attitudes towards dogs and animal welfare among children in Lilongwe, Malawi

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Effect of rabies education programs on rabies awareness, attitudes towards dogs and animal welfare among children in Lilongwe, Malawi

Effekten av utbildningsprogram om rabies på kunskapen om rabies, attityd till hundar och djurvälstånd hos barn i Lilongwe, Malawi

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SUMMARY

This study examines differences in the knowledge of rabies and animal welfare, as well as attitudes towards dogs between children that have participated in an education program about these subjects and children who have not participated in such programs in Lilongwe, Malawi. Rabies is a lethal, viral disease in humans and mammals that is widespread around the world. Most cases in humans affect children and transmission to humans occur mainly through dog bites, which make children's knowledge about dog behavior and how to avoid dog bites important to prevent rabies cases in humans. To increase knowledge of rabies transmission and prevention among children, education programs about these subjects are used. Education programs are also used to increase animal welfare in areas where animal welfare issues are not always prioritized because of other difficulties that burden people in those areas. Through education programs about how to take care of other creatures the prospect is to increase animal welfare by changing the attitudes of children towards animals.

Data for this study was collected through interviews of 169 children of the age 8-18 in 11 different schools during fall 2013. Children that had participated in the education program showed in several cases that they were more aware of rabies disease, as well as more aware of animal welfare of dogs. They also tended to like dogs in greater extent than the children that had not participated in the education program. However, it is unknown if other variables like differences in socio-economic situation, gender or general interest in animals have affected the results. Though, the conclusion is that education programs about rabies and animal welfare can improve the awareness of rabies and hopefully contribute to a reduction of rabies cases in children and also contribute to improve attitudes towards dogs and thus animal welfare.

SAMMANFATTNING

I denna studie undersöktes skillnader i kunskaperna om rabies och djurvälfärd, samt skillnader i attityden till hundar mellan barn som har fått utbildning inom dessa ämnesområden och barn som inte har fått det i området Lilongwe, Malawi.

Rabies är en dödlig, viral sjukdom som finns i stort sett över hela världen och förekommer hos både människor och andra däggdjur. De flesta humana fallen av rabies drabbar barn och sjukdomen sprids framförallt via hundbett, vilket gör att barns kunskaper om hur de ska undvika att bli hundbitna och deras kunskaper om hundars beteenden i allmänhet är viktiga för att förebygga humana rabiesfall. För att öka kunskapen om hur rabies sprids och hur det förebyggs hos barn används utbildningsprogram inom dessa ämnen. Utbildningsprogram är också en metod för att öka djurvälfärden i områden där sådana frågor inte alltid prioriteras då man omges av andra svårigheter som man måste ta itu med. Genom utbildningsprogram om hur man tar hand om djur är förhoppningen att man ska kunna öka djurvälfärden genom att förändra barns attityder till djur såsom hundar.

Data till denna studie samlades in genom att 169 barn i åldern 8-18 år från 11 olika skolor intervjuades under hösten 2013. Barnen som hade deltagit i utbildningsprogrammet uppvisade i flera fall en större medvetenhet av sjukdomen rabies och visade även att de var mer bekanta med hur man tar hand om en hund på ett bra sätt. Dessa barn tyckte också bra om hundar i större utsträckning än de barn som inte hade deltagit i utbildningsprogrammet. Det är dock okänt hur andra variabler, såsom skillnader i socioekonomisk status, kön och allmänintresset för hundar har påverkat resultaten i denna studie. Slutsatsen är ändå att utbildningsprogram om rabies och djurvälfärd kan förbättra medvetenheten om rabies och förhoppningsvis kan det bidra till att minska rabiesfallen bland barn, samt även bidra till att förbättra attityden till hundar och på så vis även djurvälfärden.

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LIST OF ABBREVIATIONS

GDP- Gross Domestic Product

RSPCA- Royal Society for the Protection and Care of Animals

KSPCA- Kenyan Society for the Protection and Care of Animals

LSPCA- Lilongwe Society for the Protections and Care of Animals

OiE- Office International des Epizooties

PEP- Post-exposure Prophylaxis

SIDA- Styrelsen för Internationellt Utvecklingssamarbete/Swedish International Development Cooperation Agency

USD- United States Dollar

WHO- World Health Organization

INTRODUCTION

The World Health Organization (WHO) considers rabies to be a neglected disease and declare it to be primarily a problem in areas troubled with poverty and with a lack of economic resources (WHO, 2013a). With over 55 000 human deaths a year (Knobel *et al.*, 2005) and signs of it re-emerging (Depani *et al.*, 2012) there are reasons for rabies to become acknowledged and prioritized as a more serious health burden in the world than it is considered today.

People in countries that are endemic to rabies find the threat of the disease to be a serious problem and consider it to be a risk that could afflict their loved ones (Thomas *et al.*, 2013). It is important to take the concerns of people seriously, especially because this is a disease that is preventable if resources are available (Lembo *et al.*, 2010). Most human cases of rabies are caused by dogs (Dodet *et al.*, 2008; Jemberu *et al.*, 2013; WHO, 2013a). How people keep their dogs, as well as the presence of stray dogs in the communities are issues important to assess when rabies prevention is the goal. Thus, animal welfare and attitudes towards dogs are parts that are needed to be worked on when trying to extinguish rabies. Arrangements to illuminate animal welfare issues are also needed to improve the handling of animals in general in areas where this is not generally prioritized. The behavior of people towards animals is affected by the attitudes they have towards the animals (Hemsworth *et al.*, 2002; Coleman *et al.*, 2003). To get people to acquire a more positive attitude towards dogs might improve the behavior of people towards dogs and thereby improve animal welfare. Attitudes and behavior towards animals can be improved by education and by getting a greater understanding of animals (Hemsworth *et al.*, 2002).

Education programs have been suggested to prevent dog bites by improving the knowledge of dog behavior (Lakestani *et al.*, 2011). The use of education programs have also been suggested to improve animal welfare (Miura *et al.*, 2002) and to promote responsible dog ownership (OiE, 2010). Education has been shown to be efficient in these above mentioned aspects in other studies (Ascione & Weber, 1996; Spiegel, 2000) and has also been capable to rise the knowledge of rabies among people (Matibag *et al.*, 2009).

The objectives of this study were to evaluate differences in knowledge about rabies, animal welfare and attitudes towards dogs between children that had and children that had not participated in the education program about these subjects provided by the organization Lilongwe Society for the Protection and Care of Animals (LSPCA). A literature review to look into other findings and conclusions in these aspects was also an important part of the study. If participation in an education program like the one that is provided by LSPCA is found to increase knowledge about rabies, animal welfare and improve attitudes towards dogs it is motivated to continue with the programs and to expand the magnitude of the program. That is to reach the long-term goal, which is to reduce rabies incidence in dogs and people, as well as to improve animal welfare.

LITERATURE REVIEW

Rabies

Rabies etiology and epidemiology

Rabies is caused by a virus within the virus family *Rhabdoviridae* (Zachary, 2007). It is a disease of mammals, but the sensitivity to the virus can vary between different mammal hosts (Quinn *et al.*, 2002).

Rabies virus is spread over geographical areas through mammal reservoirs. Different parts of the world have different mammal species as main reservoir for the disease, such as the red fox and raccoon dog in Europe (Finnegan *et al.*, 2002), vampire bat in Central- and South America (Schneider *et al.*, 2009) and raccoons, skunks, foxes and bats in North America (Finnegan *et al.*, 2002). Domestic dogs are believed to contribute to a great extent as rabies virus reservoirs in African countries (Prager *et al.*, 2012).

Rabies transmission

The virus is spread through infected saliva in bites, scratches and through licks from infected animals in open wounds or on mucosal membranes (WHO, 2013b; Depani *et al.*, 2012).

The virus is then spread from the bite wound site via the peripheral nervous system and it generates clinical symptoms in step with destruction of the nervous tissue. Some other tissues also get infected with virus, such as muscles and the salivary glands which is why saliva becomes infective to other individuals that come in contact with it (Quinn *et al.*, 2002).

Rabid animals can transmit virus early in the infection because of the spread of virus to the salivary glands and the saliva occur at the same time as the virus is spread in the central nervous system. This causes neurological signs, such as aggressiveness and an increased risk of biting people or other animals, and the risk of transmission of virus to occur simultaneously in an infected animal (Zachary, 2007). Dog bites are an important way of transmission for rabies disease in humans (Dodet *et al.*, 2008; Jemberu *et al.*, 2013; WHO, 2013a).

It is possible to prevent a person exposed to the virus from getting ill to rabies by neutralizing virus with antibodies before the virus invades the nervous tissue. This is done through vaccination and/or use of immunoglobulins, so called post-exposure prophylaxis (PEP) (Franka *et al.*, 2009; Permpalung *et al.*, 2013)

Signs of rabies

After the incubation period the animal enters a "prodromal phase" when it can show different signs of behavioral changes (Quinn *et al.*, 2002). After the prodromal phase the animal can either undergo a "furious" or a "paralytic phase" of the disease (Quinn *et al.*, 2002). Unprovoked attacks, aggressiveness, restlessness and excessive salivation are some of the signs of rabies in dogs. Head ache, hydrophobia and behavioral changes and a wound that itches or is painful are some examples of signs of rabies in humans (WHO, 2013b).

Humans, as well as animals, usually die within a week after the first neurological signs are seen (Taylor, 2009; Depani *et al.*, 2012).

Rabies prevention

Rabies disease is possible to prevent by vaccination. To reduce the number of human rabies cases, vaccination of dogs against the disease is recognized as a relatively financially sustainable method (Lembo *et al.*, 2010). The aim in countries that try to reduce the prevalence and the incidence of rabies is to vaccinate as big part of the local dog population that the risk of an outbreak of rabies can be kept at a minimum level. The “vaccination coverage” needed to prevent a serious outbreak is estimated to be 70 percent of the dog population in a community (Coleman & Dye, 1996). Though unfortunately, several countries endemic to rabies do not succeed in getting a vaccination coverage that high (Edelsten, 1995; Fielding *et al.*, 2012). Reasons why vaccination coverage goals do not succeed could be because of a lack of awareness of the importance of dog vaccination among dog owners, lack of vaccine, as well as because of the cost of the vaccine for the dog owner (Jemberu *et al.*, 2013). People are less likely to take their dogs for annual vaccinations if they find it difficult (Rohlf *et al.*, 2012). Examples of difficulties perceived by dog owners are to capture, restrain and transport the dog to the vaccination area, as well as aggressiveness of the dog (Thomas *et al.*, 2013). Thus, many factors contribute to why dogs do not get vaccinated against rabies as recommended in those areas.

Reports of reduced incidence of rabies among people and/or among dogs after participation in a rabies control program that provided dog rabies vaccinations have been published, for example in Sri Lanka (Kumarapeli & Awerbuch-Friedlander, 2009) and in Tanzania (Cleaveland *et al.*, 2003). Thus, rabies control programs are motivated in countries with endemic rabies to reduce the incidence of the disease.

After getting bitten by a dog it is of great importance to know which first aid measures that are needed in case of the dog was infected with rabies. Those first-aid measures are to clean the bite wound with water and soap and after that to get post-exposure prophylaxis as soon as possible (WHO, 2013a).

Public awareness and an increase of knowledge about rabies disease, first aid measures after dog bites, increased knowledge about dog behavior and how to avoid getting bitten by dogs are suggested methods to prevent rabies in humans (Depani *et al.*, 2012; Fielding *et al.*, 2012).

In general, a lack of awareness about rabies is considered to be a major obstacle in rabies prevention (Dodet *et al.*, 2008). Education about dog behavior is suggested to prevent dog bites (Lakestani *et al.*, 2011) and has been shown to have an effect on the awareness of children regarding how they should act around dogs to avoid dog bites (Spiegel, 2000). Education has also been shown to increase the participation of children in the prevention of animal welfare violations (Ojwang *et al.*, 2010) and to increase knowledge of first aid measures after a dog bite and increase knowledge of recommended vaccination practices to prevent the disease in dogs (Matibag *et al.*, 2009).

By finding out the factors that differentiate why some people assimilate to certain health-related recommendations, such as vaccinations of dogs, and some others not to do so it might also facilitate to find methods to encourage those people to also make a change and to follow

health-related recommendations (Ajzen *et al.*, 2007). For example, people who participate in activities together with their dogs also tend to be more prone to follow health-related recommendations regarding their dogs (Rohlf *et al.*, 2012). In other words, it might be beneficial for dog health to encourage dog owners to participate in that kind of activities (Rohlf *et al.*, 2012). Other engaging activities, such as to get the local people involved in vaccination campaigns is also suggested to improve the turn-up at vaccination centers and improve vaccination coverage (Thomas *et al.*, 2013).

Stray dogs in developing countries

To have a large population of stray dogs in a community is considered to be a risk of zoonotic diseases such as rabies (OiE, 2010). Responsible dog ownership is promoted as a key stone to reduce the population of stray dogs and also to reduce the number of human cases of dog bites and transmission of zoonoses (Spiegel, 2000; Beck *et al.*, 2013). Responsible dog ownership include, for example, to take responsibility for the dog's welfare and health and to make sure it does not run around unsupervised and does not pose a risk to people (Hiby, 2013; OiE, 2010).

Sterilization is used to prevent unwanted puppies from being born and by that to reduce the stray dog population (Hiby, 2013). Control of dog movement, that is, for example to have the dogs on a leash or in a fenced area and to control the food sources of stray dogs is also recommended to reduce the stray dog population and thereby the rabies incidence (OiE, 2010). In spite of the fact that many people have negative feelings against stray dogs, there are areas that report that they have a problem with people who feed those animals and by this behavior they prevent a reduction in the stray dog population (Fielding *et al.*, 2012). Unsupervised dogs in the streets are not only a problem for people, but is also an animal welfare issue, since those dogs might not get the care they need and if they are also not sterilized reproduction among those dogs will be unlimited.

Dogs that are kept outdoors are less likely to be neutered than dogs kept indoors, which could reflect that dogs that are kept outdoors are neglected in compare with dogs that are kept indoors (Fielding *et al.*, 2012). It is important to enlighten dog owners of their part in dog population control and rabies prevention, such as getting their dogs sterilized (Edelsten, 1995; Herbert *et al.*, 2012).

Even if an area has a high density of stray dogs, most of dog bites are committed by dogs people know and not by dogs in the streets (Spiegel, 2000; Fielding *et al.*, 2012), but if people let their own dogs wander the streets those dogs come in contact with other dogs in the streets and are then put at risk of getting infected with rabies. Hence, by getting the dogs of the households vaccinated against rabies the risk of human incidence of the disease would be reduced (Fielding *et al.*, 2012).

Rabies in the world

Rabies causes most problems outside of Europe, but like other infectious diseases it poses a risk of being spread when people and animals are moving across borders (Fooks *et al.*, 2003; Lankau *et al.*, 2013). That is, for example international travelling, both among people and among dogs (Velasco-Villa *et al.*, 2008; Lankau *et al.*, 2013; Global Alliance for Rabies Control. 2013), as well as animal trade when pets cross country borders from an area endemic to rabies to an area former free from the disease (Mcquiston *et al.*, 2008). Illegal imports of pets is another important transmission route for zoonoses like rabies because the imports occur without insight from authorities and often without recommendations about vaccinations, anti parasitic treatments and veterinary examinations being followed (Eismann *et al.*, 2010; Tietjen *et al.*, 2011). Migration of wild animals also poses a considerable risk of a spread of the disease into new areas (Singer *et al.*, 2009). Spill-over of virus from the wild animal population to the dog population poses a potential risk of reintroduction of dog rabies into areas that have earlier successfully eradicated the disease (Blanton *et al.*, 2012). Rabies is, because of its wide spread across the world and its potential risk of reintroduction in former virus free countries a disease that should not be neglected and demands cooperation across borders to be defeated (Lembo *et al.*, 2011). It is also, with illegal trade of animals and international travelling, a disease that Swedes should pay attention to and get aware of as well.

Rabies in developing countries

Africa is, together with Asia, the continent that suffers from most human deaths related to rabies (WHO, 2013a). The people who are most subject to the risks of rabies are poor people and those living in rural areas, because there might be a limited access of vaccine and economical resources in those areas (Knobel *et al.*, 2005). In addition, people in rural areas are less likely to seek modern treatment after a dog bite than people in urban areas, possibly because of a limited access to modern medical care in those areas or because people in rural areas are less aware of modern medicine and/or rabies (Jemberu *et al.*, 2013). People in rural areas are also more likely to own dogs and are then to a greater extent put at risk of being bitten by a dog (Knobel *et al.* 2008a).

Rabies awareness

The knowledge of rabies differ among groups of people depending various factors. People with higher education tend to know more about rabies (Palamar *et al.*, 2013), while illiterate persons tend to know less about rabies (Herbert *et al.*, 2012). Men tend to have less knowledge of rabies than women (Herbert *et al.*, 2012; Palamar *et al.*, 2013). Some minority ethnic groups have been found to have less awareness of rabies than others in the USA, which partly could be due to lingual difficulties since information about rabies was provided in English, and not in the main language of those minorities (Palamar *et al.*, 2013). Reports indicate that many people are somewhat familiar with the presence of the disease, but possess low awareness of the transmission and prevention of it (Fielding *et al.*, 2012; Jemberu *et al.*, 2013), which might contribute to low vaccination coverage in rabies endemic areas.

Rabies is most common in children and is more common in males than females (Cleaveland *et al.*, 2002; Knobel *et al.*, 2005; Dodet *et al.*, 2008).

Attitudes towards dogs

Historically the attitudes towards dogs among the great religions Christianity, Islam and Judaism have been adversely portrayed, often demonizing the nature of the species in different aspects (Menache, 1997). It is possible that some of the negative attitudes against dogs in religion derive from savage dog packs that spread rabies and created an insecure environment during prehistoric and medieval times (Menache, 1997).

There is a hypothesis that humans regard the purpose of animals as either useful as a human tool or affectionate where focus is on the emotional value of the animal (Serpell, 2004). One could assume that attitudes towards pets would be less affectionate in areas where a lot of dogs are allowed to roam freely as this might be seen as a sign of neglect, but studies have shown that people in such areas to a great extent consider their dogs to be a part of the family (Fielding *et al.*, 2012).

Several factors affect the attitude of people towards animals, for example cultural differences and religion (Al-Fayez *et al.*, 2003), but also if one is a dog owner or not, which might differ in frequency in different cultures (Miura *et al.*, 2002). Lakestani *et al.*, (2011) showed that dog owners had a more positive attitude towards dogs than non-dog owners, which has also been seen in other studies (Schenk *et al.*, 1994).

To have been bitten by a dog was shown not to affect attitudes towards dogs negatively, independent of dog ownership status (Lakestani *et al.*, 2011). It has actually been shown that there is a positive correlation between to have been bitten by a dog and to have a positive attitude towards pets. This might be due to the assumption that people who like dogs probably seek contact with dogs in greater extent and put themselves more at risk of dog bites than people that do not like dogs (Schenk *et al.*, 1994; Lakestani *et al.*, 2011).

Dogs and people

The behavior of people towards animals is strongly connected to their attitudes towards animals (Hemsworth *et al.*, 2002; Coleman *et al.*, 2003). Factors that affect dog ownership are for example the structure and religion of the household. Dog ownership is less common in Muslim families, but families that own livestock are more likely to own a dog regardless of religion (Knobel *et al.*, 2008a).

Some studies say that gender is one of the predictors for perception of pets (Miura *et al.*, 2002) and attachment towards pets among people (Vizek-Vidović *et al.*, 2001). Other studies could not find a connection between the level of attachment towards pets and the gender of people (Bodsworth & Coleman, 2001). A study that investigated the correlation between attitudes and behavior towards animals also showed that tough-mindedness of the stock persons in a slaughter house was correlated to a more frequent use of switched on electrical prods on the pigs which suggests personality of a person also affects the behavior towards animals (Coleman *et al.*, 2003).

Some people have negative feelings towards dogs for different reasons and there are indeed some negative aspects and risks with dog ownership that must be considered by dog owners. Dog ownership puts people at risk for not only zoonoses like rabies, but also to other zoonoses such as parasites like toxocarosis (Morgan, 2013), bacteria like Leptospirosis (Chomel & Arzt, 2013) among other infectious diseases. Some of these risks are possible to reduce by responsible dog ownership, such as deworming of the dog and removal of dog faeces from public areas (Morgan, 2013). In other words, people would benefit, as would the dogs, if more people were responsible dog owners.

Dogs and children

Children tend to love dogs (Spiegel, 2000) and often feel very emotionally attached to their dogs (Vizek Vidović *et al.*, 1999). Children are considered to be the group that is most at risk of getting rabies since they tend to spend more time with animals than adults usually do (WHO, 2013a; Depani *et al.*, 2012; Mallewa *et al.*, 2007). Rabies transmission through contact with saliva on mucosal membranes is possible, which can make young children at risk of getting the disease if they are licked in the face by a rabid dog (Depani *et al.*, 2012).

In spite of the risks with pets, there are some meaningful aspects to consider in the relationship between dogs and children. Pets are known to be a source of comfort and support during childhood (Bodsworth & Coleman, 2001; Miura *et al.*, 2002) and in addition it has been shown that young people that had pets during childhood tend to show more empathy towards both other people and towards animals than those who did not own pets during childhood (Vizek-Vidović *et al.*, 2001). Contact with a dog has also been shown to have possible positive effects on child development and to reduce aggressive behavior among children (Hergovich *et al.*, 2002).

Attachment to pets has been shown to be higher among children in families where only one parent is present instead of two (Bodsworth *et al.*, 2001). Hence, a dog seems to some extent be able to make up for a lack of social contacts with adults in the life of a child (Bodsworth *et al.*, 2001). Younger children have been shown to be more attached to their pets than older children (Vizek Vidović *et al.*, 1999).

Children's attitude towards pets

To develop positive attitudes towards animals among children is encouraged by contact with pets during childhood (Hergovich *et al.*, 2002; Lakestani *et al.*, 2011). In other words, children that come in contact with pets develop a more positive attitude towards animals. This has also been shown to apply in spite of cultural differences (Miura *et al.*, 2002). Attitudes towards dogs among children and adults in some European countries have been shown to be positive (Lakestani *et al.*, 2011).

There are also other factors that affect attitudes towards pets among children. For example, the attitudes of parents towards pets affects the attitudes of their children towards pets (Schenk *et al.*, 1994). One study reports that the attitudes of the children towards dogs are more determined by the attitude of the father of the family, than the mother, which might differ between countries due to differences in culture and religion (Al-Fayez *et al.*, 2003),

since studies conducted in other countries suggest the opposite (Schenk *et al.*, 1994). In addition to other mentioned benefits of contact with pets during childhood it has been shown that pet ownership can contribute to learn children about how to care for animals and about responsibility (Miura *et al.*, 2002).

Malawi

Malawi is a developing republic in the South-East of Africa. The capital of Malawi is Lilongwe and is located in the central part of the country. Malawi was a dictatorship between the years 1964-1994 and before that the country was a British colony. The country has been suffering from censor of media and corruption as well as the HIV-epidemic, natural disasters and malnourishment (Landguiden, 2013).

The majority of the population of Malawi make a living based on agriculture, which make the country sensitive to changes in weather and climate. Malawi is one of the most densely populated countries in Africa. The official languages are Chichewa and English and the majority of the Malawians consider themselves to be Christian. The country has a eight-year long mandatory attendance at school, but it is not unusual that children do not fulfill all years of education because of economical reasons. This is especially common among girls. GDP per person is 404 USD (2012). The most common causes of death are malaria and malnutrition (Landguiden, 2013).

Rabies in Malawi

Rabies is an endemic disease in Malawi (Edelsten,1995). Between the years 1979-1992 there were 2612 confirmed cases of animal rabies in Malawi. Many of those cases consisted of domestic animals and most commonly dogs (Edelsten, 1995).

In the last couple of years the incidence of rabies has been reported to rise in the Southern parts of Malawi (Depani *et al.*, 2012). There are several possible contributing factors to this. For example a lack of vaccine has been a problem in Malawi (Edelsten, 1995) and a lack of vaccine for post-exposure prophylaxis has caused human rabies deaths in the country (Depani *et al.*, 2012). In addition, rabies vaccination coverage in the Malawian dog population is believed to be lower than the recommended vaccination coverage (Edelsten, 1995; Coleman & Dye. 1996). This might partly be due to a lack of vaccine, as seen in some other countries with low vaccination coverage (Thomas *et al.*, 2013).

At a hospital in Blantyre, which is one of the larger cities in Malawi, 10.5 % of 133 children that died from what was believed to be CNS infections during a three-year period turned out to have rabies (Mallewa *et al.*, 2007). Furthermore, during a three-month period in 2011, 5 children died of rabies in the same area and it is therefore an important disease of children in the country (Depani *et al.*, 2012; Mallewa *et al.*, 2007).

Lilongwe Society for the Protection and Care of Animals (LSPCA)

LSPCA is a trust connected to Royal Society for the Protection and Care of Animals International (RSPCA) and was founded in 2008 with support from the Malawian Ministry of Agriculture and Food security to increase animal welfare in the country (LSPCA). The

organization arranges annual rabies vaccination campaigns, education programs about rabies and animal welfare and also operates as an animal shelter and as a veterinary clinic (personal communication, Richard Ssuna, September, 2013)

LSPCA has education teams that go to different schools to teach children about rabies, how to care for animals and about animal welfare. A written description for the education program is available for the animal welfare part. This contains instructions about animal behavior and how to take care of animals. The education team has earlier learnt about the profession at the job, but the organization is now about to change parts of the team to get qualified people with a degree in education to improve the program (personal communication, Richard Ssuna, September, 2013).

MATERIALS AND METHODS

Study design

The study was conducted in Lilongwe district in Malawi from September until the beginning of November in year 2013. A total number of 169 children from 11 different schools were interviewed through a prewritten questionnaire. Of these students, 14 were from a school that was first said to have participated in the education program, but it was later found that the students only had had one lesson in humane education (i.e. How to take care of animals/Animal welfare) and none about rabies. These students (Group C) were therefore excluded from this study and the study focus on the students that had participated and the students that had not participated at all in the education program. Of the remaining students, 75 of them were from 5 different schools that had participated in education program (Group A) provided by LSPCA within the last year. In the schools that had participated in the education program the education was given in the form of non-compulsory gatherings that were called “Animal Kindness Clubs”.

Participation in the education program was defined as that the education team from LSPCA had visited the particular school at least three times within the last year since three lessons were said to ensure that the children had learnt both about rabies, how to take care of animals and other animal welfare issues. The children that were chosen to get interviewed from these schools had participated in the education. The sampling was random, schools were chosen by drawing notes with the school names written on them from a pile. The schools in group A were chosen out of 47 schools. At one school, more precisely at Mvunguti LEA school, they had just started to provide the education in form of the animal kindness clubs, but they had formerly provided the education for all students in class six. Therefore only students from class six were chosen to participate from this school to secure that all participants had had at least three lessons provided by LSPCA.

Table 1. The number of interviewed male and female students from schools that had participated in the LSPCA education program (group A) and that had not participated in the LSPCA education program (group B). Excluded participants are included in the table.

* This school had just started with animal kindness clubs and therefore the number of students in the school and the number of students in average in each class is shown instead of the number of students in the Animal Kindness Clubs.

** Numbers were provided by the teachers/headteachers at each school.

Group A				
School	Female Students	Male students	Total	Total number of students in the class**
Mbinzi LEA School	7	8	15	49
Chilambula LEA School	8	7	15	73
Chimutu LEA School	9	6	15	60
Kawale	8	7	15	167
Mvunguti LEA School	4	11	15	3512 (97)*
Sum Group A	36	39	75	-
Group B				
School	Female Students	Male students	Total	Total number of students in the school (average in each class)**
Dzenza Primary School	12	8	20	3000 (80)
Likuni Girls Primary School	14	0	14	2812 (140)
Ngowe Primary School	8	8	16	1985 (222)
Kanyandule Primary School	8	7	15	3299 (82)
Tsabango Primary School	8	7	15	9000 (160)
Sum Group B	50	30	80	-
Group C				
School	Female Students	Male students	Total	Total number of students in the school (average in each class)**
M'buka LEA School	10	4	14	5888 (202)
Sum Group C	10	4	14	-
The total number of schools	96	73	169	-

The other 80 students were from 5 different schools that had not yet participated in the education program provided by LSPCA (Group B). The schools in group B were chosen out of 39 schools. To facilitate the data collection the number of the rural schools were chosen based on accessibility, which was decided by the assistant/interpreter. Of those schools, 5

were chosen randomly by providing each school with a number and then numbers were picked randomly. The schools that had participated in the education program consisted only by urban schools in Lilongwe city and the schools that had not yet participated in the education program consisted

only by rural schools in Lilongwe district. This was because the organization had so far not been able to provide the education to the rural areas of Lilongwe. The sample in this study was consequently both a convenience sample and a random sample. Schools and number of students interviewed from each school is visualized in table 1.

A copy of the curriculum for the animal welfare part of the education program was shared from LSPCA, but no written instructions for the part of the education that includes the rabies knowledge was provided.

At the beginning of the study a trial of five students from one school that had participated in the education program was made and some adjustments in the order and the construction of the questions was made to get the best chance for genuine answers as possible. Because the test interviews had been done there, this school was not included in the random selection of schools for this study. It was first tried to do 20 interviews in each school, but this turned out to take too long and the goal was then set to do 15 interviews in each school.

In each school that was visited students were chosen by the interviewer and the interpreter by different methods depending on what was applicable in the current school. In some schools a random sample through numerating each student from a list and then pick numbers randomly was possible, but in other schools this opportunity was not provided and sample was based on what classes the teacher gave access to. The children in those classes were then chosen directly in the classroom by the interviewer and the interpreter. It was tried to have equal number of girls and boys that were chosen to participate. When possible, the chosen students were told to stay in class until their turn to get interviewed as it otherwise was a long wait for the last students to get interviewed. Each student was given a small gift (a pencil and a fruit) after the interview.

At each school the head teacher or the headmaster of the school were given a short questionnaire with questions regarding education about rabies and animal welfare in their school and what their own opinion about these subjects were. The teachers filled in these questionnaires by themselves. The teacher questionnaire was not part of the objectives of this study.

Questionnaires

The questions in the children's questionnaire were designed with help from supervisors in Sweden and in Malawi. The different parts of the questionnaire were:

- Demographics (At which school in which zone and district was the interview conducted? Of what gender was the interviewed? How old was the interviewed? What grade was the interviewed in? Did the student own a dog?)
- Vaccination practices regarding the dog (if the interviewed owned a dog) (e. g. Was the dog vaccinated and in that case when and by whom?)
- Relationship and attitude towards dogs
- Health behavior after a dog bite
- Beliefs regarding health of dogs
- Knowledge about rabies (e. g. How does it transmit? What happens with someone that gets rabies? Who are the carriers of the disease?)

The questions were written in English, translated and asked by an interpreter in Chichewa and then translated back into English before the questionnaire was filled in. Each interview took about 5 minutes. Most questions were of a “Yes” or “No”-kind and some questions were open, but they still had prewritten categories for the answers to facilitate the collection of data during the interviews. Some questions were not answered by all participants due to lingual misunderstandings and some students answered both “Yes” and “No” to some questions. This aggravated the analysis of the results because it was not possible to know what category the answers should be put in and therefore these answers were excluded

Statistical Methods

After collection of the data it was entered into tables in Microsoft Excel and the results were, when possible, tested with chi square test (Chi^2 test) to see if they were statistically significant or not. All variables were nominal. Chi^2 test was chosen to investigate if there was a significant statistical difference in the provided answers of the two groups of children. It was assumed that group A would have greater knowledge of rabies and animal welfare, as well as better attitude towards animals, than group B. To some questions Chi^2 test was not applicable due to too few respondents.

Differences in the distribution of answers were also analyzed between boys and girls for some questions. Questions to this analysis were chosen depending on which questions the author regarded as core questions for the study and also depended on the number of answers provided and the possibility to perform Chi^2 test.

Literature review

This thesis also include a literature study with literature collected through search engines such as “Web of Knowledge” and “Pubmed”. Search words which were used were: Rabies, Malawi, Africa, Awareness, Knowledge, Children, Animal welfare, Dogs, Dog ownership. Other sources of information were books on veterinary medicine, information from the website for the World Health Organization (WHO), Office des Epizooties (OiE) and personnel working for LSPCA.

RESULTS

Demographics of the children

Group A and group B consisted of 155 students in total. Gender distribution and age distribution of the students in group A and group B are visualized in figure 1 and figure 2, respectively. One girl from the school called “Kawale” (group A) was shown to only have been participating for two lessons, whereof none were about rabies. This student was excluded from the study because the determined definition of participation in the education program was to have attended at least three lessons. The total number of students in group A was therefore 74 and the total number of students in group A and group B was 154. The number of respondents is, if nothing else is specified, 154 students for all questions.

The age span of the students in this study was 8-18 years with a median age of 12 years. Both group A and group B had a median age of 12 years. The incidence of dog ownership and dog rabies vaccination practices of those are shown in table 2. There was no significant difference between group A and group B regarding dog ownership.

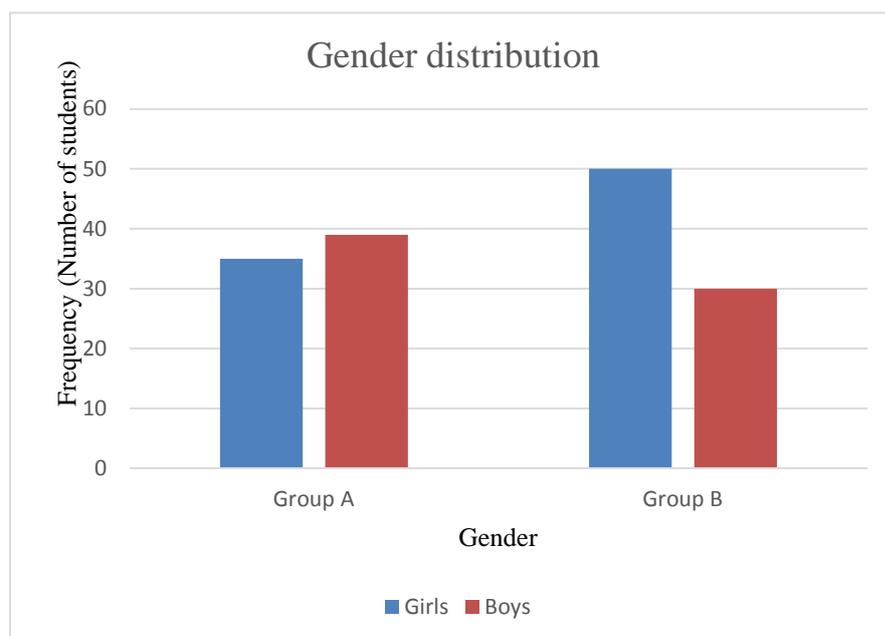


Figure 1. *The number of boys and girls in group A and group B.*

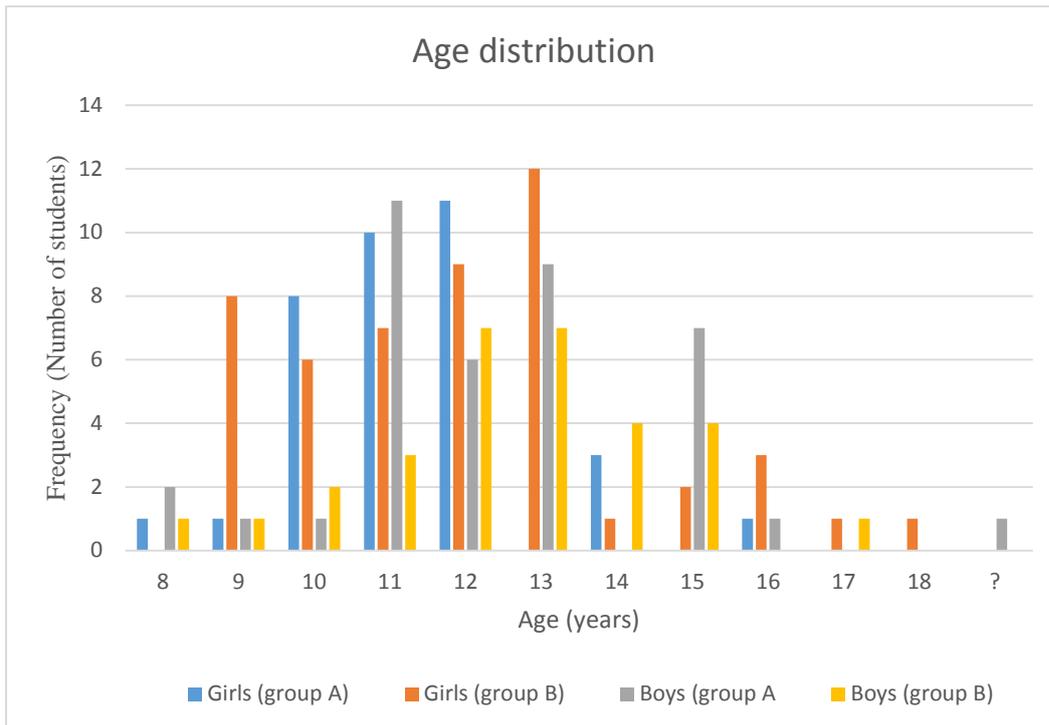


Figure 2. Age distribution of the boys and girls in group A and group B.

Table 2. The distribution of dog owners among the students and the dog rabies vaccination practices among the dog owners in absolute numbers followed by the percentage of all students in group A and group B, respectively. Percentage in vaccination practices are calculated from the dog owners in group A and group B, respectively

Status of dog ownership	Group A	Group B	Total	α
a. Dog owners	28 (37.8 %)	32 (40.0%)	60 (39.0 %)	ns
b. Non-dog owners	46 (62.3 %)	48 (60.0 %)	94 (61.0 %)	ns
Purpose of owned dog	Group A	Group B	Total	
a. Kept dog as a pet	3 (10.7 %)	0 (0.0 %)	3 (5.0%)	
b. Kept the dog for protection	26 (92.9 %)	32 (100.0 %)	58 (96.7 %)	
c. Kept the dog for hunting	0 (0.0 %)	2 (6.3 %)	2 (3.3 %)	
Rabies vaccination of owned dogs	Group A	Group B	Total	α
a. Vaccinated dogs	21 (75.0 %)	15 (46.9 %)	36 (60.0 %)	ns
b. Not vaccinated	7 (25.0 %)	13 (40.6 %)	20 (33.3 %)	ns

α = Level of statistical significance (Chi2-test) *** $p < 0.001$ ** $p < 0.01$ * $p < 0.05$ ns = not significant

Rabies awareness

The answers to the questions about rabies awareness are presented in table 3 and 4. In the answer category “other” to the question “How can you tell that a dog has rabies?” one student from group A (1.4%) mentioned hydrophobia. From group A 4 students (5.4%) specified rabies transmission as “contact with saliva on broken skin”, which was also mentioned by one student from group B (1.3%).

Table 3. *The distribution of answers in group A and group B. Absolute numbers for group A and group B are followed by percentage of all the respondents in group A and group B, respectively, in brackets after the number.*

“Have you ever heard of rabies?”				
Answer	Group A	Group B	α	
a. Yes	74 (100.0%)	57 (71.3%)	***	
b. No	0 (0.0%)	23 (28.8%)	***	
c. Don't know	0 (0.0%)	0 (0.0%)		
“What is rabies?”				
Answer	Group A	Group B	α	
a. A disease	68 (91.9%)	50 (62.5 %)	***	
b. Don't know	3 (4.1%)	12 (15.0%)	*	
c. Mad dog/madness/aggressiveness	2 (2.7%)	16 (21.3 %)	***	
d. Other	1 (1.4%)	5 (6.3%)		
”Can people get rabies?”				
Answer	Group A	Group B	α	
a. Yes	73 (98.6)	62 (79.5%)	***	
b. No	1 (1.4%)	16 (20.5%)	***	
c. Don't know	0 (0.0%)	2 (2.5 %)		
”Can dogs get rabies?”				
Answer	Group A	Group B	α	
a. Yes	74 (100.0%)	75 (93.8 %)		
b. No	0 (0.0%)	5 (6.3 %)		
c. Don't know	0 (0.0%)	0 (0.0 %)		

“How can people and animals get rabies?”			
Answer	Group A	Group B	α
a. Bite from an infected animal	73 (98.6%)	60 (75.0%)	***
b. Through air/breathing	0 (0.0%)	3 (3.8%)	
c. Through sex	0 (0.0%)	4 (5.0%)	
d. Through food	1 (1.4%)	1 (1.3%)	
e. Via a vector (e.g. mosquito bites)	0 (0.0%)	1 (1.3%)	
f. Magic/supernatural powers	0 (0.0%)	1 (1.3%)	
g. Several sorts of contact with an infected animal (e.g. bite, lick, scratch)	0 (0.0%)	0 (0.0%)	
h. Don't know	1 (1.4%)	8 (10.0%)	
i. Other	1 (1.4%)	8 (10.0%)	
“How can you tell that a dog has rabies?”			
Answer	Group A	Group B	α
a. It has altered/strange behavior	31 (41.9%)	41 (51.3 %)	ns
i. It is aggressive	11 (14.9%)	17 (21.3 %)	ns
ii. It is chasing people	7 (9.5%)	11 (13.8 %)	ns
iii. It is barking	8 (10.8%)	2 (2.5 %)	
iv. It is not settled/walking around	6 (8.1%)	3 (3.8 %)	
v. It does not eat	4 (5.4%)	0 (0.0%)	
b. It tends to bite	20 (20.0%)	31 (38.8 %)	ns
c. It has excessive salivation	37 (50.0%)	9 (11.3 %)	***
d. The tongue is always out	10 (13.5%)	4 (5.0 %)	ns
e. It has red eyes	5 (6.8%)	0 (0.0 %)	
f. It is panting	4 (5.4%)	0 (0.0%)	
g. You can not know surely by just looking at it	1 (1.4%)	4 (5.0%)	
h. Don't know	0 (0.0%)	5 (6.3%)	
i. Other	6 (8.1%)	8 (10.0%)	ns

α = Level of statistical significance (χ^2 -test) *** $p < 0.001$ ** $p < 0.01$ * $p < 0.05$ ns = not significant

Of all the students, 63 (40.9 %) said they play with dogs. Of these, 34 students (45.9 % of group A) were from group A and 29 students were from group B (36.3 % of group B). There was no significant difference between the groups if they played with dogs or not.

Table 4. Distribution of answers regarding rabies awareness in group A and group B. Absolute number for group A and group B are followed by percentage of all the respondents in group A and group B, respectively, in brackets after the number.

“What happens with a person who gets infected with rabies?”			
Answer	Group A	Group B	α
a. The person gets ill	14 (18.9%)	14 (17.5%)	ns
b. The person gets crazy/mad/dangerous	27 (36.5%)	37 (46.3%)	ns
c. The person die	48 (64.9%)	32 (40.0%)	**
d. Severe headache	4 (5.4%)	0 (0.0%)	
e. Wound that does not heal/itches	6 (8.1%)	1 (1.4 %)	
f. Some can get better/get treatment/do not die	1 (1.4%)	8 (10.0 %)	
g. Nothing happens	0 (0.0%)	3 (3.8%)	
h. Don't know	0 (0.0%)	6 (7.5%)	
i. Other	0 (0.0%)	7 (8.9 %)	
“What can you do if you get bitten by a suspected rabid dog?”			
Answer	Group A	Group B	α
a. Get a vaccination/a shot	0 (0.0%)	10 (12.5%)	
b. Go to the hospital/Contact a medical doctor	69 (93.2%)	69 (86.3%)	ns
c. Clean the bite wound	12 (16.2%)	2 (2.5%)	**
d. Contact a traditional healer	0 (0.0%)	1 (1.3%)	
e. Ask for rabies vaccination certificate of the dog	7 (9.5%)	0 (0.0%)	
f. Wound treatment (e.g. apply medication or put a Band-Aid on it)	2 (2.7 %)	2 (2.5 %)	
g. Report it to the dog owner	2 (2.7 %)	2 (2.5 %)	
h. Contact a veterinarian	6 (8.1 %)	0 (0.0 %)	
i. Tell parents	6 (8.1 %)	2 (2.5 %)	
j. Nothing	0 (0.0%)	0 (0.0%)	
k. Kill the dog	0 (0.0 %)	6 (7.5%)	
l. Don't know	0 (0.0 %)	1 (1.3 %)	
m. Other	3 (4.1 %)	2 (2.5 %)	

α = Level of statistical significance (χ^2 -test), *** $p < 0.001$ ** $p < 0.01$ * $p < 0.05$ ns = not significant

Attitudes towards dogs and animal welfare

Results for the questions about children's feelings regarding dogs are presented in table 5. When calculated, the level of significance is presented in the table, as well.

Of children that said that they were scared of dogs (75 (48.7 % of group A and group B)) some mentioned that they were "scared of the neighbor dogs, but not my own dog", "scared of dogs in the streets" or "scared of the big dogs". The students were also asked if it was okay to hit a dog in general. Results to this question are visualized in figure 3.

From group A 7 (77.8% of the students that thought it was okay to hit a dog) of the students that said it was okay to hit a dog said it was only proper to hit a dog when the dog has done something wrong or does not obey, but that you should not hit the dog if it is calm or did not do anything wrong. Correlative numbers for group B was and 12 students (25.0% of the students that thought it was okay to hit a dog). Situations that the students felt it was okay to hit/beat a dog are compiled in table 6.

Students that answered that it is not okay to hit a dog in general or in any of the proposed situations often reported one should use other preventing methods instead, like to put food somewhere were the dog will not reach it, scare the dog away when it attacks or train the dog not to those things.

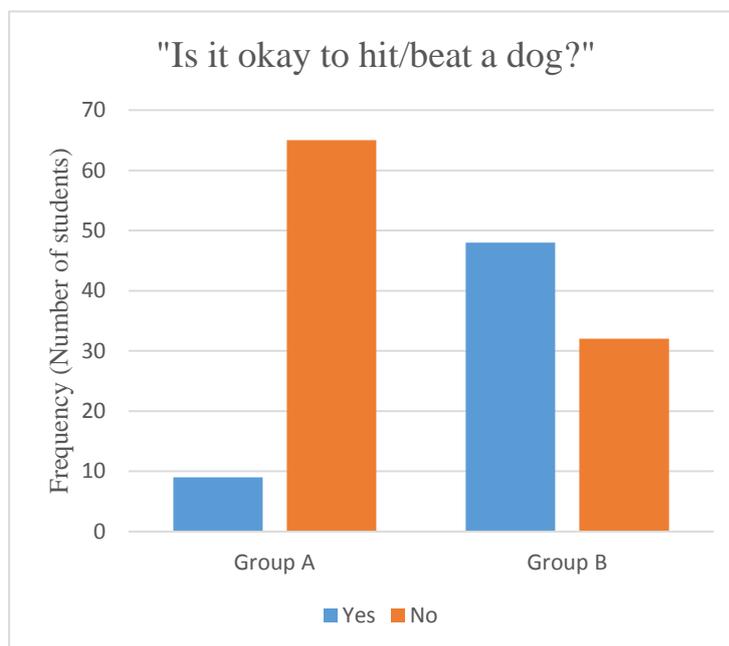


Figure 3. Distribution of answers to the question "Is it okay to hit/beat a dog?". Number of respondents is 154 students. There was a statistically significant difference ($p < 0.001$) between group A and B

Table 5. The distribution of answers in group A and group B to the questions about their opinions regarding dogs. Absolute number for group A and group B are followed by percentage of all the respondents in group A and group B, respectively, in brackets after the number

☒ 151 respondents ☒ 152 respondents ☒☒ 122 respondents

”Do you like/not like dogs?”☒				
Answer	Group A	Group B	α	
a. I like dogs	54 (75.0%)	29 (36.7%)	***	
b. I do not like dogs	18 (25.0 %)	50 (63.3 %)	***	
”Are dogs important to humans?”☒☒				
Answer	Group A	Group B	α	
a. Yes	73 (98.6%)	71 (91.0%)		
b. No	1 (1.4%)	7 (9.0%)		
c. Don’t know	0 (0.0%)	0 (0.0%)		
”Are dog friendly/not friendly?”☒☒☒				
Answer	Group A	Group B	α	
d. Dogs are friendly	54 (83.1 %)	30 (52.6%)	***	
e. Dogs are not friendly	11 (16.9%)	27 (47.4%)	***	
“Are dogs good guards/not good guards?”☒☒☒				
Answer	Group A	Group B	α	
a. Dogs are good guards	67 (97.1 %)	48 (90.6 %)	ns	
b. Dogs are not good guards	2 (2.9 %)	5 (9.4 %)	ns	
“Are you scared of dogs?”				
Answer	Group A	Group B	α	
a. I’m scared of dogs	30 (40.5 %)	45 (56.3 %)	ns	
b. I’m not scared of dogs	44 (59.5%)	35 (43.8%)	ns	
Other thoughts about dogs				
Answer	Group A	Group B	α	
a. Dogs are good hunters	0 (0.0%)	4 (5.0 %)		
b. If you do not take care of a dog or hit it, it will not become friendly/a good guard	6 (8.1%)	3 (3.8 %)		
c. No particular feeling about dogs	2 (2.7 %)	0 (0.0 %)		
d. Don't know	0 (0.0 %)	0 (0.0 %)		
e. Other	0 (0.0 %)	2 (2.5 %)		

α = Level of statistical significance (Chi²-test), *** $p < 0.001$ ** $p < 0.01$ * $p < 0.05$ ns = not significant

Table 6. The distribution of answers in group A and group B to the question “In what situation/-s is it okay to hit/beat a dog?”. Absolute number for group A and group B are followed by percentage of all the respondents in group A and group B, respectively, in brackets after the number.

⌘ Students that only answered "Yes" on the alternatives "When it attacks me" and/or "When it attacks another dog/animal"

“In what situation/-s is it okay to hit/beat a dog?”			
Answer	Group A	Group B	α
a. When it steals food	12 (16.2 %)	57 (71.3 %)	***
i. If it steals food you can kill it	0 (0.0 %)	1 (1.3%)	
b. When it barks/makes disturbing noises	1 (1.4 %)	27 (33.8 %)	***
c. When it attacks me	15 (20.3%)	52 (65.0%)	***
d. When it attacks another dog	15 (20.3 %)	61 (76.3 %)	***
i. When it attacks a dog or another animal (e.g. goat, cattle, chickens)	1 (1.4 %)	6 (7.5 %)	
e. Whenever I feel like it	0 (0.0%)	13 (16.3%)	***
f. If it has rabies you can hit it or kill it	0 (0.0 %)	1 (1.3 %)	
g. It is okay to hit a dog in situations where you try to save your life or the life of another animal ⌘	10 (13.5 %)	11 (13.8 %)	ns
h. One should never hit a dog/One should use other methods to prevent these situations	50 (67.6 %)	5 (6.3%)	***
i. Don't know	0 (0.0 %)	0 (0.0%)	
j. Other	0 (0.0 %)	2 (2.5 %)	

α = Level of statistical significance, (Chi²-test), *** $p < 0.001$ ** $p < 0.01$ * $p < 0.05$ ns = Not significant

Care of dogs

The results for what the children said a dog needs to feel well and healthy is presented in table 7. The students were asked if a dog needs clean water and healthy food. Provided answers are presented in figure 4.

When the answer “No” was given to the questions about if dogs need healthy food or/and clean water the students often added that dogs can eat “left-overs” or drink “any” water. Interestingly no students from either group said dogs need friends of their own species. When asked if a dog needs to be taken to hospital (veterinarian) when it is ill, 73 students (98.6 %) from group A and 54 students (67.5 %) from group B said “Yes”, which was found to be a significant difference between the groups ($p < 0.001$).

Table 7. The distribution of answers to the question “What do you think dogs need to feel well and healthy?” in group A and group B. Absolute number for group A and group B are followed by percentage of all the respondents in group A and group B, respectively, in brackets after the number.

“What do think dogs need to feel well and healthy?”			
Answer	Group A	Group B	α
a. Water	32 (43.2 %)	28 (35.0 %)	ns
b. Food	71 (95.9 %)	74 (92.5 %)	
i. Enough food	6 (8.1 %)	10 (12.5 %)	ns
ii. Good/recommended/balanced food	35 (47.3 %)	26 (32.5 %)	ns
b. Love, affection, to be petted	9 (12.2 %)	7 (8.8 %)	ns
i. Caring	3 (4.1%)	1 (1.3 %)	
c. Good shelter	36 (48.6 %)	4 (5.0 %)	***
d. Medical care	25 (33.8 %)	22 (27.5 %)	ns
i. Profylactic healthcare (e.g. vaccinations, sterilization)	0 (0.0 %)	4 (5.0 %)	
ii. Anti parasitic treatment	5 (6.8 %)	2 (2.5 %)	
e. To be clean	3 (4.1 %)	2 (2.5 %)	
f. A human friend	5 (6.8 %)	4 (5.0 %)	
g. A dog friend	0 (0.0 %)	0 (0.0%)	
h. Some kind of restraint/not wander the streets	1 (1.4 %)	2 (2.5 %)	
i. Nothing	0 (0.0 %)	0 (0.0%)	
j. Don't know	0 (0.0 %)	2 (2.5 %)	
k. Other	1 (1.4 %)	2 (2.5 %)	

α = Level of statistical significance (χ^2 -test), * $p < 0.05$ ** $p < 0.01$ *** $P < 0.001$, ns = Not significant

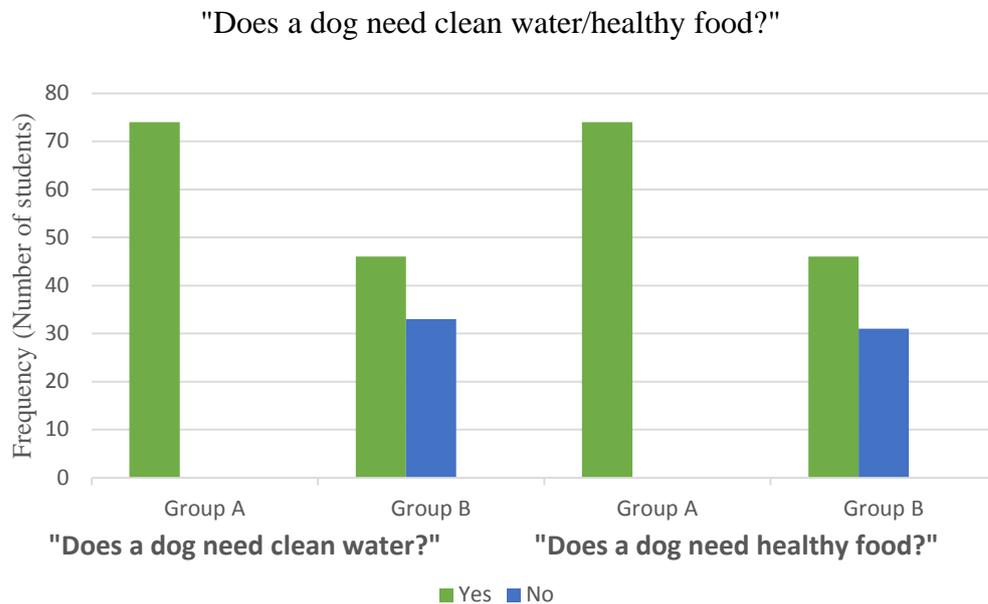


Figure 4. *Distribution of answers to the questions "Does a dog need clean water?" (154 respondents) and "Does a dog need healthy food?" (151 respondents). There was a statistically significant difference ($p < 0.001$) between group A and B for both questions*

One student (1.4%) from group A and two students (2.5 %) from group B said that they would ask the veterinarian to come to them instead, because of for example difficulties and expenses with transportation of the dog to the veterinary clinic. One student (1.3 %) from group B said that if she would take the dog to a veterinarian or not depended on the breed of the dog and that local Malawian dogs were not worth enough money to be taken to a veterinarian when they are ill.

The children were asked in what specific situations they think a dog needs medicine and veterinary care. Provided answers are visualized in figure 5.

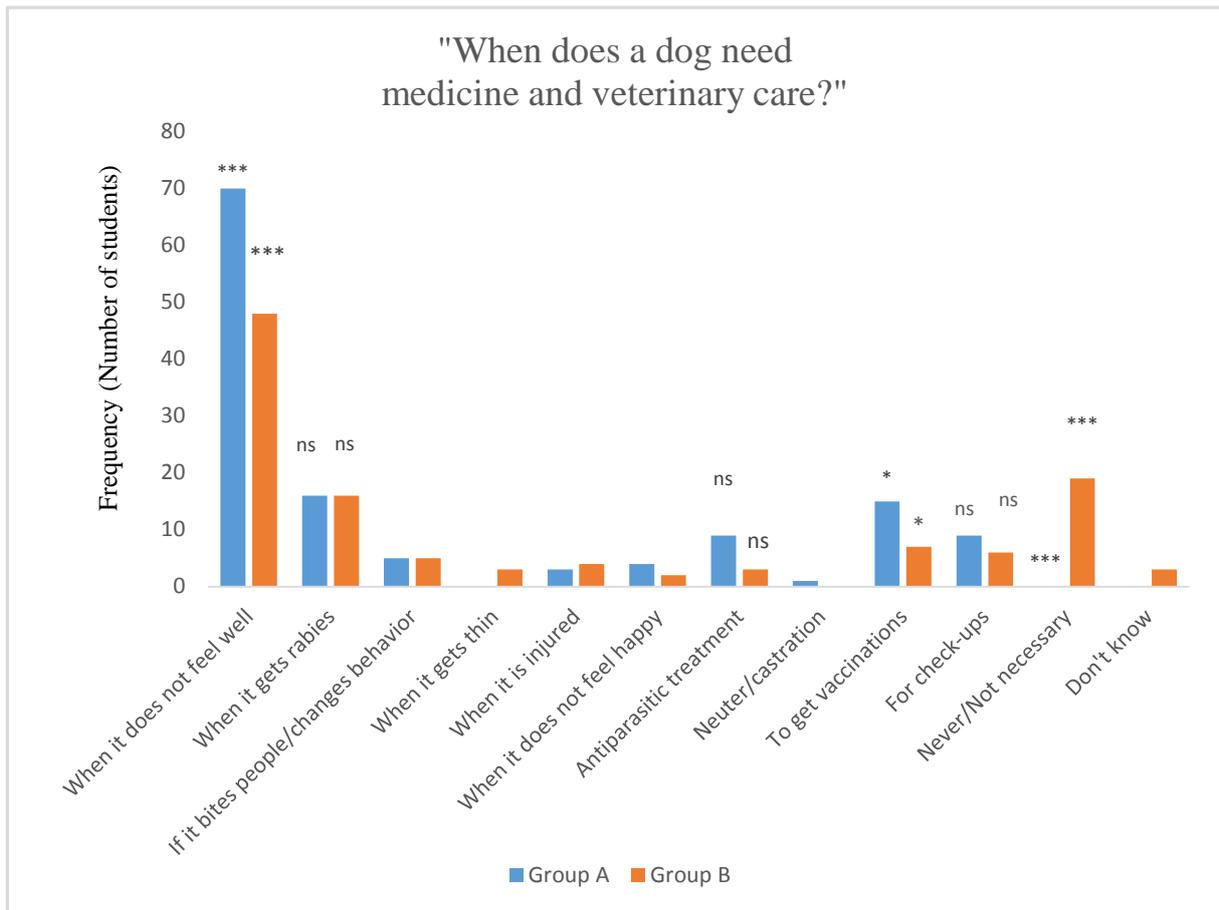


Figure 5. The distribution of the answers to the question “When does a dog need medicine and veterinary care?” in group A and group B. The number of respondents is 154. When calculated the level of significance for the difference between group A and group B is visualized above each bar. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, ns = not significant.

As seen in figure 6 most students reported the use of a dog is mainly for protection, though some students in group A also mentioned that dogs could be pets held for company as well.

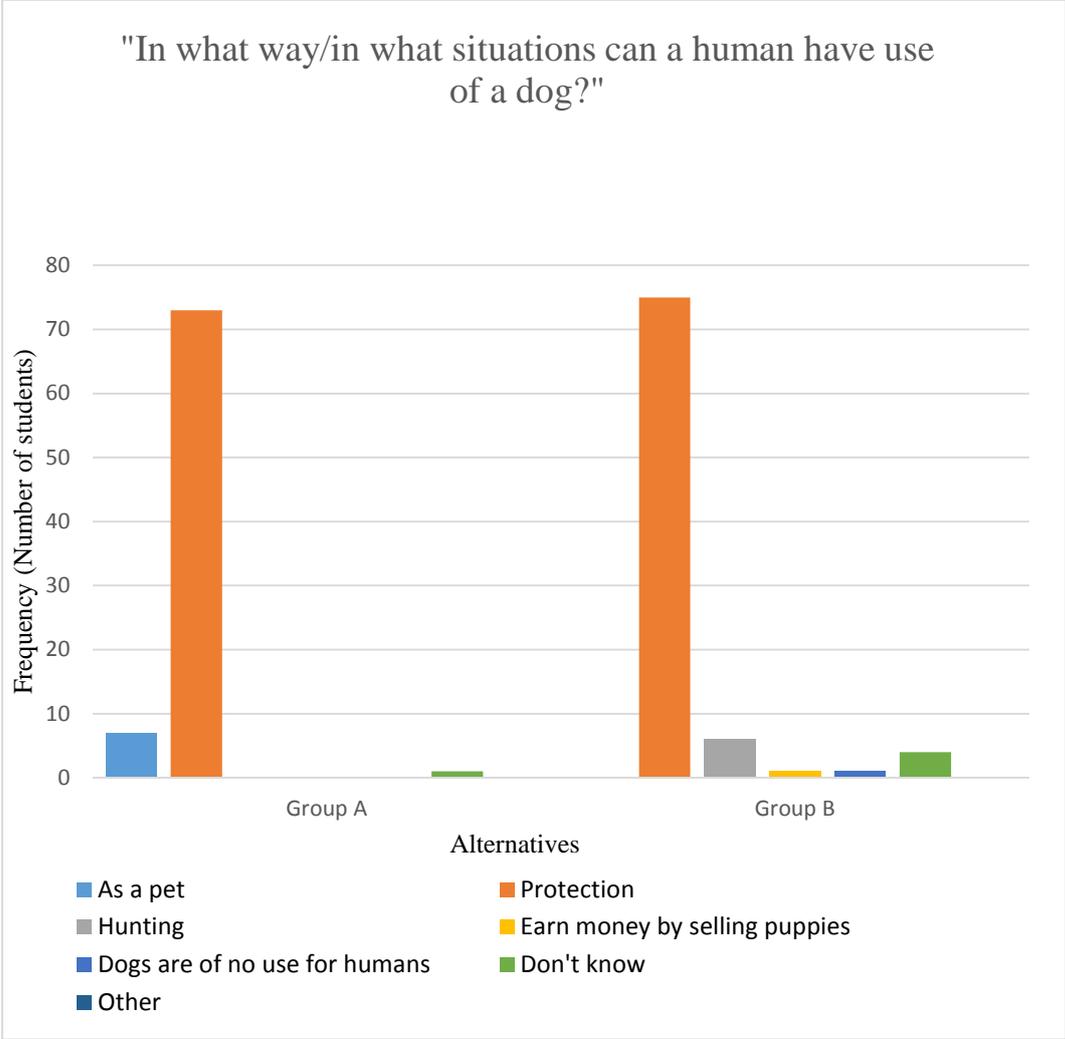


Figure 6. The distribution of answers to the question "In what way/in what situations can a human have use of a dog?" in group A and group B. Absolute number for group A and group B are presented followed by percentage of all the respondents in group A and group B, respectively, in brackets after the number.

Gender differences

Differences in the distribution of answers between girls and boys to some of the questions in this study are presented in table 8. Since this is not the main objective of this study only parts of the asked questions are analyzed through this point of view.

Table 8. *The distribution of answers to selected questions among girls and boys in group A and group B. Absolute numbers for girls and boys are followed by percentage of all boys and girls, respectively, in brackets after the number. The number of children that was asked the question is shown in brackets after each question.*

“Have you ever heard about rabies?” (154 respondents)				
Answers	Girls	Boys	Total	α
a. Yes	63 (74.1%)	68 (98.6%)	131	***
b. No	22 (25.9%)	1 (1.4%)	24	***
c. Don't know	0 (0.0%)	0 (0.0%)	0	
“What is rabies?” (154 respondents)				
Answers	Girls	Boys	Total	α
a. A disease	57 (69.5%)	61(88.4%)	118	**
b. Madness/ mad dog	11 (13.4%)	7 (10.1%)	18	ns
c. Don't know	14 (17.1%)	1 (1.4%)	15	
d. Other	4 (4.9%)	2 (2.9%)	6	
“Can people get rabies?” (152 respondents)				
Answers	Girls	Boys	Total	α
a. Yes	69 (83.1%)	66 (95.7%)	135	*
b. No	14 (16.9%)	3 (4.3%)	17	*
c. Don't know	2 (2.4%)	0 (0.0%)	2	

“How can people and animals get rabies?” (154 respondents)				
Answers	Girls	Boys	Total	α
a. Bite from an infected animal	67 (78.8%)	66 (95.7%)	133	**
b. Through air/breathing	2 (2.4%)	1 (1.4%)	3	
c. Through sex	4 (4.7%)	0 (0.0%)	4	
d. Through food	2 (2.4%)	0 (0.0%)	2	
e. Via a vector (e.g. mosquito bites)	0 (0.0%)	1 (1.4%)	1	
f. Magic/supernatural powers	1 (1.2%)	0 (0.0%)	1	
g. Any sort of contact with an infected animal (e.g. bite, lick, scratch)	0 (0.0%)	0 (0.0%)	0	
h. Don't know	8 (9.4%)	1 (1.4%)	9	
i. Other	6 (7.1%)	3 (4.3%)	9	
“Do you play with dogs?” (154 respondents)				
Answers	Girls	Boys	Total	α
a. Yes	34 (40.0%)	29(42.0%)	63	ns
b. No	51 (60.0%)	40 (58.0%)	91	ns
c. Don't know	0 (0.0%)	0 (0.0%)	0	
“What can you do if you get bitten by a suspected rabid dog?” (154 respondents)				
Answers	Girls	Boys	Total	α
a. Get a vaccination/a shot	5 (5.9%)	5 (7.2%)	10	
b. Go to the hospital/contact a medical doctor	79 (92.9%)	59 (85.5%)	138	ns
c. Clean the bite wound	6 (7.1%)	8 (11.6%)	14	ns
d. Contact a traditional healer	0 (0.0%)	1 (1.4%)	1	
e. Ask for rabies vaccination certificate of the dog	3 (3.5%)	4 (5.8%)	7	
f. Wound treatment (e.g. apply medication or put a Band-Aid on it)	1 (1.2%)	3 (4.3%)	4	
g. Report it to the dog owner	1 (1.2%)	3 (4.3%)	4	
h. Contact a veterinarian	0 (0.0%)	6 (8.7%)	6	
i. Tell the parents	5 (5.9%)	3 (4.3%)	8	
j. Nothing	0 (0.0%)	0 (0.0%)	0	

k. Kill the dog	3 (3.5%)	3 (4.3%)	6	
l. Don't know	0 (0.0%)	1 (1.4%)	1	
m. Other	3 (3.5%)	2 (2.9%)	5	
“What do you think of dogs?” (151 respondents)				
Answer	Girls	Boys	Total	α
a. I like dogs	36 (43.4%)	47 (68.1%)	83	**
b. I don't like dogs	47 (56.6%)	21 (30.4%)	68	**
“Are dogs needed to be taken to a hospital (veterinarian) when they are ill?” (150 respondents)				
Answer	Girls	Boys	Total	α
a. Yes	65 (78.3%)	62 (92.5%)	97	*
b. No	18 (21.7%)	5 (7.5%)	23	*
c. Don't know	0 (0.0%)	0 (0.0%)	0	
“Do dogs need healthy food?” (151 respondents)				
Answer	Girls	Boys	Total	α
a. Yes	61 (73.5%)	59 (86.8%)	120	*
b. No	22 (26.5%)	9 (13.2%)	31	*
c. Don't know	0 (0.0%)	0 (0.0%)	0	
“Is it okay to hit a dog?” (154 respondents)				
Answer	Girls	Boys	Total	α
a. Yes	39 (45.9%)	18 (26.1%)	57	*
b. No	46 (54.1%)	51 (73.9%)	97	*
c. Don't know	0 (0.0%)	0 (0.0%)	0	

α = Level of statistical significance (Chi^2 -test), * $p < 0.05$ ** $p < 0.01$ *** $P < 0.001$, ns = Not significant

Teacher questionnaire

These results represent the answers from all the teachers or headmasters that participated in this study and answered the provided questionnaire (i.e. 11 teachers or headmasters). Of the teachers, 8 (73 %) said that rabies is an important disease in the area. The remaining teachers filled out in the questionnaire that they did not think it was important, but when they were asked to motivate why or why not they found it important or not they provided an answer that indicated that they did think it was important. All of the teachers that thought rabies was an important disease in the area said it was important because people die because of it.

All of the respondents (100.0 %) said that education about rabies and animal welfare was important. Of the respondents 9 (82 %) said that education about rabies was important because it can help to prevent the disease and 10 (91 %) said that education about animal welfare was important to teach the children how to take care of animals.

Out of 9 respondents, four (44 %) said that education about rabies was included in the school curriculum and 10 out of 10 respondents (100.0%) said that animal welfare was included in the school curriculum. All the teachers thought the children needed more education about animal welfare and 10 out of 10 respondents (100.0%) thought the children needed more education about rabies as well. Three teachers (27 %) believed that when the children gain knowledge about rabies and animal welfare the knowledge of these subjects will also improve in the communities.

DISCUSSION

Rabies awareness

In this study it was found that students that had participated in classes with education about rabies reported that they had heard about rabies and said it was a kind of disease in higher extent than students that had not participated in such classes. Students that had not participated in the education program were more likely to associate rabies with “aggressiveness” or “madness” or to report that they did not know what rabies was (Table 3). That people tend to associate rabies with different words for “madness” is consistent with other studies (Jemburu *et al.*, 2013). This association is probably due to the serious neurological signs that are seen when humans or animals get ill from the disease.

Students that had participated in the education program were also significantly more aware that it was a disease that humans can get and that it can be transmitted through bite (Table 3). This is important knowledge since a lack of this knowledge poses a risk of people not getting the appropriate treatment after an exposure to a rabid animal and is also a risk of people not getting their dog vaccinated (Jemburu *et al.*, 2013). Though, many of the participating students said that rabies transmission occurs through bite, none mentioned transmission through licks or scratches. Some added “contact with saliva on broken skin” as a source of infection, which could be due to a deeper knowledge of rabies transmission of those students. Saliva in wounds or across mucosal membranes is the main source for transmission of rabies virus (WHO, 2013b; Depani *et al.*, 2012). To say saliva is a source for transmission is a more specific explanation than to say transmission occur through bites, since it is the contact with saliva that makes bites infectious. It cannot be excluded that those students meant that rabies transmission can occur through scratches and licks as well. Though, there were only 5

students out of 154 that mentioned this knowledge about rabies transmission, which is a relatively low number. Thus, increased knowledge of rabies transmission is desirable for both groups.

Deficient knowledge of rabies transmission has also been seen in other studies, for example in a study by Palamar, et al. (2013) who found that only 41 % of the respondents in one of the ethnic groups that participated in that study knew rabies transmission to humans occur through bite from an infected animal. Another example of low awareness of rabies transmission was seen in a study by Herbert, et al. (2012) where it was found that only half of the respondents knew that not only bites, but also licks and scratches from infected animals are routes of transmission for rabies virus. Though, there was a difference in the awareness of human rabies, both groups of students in the present study were aware that rabies is a disease that dogs can get (Table 3), which may reflect that it is commonly known as a “disease of dogs”. That it was a “disease of dogs” was a frequent explanation when the children were asked what rabies was. It seems like many children associated rabies with dogs without reflecting on how this disease could affect themselves or their loved ones. This is due to either lack of knowledge and education about this or because of other factors.

The number of students in group B that said they did not know what rabies was, was significantly higher than in group A (Table 3). More of the students in group B said a person could get better and that a person that gets rabies does not die, though this could not be tested with chi square test since the number of respondents was too low. However, significantly more students in group A actively said that a person die if the person gets rabies (Table 4). To know it is a fatal disease could make people more concerned of their parts in prevention issues, such as vaccination of their dogs to avoid to accidentally take the disease into their households.

Both groups said that the consequence after a person gets infected with rabies was that the person gets “crazy”, “mad” or “dangerous”, but more of the students in group A said that the person will get “severe headache” and “an itching wound” (Table 4).

The only significant difference between the two groups regarding the reported signs of rabies in a dog was “excessive salivation”, which was more likely to be reported from group A. Other symptoms that was mentioned in as high extent in both groups were altered behaviors such as “aggressiveness” and “chasing people” and that the dog “tend to bite” (Table 3). One student from group A also mentioned hydrophobia as a sign of rabies in dogs. This is a sign of rabies in humans, but it is not seen in dogs (WHO, 2013b). Still, hydrophobia is a good guess, since it is a relatively rabies specific symptom.

Thus, group A tended to know more rabies specific symptoms in both humans (e.g. “severe headache” and “itching wounds”) and in dogs (“excessive salivation”) than group B. The answers that were provided from group B were not wrong, but they were not as specific as some of the answers from group A (Table 3 & 4). To say that a person “gets crazy” is a relatively vague description of a person with behavioral changes due to rabies encephalitis, as well as to say that a rabid dog gets “aggressive” and “tend to bite”, which could be a description of many dogs ill of other reasons. However, behavioral changes is one of the

major signs of rabies (WHO, 2013b). To say that the person gets an “itching wound” shows the respondents know it has something to do with lesions, such as dog bites. This could indicate that the respondents had knowledge about how “the person” got rabies and thus, they showed that they had knowledge about rabies transmission.

The differences can be due to a greater knowledge about this among the children in group A because of a general interest in those questions or because they had heard it during the lessons in the LSPCA education program. These findings indicate that education about rabies has an effect on knowledge of rabies among children since the children from the education program tended to provide the more correct answers to rabies-related questions in higher extent than the other students.

Both groups were as likely to go to hospital after a dog bite, which is consistent with other studies performed in Malawi that showed that Malawians in general are prone to seek help after a dog bite (Edelsten, 1995). However, group A was more likely to say that they would “clean the wound” after a bite from a suspected rabid dog, which is considered to be an important first aid measure after a dog bite (WHO, 2013b) (Table 4). A lack of knowledge of the recommended first-aid measures after a dog bite, such as to clean the wound and to get post-exposure prophylaxis has been reported in other studies performed in other countries, as well (Dodet *et al.*, 2008; Herbert *et al.*, 2012; Palamar *et al.*, 2013). To increase common knowledge about proper behavior after a dog bite, such as about recommended first-aid measures seems to be necessary in several countries, as well as in Malawi as seen in the present study. Since no curriculum was available for the rabies awareness lessons it is difficult to evaluate if the higher knowledge about first-aid measures in group A is due to the education or due to other factors. Though, the results show that children that had participated in the program were more aware of first-aid measures and one could suspect that the education program has caused this difference between the groups.

Only one student, from group B, said he/she would take use of traditional medicine after a bite from a suspected rabid dog (Table 4), which is a considerable low number compared to other similar studies, such as a study by Jemburu (2013), where 84 % of the respondents said they would take use of traditional medicine if they were exposed to rabies virus. Perhaps are people in Malawi more aware of modern medicine and do not depend as much on traditional medicine as people in Ethiopia where the study by Jemburu (2013) was conducted.

An earlier study performed in Malawi claims that Malawians are well aware of rabies in terms of, for example, discovering rabies cases among animals (Edelsten, 1995). Although 131 (85.1 %) of the children in this study (both group A and B) had heard about rabies there was still a significant difference between the children that had gotten the education provided by LSPCA and those who had not (Table 3). Hence, there is room for improvement regarding rabies awareness among the children.

To educate children about rabies and about animal welfare will hopefully increase the level of knowledge about these subjects in the future. There is also a possibility that education programs provided to children also could increase knowledge in the households, since children tend to talk about what they have learnt in school at home (Spiegel, 2000; Ojwang *et*

al., 2010). Social norms and social pressure affect how people treat their dogs (Rohlf *et al.*, 2012). In other words if the respect of children towards dogs improves, social pressure to take care of and to treat dogs properly might increase in the communities as well. Of the participating teachers in the present study some that if the children learn about rabies and about animal welfare in school the knowledge of these subjects will also rise in the communities. Then the gained knowledge of the students has potential to become beneficial for the whole community.

Attitudes towards dogs and animal welfare

There was a significant difference between group A and B regarding if they liked dogs or not, were group A tended to like dogs more than group B (Table 5). If they like dogs or not might affect if they are interested in learning about dog behaviors, needs and health. Children in group A also thought of dogs as friendly in significantly higher extent than did the children in group B. Why that is, is not known, but it could possibly be because the children in group B have negative experiences associated to dogs, since those children also did not like dogs in general.

Since the children that had participated in the Animal Kindness Clubs are suspected to be more interested in animals in general, because of their membership in the club, but also because they were found to like dogs in higher extent, it is possible they had the information and attitudes assessed in this study before LSPCA provided them with the education about rabies and animal welfare. Another alternative is that participation in the animal kindness clubs has made them more interested in and more found of dogs. Education about animals and their behavior has been proved to affect attitudes and consequently behavior towards animals in other situations (Coleman *et al.*, 2000).

The children in group B reported to dislike dogs and think of dogs as unfriendly in significantly higher extent than did the other children (Table 5). This group also said they were scared of dogs more frequently than the children in group A, though the difference was not significant between the groups (Table 5). If one is scared of dogs would probably affect if one likes dogs or not. The question is why the fear of dogs is as common among children as seen in this study. To have been bitten by a dog does not consequently mean a person gets a negative attitude against dogs (Lakestani *et al.*, 2011). Some of the children said they were scared of dogs in the street (i.e. stray dogs, author's comment) and someone mentioned a dog simply should not be friendly to everyone, because they are supposed to guard the property and scare intruders away.

The major purpose of owned dogs in Tanzania was reported to be as a guard to protect the property, especially against human trespassers and to a lesser extent to protect livestock from predators (Knobel *et al.*, 2008a). If the purpose of dog ownership is primarily for protection against humans, in combination with many free-roaming dogs existing in the area, this might contribute to people and children regarding dogs as unpleasant and scary, since a guard dog is supposed to scare people away. Most children said the importance of dogs to humans is indeed mainly for protection (Figure 6), which also was what most of the dog owning children reported as the purpose of their dogs at home (Table 2). This was applicable to both groups,

though some children in group A also mentioned that dogs could be pets held for company. This could not be tested for significance, but it suggests there were some children that possessed affective feelings for dogs besides seeing dogs as a useful tool in the household. The children that said that dogs could be pets were all from group A, although they were few. Still, one could wonder if positive feelings regarding dogs, as seen in group A, are connected to the perception of dogs as pets and as company rather than as a working animal. In that case a shift in the perceived purpose of owned dogs would improve attitudes against dogs.

Both groups thought dogs are important to humans (Table 5), though some in group B said dogs are not important at all (Table 5 & Figure 6). No children said that dogs are unimportant in group A, which might be because they like dogs more in general or because they are more empathetic with other living creatures. Higher empathy for living creatures could, for example be due to either knowledge about animal value from the education program or because they perhaps have been in contact with animals more, which can increase empathy towards animals (Vizek-Vidović *et al.*, 2001).

It was a highly significant difference between the groups regarding if it was considered to be acceptable to hit a dog or not (Figure 3). Group A said that it was not okay to hit a dog and that one should never hit a dog, in much greater extent than group B did. Children in group B were much more likely to say that they would hit a dog in several of the suggested situations (Table 6). This was also found to be highly significant. This was one of the questions where the difference between the two groups appeared to be most pronounced. Possible factors that contribute to this difference are that children in group A were more fond of dogs, possessed a greater empathy towards dogs or possibly also because of the knowledge gained they had from the lessons with the animal kindness clubs where these questions are discussed. The results suggest that awareness of animal welfare and behavior towards dogs are reachable through education programs. It would be interesting to investigate how the children motivate that they think it is okay to hit a dog in the different situations, for example if the dog steals food. The reason to hit the dog in that situation might perhaps be if food is of limited supply and must be saved for the family. Since socio-economic factors are not investigated in this study there might be differences between the groups regarding food and economic resources. If resources were more scarce in group B that might be the reason why those children were willing to hit a dog to protect the food. It is unfair to criticize children that admitted they would hit a dog that attacks them or another animal, because it must be considered one's legitimate right to save one's or another animal's life in that kind of situation.

Care of dogs

Of things dogs need to feel well and healthy many children mentioned food, water and medical care, which could be considered to be some of the basic needs of a dog. Though, significantly more children in group A said that dogs also need good shelter (Table 7), which is mentioned in the curriculum for the animal kindness clubs. Many children added that food should be of enough quantity and/or of a good quality. However, significantly more children in group A said dogs need clean water and healthy food when they were asked specifically about this (Figure 4). These subjects are discussed in the animal kindness clubs and it is possible that the children in group A had learnt this in those classes.

Some said that a dog could be given other food and water depending on what you have to provide them with and that is an important factor to consider when evaluating dog ownership and care of dogs in this area, since it is considered to be a poor country and many people have economic difficulties. Children in group B might have experienced economic difficulties in higher extent than the children in group A. As mentioned earlier, socio-economic status was not investigated in this study and it remains unknown if such differences between group A and group B might have affected the results. Though, all of the students that said that dogs do not need healthy food or clean water or that it depended on what you have to provide them with were all from group B, so it is not possible to rule out that they tend to think this way because they appreciate dogs less than the children in group A. It could also be due to poorer knowledge of the needs of dogs in that group of children.

That people might have economic difficulties must also be considered before disparage that significantly more children in group B said that it is never necessary to take the dog to the veterinarian regardless of the dog's health (Figure 5). On one occasion a student from group B mentioned there is no need to take a dog to the veterinarian since you could always get a new dog if the one you have dies. This is of course a major animal welfare issue, which organizations like LSPCA try to relieve by providing free health care for animals that belong to owners in economic distress (personal communication, Richard Ssuna, September, 2013) and by educating children about animal welfare. The children that had participated in the education program were much more likely to say that a dog needs to be taken to a veterinarian when it is ill. Significantly more children in group A also said that dogs need to get vaccinations, which also suggests that they were more aware of some of the assignments of being a responsible dog owner, but it also suggests that they knew more about issues like rabies (Figure 5). Perhaps they were more aware of their own responsibility in rabies prevention due to the knowledge gained at the animal kindness clubs.

An approach to improve attitudes towards animals, similar to the one done by LSPCA, has been done in Kenya by Kenya Society for the Protection and Care of Animals (KSPCA) and they reported that some of the children that had been educated in their program showed a change of attitude and behavior towards animals, such as engaging their parents in animal welfare arrangements and by telling owners of donkeys not to beat their animals (Ojwang *et al.*, 2010). This suggest that increased knowledge and understanding of animals could improve animal welfare, not only regarding dogs, but also for other domestic animals.

Gender differences

In the whole study group there were more girls than boys, whereas there were more boys than girls in group A and more girls than boys in group B (Figure 1). A possible variable that could have affected the results in this study is that there are more girls than boys. Some of the questions has been shown to differ, not only between group A and B, but also between male and female students, which suggest that gender was a variable that affected the results in this study.

When it was investigated if there were any differences in the distribution of answers depending on the gender of the respondent, it was found that boys were significantly more

likely to have heard about rabies and to know it was a disease than girls. Boys were also more aware that humans can get rabies and that transmission of rabies occur through bites of an infected animal. There was no difference between boys and girls regarding if they played with dogs or not (Table 8). In other words, it is of great importance that both genders are aware of the disease, since both are at risk to get infected with the virus. It has been found in prior studies that rabies awareness is lower among men than among women (Herbert *et al.*, 2012; Palamar *et al.*, 2013), but the results from this study suggest that the level of rabies knowledge is somewhat lower among the girls than the boys in this study. The difference could be because there were more girls in group B and more boys in group A or else it could be due to if girls are more absent in school than boys, because for example if they must help the family to make a living. Boys liked dogs in higher extent than girls and were also more likely to say that a dog that is ill should be taken to see veterinarian. The differences in attitude towards pets is not consistent with some other studies that found that girls tend to possess a more positive attitude towards and be more attached to pets than boys (Vizek-Vidovic *et al.*, 2001; Miura *et al.*, 2002). A suggestion to why the results differ from those studies is due to cultural differences, since those studies were made in Europe and in Asia.

Limitations and suggestions

Sample selection

The schools that participated in this study were chosen based on if they had participated in the education program or not and also depending on accessibility. Children were chosen by different methods; in some cases with help of a list of the students and in other cases they were picked out in the classroom. To get a more randomly selected sample one could include the more distant schools in the selection and prepare the selection with help of a list of students before arrival at the school, if possible. By this, one could also make sure there will be equal numbers of boys and girls and also chose by age.

Interest of the students

There is a possibility that the students in the Animal Kindness Clubs (that is, the students in group A) were more interested in animals and therefore knew the information regardless of the education provided by LSPCA.

Dog ownership and contact with dogs

People that had pets during childhood have been shown to be more likely to pay interest in animal welfare issues in adulthood (Miura *et al.*, 2002) and in that case dog ownership should be a predictor for if the children will be interested in the welfare of animals as adults and perhaps also a predictor for if the children are interested in animal welfare during childhood. This study has not investigated if the answers differed between dog owners and non-dog owners, though dog ownership was equally common in both groups. It would be interesting to investigate if pet ownership is a predictor for interest in animal welfare in a country like Malawi or if it differs between cultures since the study done by Miura (2002) was conducted in Japan and the United Kingdom, which must be considered to be culturally different from Malawi. Another option could be that it is not only whether you are a pet owner or not that affects if you are interested in animal welfare, but also it could depend on the perceived

purpose of dogs. That is, if dogs are regarded as “pets” or a “working animal”, such as guards of property, which was the most common purpose of dogs found in the present study.

There was no difference between the groups regarding if the children played with dogs or not. This means that the found differences between the two groups cannot be explained by that the children in group A played with dogs in higher extent than group B. This question is interesting to investigate since children are considered to be at high risk of getting infected with rabies (Mallewa *et al.*, 2007; Depani *et al.*, 2012; WHO, 2013a) and if the children played with dogs they would be more put at risk to get bitten by dogs and thus more at risk of getting infected with rabies.

Rural and urban differences

This study found that knowledge and awareness about rabies as well as knowledge about the care of dogs were higher among children that had participated in the education program that was provided by LSPCA. Though, the schools that had participated in the program were schools that were located in town, whereas the schools that had not participated were located in rural areas. Because of this, it is possible that the difference in knowledge about these subjects is due to that some of the children lived in town and some lived in rural areas, which has been seen to be a contributing variable in other studies. An example of this is a study by Jemburu (2013) that found that people in urban areas tend to seek modern medical treatment after exposure to rabies virus in higher extent than people in rural areas. This could not be seen in the present study were both groups were as likely to go to a hospital after a dog bite, even if the children were from rural areas and had not participated in the education program about rabies.

As no proper curriculum for the rabies education was provided it was difficult to assess the content of the education program and thereby to assess the reason for the found differences between the groups. For example, if the differences that were found are due to geographical or environmental factors or if it was due to that the children in group A were provided the education. It would be interesting to compare urban and rural children that all have been provided the education to assess if there was a difference in the gaining of the knowledge or if it was rather the lack of accessible knowledge that made them less aware of rabies and animal welfare issues. Jemburu (2013) also found other differences among people in different geographical areas, like that 32 % of the respondents in that study thought that rabies transmission occur through inhalation. All of those respondents were from an area with mainly rural communities. Thus, differences in knowledge could be due to that people live in different areas, such as urban and rural. However, transmission through inhalation has occurred and thus it is not an incorrect answer, but it is considered an atypical route of transmission for rabies (Johnson *et al.*, 2006). Since, the study by Jemburu (2013) also found that 86 % of the respondents said that dogs can get rabies from starvation and thirst it was probably not awareness of atypical transmission routes that was the reason that many said inhalation is a way of transmission, but rather a result of people guessing. That is probably also the case for the 3 students (1.9 %) that mentioned inhalation as a route of transmission for rabies in the present study.

Interviews with children

The risk that children not answer genuinely has been noticed as a possible bias in other studies (Spiegel, 2000) and was in this study tried to be avoided by asking the children to answer genuinely and by promising they would be provided a gift regardless of their answers. To improve conductivity of the interviews one could make sure to have access to an area or a classroom separate from the other children to also avoid other children overhearing the answers while they are waiting for their interview. To get access to a separate area was sometimes found difficult when collecting data for this study.

Education programs

One suggested improvement for the LSPCA education program is to design a proper curriculum for the animal welfare lessons, as well for the rabies lessons to get consistency in what the individuals in the education team teach the children, but also to get a plan for what they will teach about for each class. As this paper was written it was reported that a qualified educationist was recently hired to improve the education program (personal communication. Richard Ssuna, September, 2013). Hopefully a qualified teacher will improve the effectiveness of the learning of the students. To have a curriculum would also make it easier to assess the education program in the future as the investigator could easily get access to the content of the education program and thereby design a suitable study.

Another suggestion is to expand the education program to include not only those that are interested in animals, but also the ones with little interest in animals and to expand the area where the education is provided to not only schools in town, but also to schools in rural areas. Especially since dog ownership is more common in rural areas and people also are more a subject to the risks of rabies in those areas (Knobel *et al.*, 2008a; WHO, 2013a). Though, in the present study no significant difference in the incidence of dog ownership was found between children in rural and urban areas.

The LSPCA education program about animal welfare could also try to use animals in the education, since contact with animals during childhood is a factor that affects attitudes towards animals in adulthood (Miura *et al.*, 2002). This must be done without compromising animal welfare of course, but to get children in contact with a stable and good behaved dog could perhaps be a way to get children who are scared of dogs or posing negative attitudes towards dogs to change their point of view. Having a dog present in a classroom has also been shown to have positive effects on children in other terms, such as less aggressiveness among the children (Hergovich *et al.*, 2002). In addition, to participate in different activities and spend time with the dog have shown to correlate to dedication of the dog owner to practice recommended health-related behaviors regarding the dog (Rohlf *et al.*, 2012). Thus, to let the children spend time with dogs could maybe make them both like dogs more and make them more interested in the health recommendations of dogs, such as to get the dog vaccinated.

The optimal option would be if animal welfare, as well as rabies awareness education, could be subjects brought up in the school curriculum. Less than half of the responding teachers in this study said that rabies, as well as animal welfare were subjects brought up in the curriculum. Though, this has not been verified. That schools often not provide information

about rabies has also been reported in a study that was conducted in several countries in Asia (Dodet *et al.*, 2008). A lack of animal welfare subjects in the school curriculum has been enlightened in Kenya as well (Ojwang *et al.*, 2010). To implement animal welfare in the school curriculum would probably also make the teachers more aware of animal welfare and help the teachers to make good examples for the children to follow.

Another issue to deal with when implementing education programs in a school is to primarily get access to the school and also to involve the teachers, which can be difficult since some teachers do not consider animal welfare important (Ojwang *et al.*, 2010). However, in the present study all of the respondent teachers said education about rabies and animal welfare was important. If this is what the teachers genuinely think it should facilitate implementation of such subjects in the school curriculum in Lilongwe schools. Difficulties to get access to schools were experienced also during this study and at several schools it was not approved that the children would miss out classes to participate in the interviews, though every teacher agreed to let the children participate in the end. Thus, to get time spared for additional classes in animal welfare and rabies awareness could become problematic.

Innovations to implement humane education in the existing curriculum without loading teachers with lots of extra tasks has been designed (Ascione & Weber, 1996) and could help the teachers to implement such education in the schools without compromising with other work duties.

Lingual difficulties

How an education program is designed comes not only down to content, but also to how the information is presented. It is essential that the information is adjusted to the receivers, regarding for example language or illiteracy. This issue was seen in a study by Palamar, et al. (2013) where it was found that Hispanic minorities in a town in United States were less aware of rabies than native Americans, possibly because information was given in English and many Hispanics spoke mainly Spanish. Lingual difficulties was also a problem in the present study, since it forced use of an interpreter instead of the author performing the interviews. That is a possible source of misinformation since the questions and answers were translated back and forth from English to Chichewa. To avoid misinterpretation as much as possible the questions were checked by the interpreter and the author before and after all the interviews were done, but there is still a risk of misunderstandings when a third part was used to perform the interviews. Since the same interpreter was used in all the interviews there was, however, consistency in the asked questions and provided answers because different reading of the questions by different persons was avoided. Different persons that perform the same interview is a risk of different understandings of the questions and answers as seen in other studies (Knobel *et al.*, 2008b).

Knowledge and behavior

It is also worth underlining that even if children are aware and have the knowledge of proper behavior after a dog bite or how one should take care of dogs their behaviors in those situations are not necessarily changed. To assess if the gained knowledge also changed the behavior of the children in those situations one must perform for example an observation

study, to examine behavior towards dogs and the correlations with attitudes towards dogs. Though, behavior towards animals has been found to change with changed attitude towards animals in other studies (Coleman *et al.*, 2000).

Limitations of the statistical analysis

Because there were too few respondents to perform Chi² test, some questions are not tested for significance. Other options to examine if there is statistical significance, like for example the Fishers exact test exist, but has not been performed in this study. Thus, it is possible that more significant differences could be found in the data.

Gender

As seen above, gender could be a variable that have affected the results of this study.

Age

Median age were the same in both groups and in the whole study group in total and thus, age does not seem to be a factor that affect the results in this study. One would assume that older students would be more aware of rabies and possibly also more aware of animal welfare than younger students, but some other studies report that the level of attachment to animals decline as children grow older (Vizek Vidović, *et al.*, 1999) which probably affect the interest in animal welfare issues. In that case the results could have turned out different if the age span in the study was shifted to younger or older students, for example if more 8-year-olds than 12-year-olds had participated in this study.

CONCLUSIONS

In summary it was found that children that had been educated about the disease rabies and about animal welfare had better knowledge about these subjects, though it is unknown if those children were more interested in animals before participation in the education program and if this has affected the results of this study. The children that had participated in the education program were more aware of rabies, its transmission route and hosts, but both groups were as likely to own a dog or to play with dogs and are therefore as likely to contract rabies disease from dogs. Thus, knowledge about rabies is important in both groups.

Increased knowledge is especially needed regarding violence against animals, needs of dogs and the understanding of the importance of health care in a sick dog. In addition, people's perception of dogs could be improved since many in the group that had not gotten the education did not like dogs and regarded dogs as unfriendly. Rabies awareness campaigns and education programs should focus on to learn people about especially first- aid treatments after a dog bite, how rabies is transmitted and to whom and to inform people that it is a fatal disease. One should also inform people about other commitments that come with responsible dog ownership that also affect rabies epidemiology, such as not to let dogs wander the streets unattended and to get the dog vaccinated. Education should be especially targeted towards groups that had formerly not participated in the education program, for example rural areas, but also girls, since girls showed a lack of rabies awareness as well as deficient knowledge about how to take proper care of a dog compared to the boys.

The conclusion is that education seems to be a useful method to improve attitudes towards dogs and animal welfare. Education could also increase awareness of rabies and hopefully it is a contributor that could reduce the incidence of the disease in humans and in dogs by the increase of people's knowledge about the importance of vaccination and about the responsibilities you commit to when you are a dog owner.

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REFERENCES

- Ajzen, I. & Manstead, A. S. R. (2007). Changing health-related behaviours An approach based on the theory of planned behaviour. In: Hewstone, M., Schut, H. A. W., de Wit, J. B. F., van den Bos, K. and Stroebe, M. S. eds. *The Scope of Social Psychology: Theory and Applications (A Festschrift for Wolfgang Stroebe)*. Psychology Press Festschriften, Hove: Psychology Press, pp. 43-61.
- Al-Fayez, G., Awadalla, A., Templer, D. I. & Arikawa, H. (2003). Companion Animal Attitude and its Family Pattern in Kuwait. *Society & Animals*, vol. 11(1), pp. 17-28.
- Ascione, F. R. & Weber, C. V. (1996). Children's Attitudes About the Humane Treatment of Animals and Empathy: One-Year Follow Up of a School-Based Intervention. *Anthrozoös*, vol. 9(4), pp. 188-195.
- Beck, A. M. (2013). The Human-Dog Relationship: A Tale of Two Species. In: Macpherson, C. N. L., Meslin, F-X. & Wandeler, A. I. *Dogs, Zoonoses and Public Health*. 2nd ed. United Kingdom, Croydon: CPI Group, pp. 1-12.
- Blanton, J. D., Dyer, J., Mcbrayer, J. & Rupprecht, C. E. (2012). Rabies Surveillance in the United States during 2011. *Journal of the American Veterinary Medical Association*, vol. 241(6), pp. 712-722.
- Bodsworth, W. & Coleman, G. J. (2001). Child-Companion Animal Attachment Bonds in Single and Two-Parent Families. *Anthrozoös*, vol. 14(4), pp. 216-223.

- Chomel, B. B. & Arzt, J. J. (2013). Dogs and Bacterial Zoonoses. In: Macpherson, C. N. L., Meslin, F-X. & Wandeler, A. I. *Dogs, Zoonoses and Public Health*. 2nd ed. United Kingdom, Croydon: CPI Group, pp. 67-92.
- Cleaveland, S., Fèvre, E. M., Kaare, M. & Coleman, P. G. (2002). Estimating human rabies mortality in the United Republic of Tanzania from dog bite injuries. *Bulletin of the World Health Organization*, vol. 80(4), pp. 304-310.
- Cleaveland, S., Kaare, M., Tiringa, P., Mlengeya, T. & Barrat, J. (2003). A dog rabies vaccination campaign in rural Africa: impact on the incidence of dog rabies and human dog-bite injuries. *Vaccine*, vol. 21, pp. 1965-1973.
- Coleman, P. G. & Dye, C. (1996). Immunization coverage required to prevent outbreaks of dog rabies. *Vaccine*, vol. 14(3), pp. 185-186.
- Coleman, G. J., Hemsworth, P. H., Hay, M. & Cox, M. (2000). Modifying stockperson attitudes and behavior towards pigs at a large commercial farm. *Applied Animal Behaviour Science*, vol. 66, pp. 11-20.
- Coleman, G.J., McGregor, M., Hemsworth, P.H., Boyce, J. & Dowling, S. (2003). The relationship between beliefs, attitudes and observed behaviours of abattoir personnel in the pig industry. *Applied Animal Behaviour Science*, vol. 82, pp. 189-200.
- Depani, S.J., Kennedy, N., Mallewa, M. & Molyneux, E.M. (2012). Case report: Evidence of Rise in Rabies Cases in Southern Malawi – Better Preventative Measures Are Urgently Required. *Malawi medical Journal*, vol. 24(3), pp. 61-64.
- Dodet, B., Goswami, A., Gunasekera, A., de Guzman, F., Jamali, S., Montalban, C., Purba, W., Quiambao, B., Salahuddin, N., Sampath, G., Tang, Q., Tantawichien, T., Wimalaratne, O., Ziauddin, A. (2008). Rabies awareness in eight Asian countries. *Vaccine*, vol. 26, pp. 6344-6348.
- Edelsten, R. M. (1995). Epidemiology And Control of Rabies in Malawi. *Tropical Animal Health Production*, vol. 27, pp. 155-163.
- Eismann, A., Ewringmann, T., Just, F., Müller, T. & Freuling, C. (2010). Rabies in Bavaria (Germany) in an imported puppy from Bosnia-Herzegovina. In: Freuling, C. *Rabies Bulletin Europe*, vol. 34(2). Berlin: Fine Cards & Papers Limited & Co. KG. pp. 5-6.

- Fielding, W.J., Gall, M., Green, D. & Eller, W. S. (2012). Care of Dogs and Attitudes of Dog Owners in Port-au-Prince, the Republic of Haiti. *Journal of Applied Animal Welfare Science*, vol. 15(3), pp. 236–253.
- Finnegan, C. J., Brookes, S. M., Johnson, N., Smith, J., Mansfield, K. L., Keene, V. L., McElhinney, L. M. & Fooks, A. R. (2002). Rabies in North America and Europe. *Journal of the Royal Society of Medicine*, vol. 95, pp. 9-13.
- Fooks, A. R., Johnson, N., Brookes, S. M., Parsons, G. & McElhinney, L. M. (2003). Risk factors associated with travel to rabies endemic countries. *Journal of Applied Microbiology*, vol. 94, pp. 31s-36s.
- Franka, R., Wu, X., Jackson, F. R., Velasco-Villa, A., Palmer, D. P., Henderson, H., Hayat, W., Green, D. B., Blanton, J. D., Greenberg, L. & Rupprecht, C. E. (2009). Rabies virus pathogenesis in relationship to intervention with inactivated and attenuated rabies vaccines. *Vaccine*, vol. 27, pp.7149-7155.
- Global Alliance for Rabies Control. (2013-07-26). *Canine Rabies Imported into Spain*. <http://rabiesalliance.org/media/news/canine-rabies-imported-into-spain>. [2013-11-23].
- Hemsworth, P. H., Coleman, G. J., Barnett, J. L., Borg, S. & Dowling, S. (2002). The Effects of Cognitive Behavioral Intervention on the Attitude and Behavior of Stockpersons and the Behavior and Productivity of Commercial Dairy Cows. *Journal of Animal Science*, vol. 80, pp. 68-78.
- Herbert, M., Basha, S. R. & Thangaraj, S. (2012). Community perception regarding rabies prevention and stray dog control in urban slums in India. *Journal of Infection and Public Health*, vol. 5, pp. 374-380.
- Hergovich, A., Monshi, B., Semmler, G. & Zieglmayer, V. (2002). The Effects of the Presence of a Dog in the Classroom. *Anthrozoös*, vol. 15(1), pp. 37-50.
- Hiby, E. (2013). 11 Dog Population Management. In: Macpherson, C. N. L., Meslin, F-X. & Wandeler, A. I. *Dogs, Zoonoses and Public Health*. 2nd ed. United Kingdom, Croydon: CPI Group, pp. 177-204.
- Jemberu, W. T., Molla, W., Almaw, G. & Alemu, S. (2013). Incidence of Rabies in Humans and Domestic Animals and People's Awareness in North Gondar Zone, Ethiopia. *PLoS Neglected Tropical Diseases*, vol. 7(5).

- Johnson, N., Phillpotts, R. & Fooks, A. R. (2006). Airborne transmission of lyssaviruses. *Journal of Medical Microbiology*, vol. 55, pp. 785-790.
- Knobel, D. L., Cleaveland, S., Coleman, P. G., Fèvre, E. M., Meltzer, M. I., Miranda, M. E. G., Shaw, A., Zinsstag, J. & Meslin, F-X. (2005). Re-evaluating the burden of rabies in Africa and Asia. *Bulletin of the World Health Organization*, vol. 83(5), pp. 360-368.
- Knobel, D. L., Laurenson, M. K., Kazwala, R. R., Boden, L. A. & Cleaveland, S. (2008)(a). A cross-sectional study of factors associated with dog ownership in Tanzania. *BMC Veterinary Research*, vol. 4 (5).
- Knobel, D. L., Laurenson, M. K., Kazwala, R. R. & Cleaveland, S. (2008)(b). Development of an Item Scale to Assess Attitudes towards Domestic Dogs in the United Republic of Tanzania. *Anhtrozoös*, vol 21(3), pp. 285-295.
- Kumarapeli, V. & Awerbuch-Friedlander, T. (2009). Human rabies focusing on dog ecology- A challenge to public health in Sri Lanka. *Acta Tropica*, vol. 112, pp. 33-37.
- Lakestani, N., Donaldson, M. L., Verga, M. & Waran, N. (2011). Attitudes of children and adults to dogs in Italy, Spain, and the United Kingdom. *Journal of Veterinary Behavior*, vol. 6, pp. 121-129.
- Landguiden. (2013-01-08). *Malawi*. <http://www.landguiden.se/Lander/Afrika/Malawi>. [2013-08-26].
- Lankau, E. W., Cohen, N. J., Jentes, E.S., Adams, L. E., Bell, T. R., Blanton, J. D., Buttke, D., Galland, G. G., Maxted, A. M., Tack, D. M., Waterman, S. H., Rupprecht, C. E. & Marano, N. (2013). Prevention and Control of Rabies in an Age of Global Travel: A Review of Travel- and Trade-Associated Rabies Events –United States, 1986-2012. *Zoonoses and Public Health*.
- Lembo, T., Atflan, M., Bourhy, H., Cleaveland, S., Costa, P., de Balogh, K., Dodet, B., Fooks, A. R., Hiby, E., Leanes, F., Meslin, F.-X., Miranda, M. E., Müller, T., Nel, L. H., Rupprecht, C. E., Tordo, N., Tumpey, A., Wandeler, A. & Briggs, D. J. (2011). Renewed Global Partnerships and Redesigned Roadmaps for Rabies Prevention and Control. *Veterinary Medicine International*, vol. 2011.
- Lembo, T., Hampson, K., Kaare, M. T., Ernest, E., Knobel, D., Kazwala, R. R., Haydon, D. T. & Cleaveland, S. (2010). The Feasibility of Canine Rabies Elimination in Africa: Dispelling Doubts with Data. *PLoS Neglected Tropical Diseases*, vol. 4(2).
- Lilongwe Society for the Protection and Care of Animals, LSPCA. *LSPCA Lilongwe Society for the Protection and Care of Animals*. <http://www.lilongwespca.org/index.html> [2013-12-07].

- Mallewa, M., Fooks, A. R., Banda, D., Chikungwa, P., Mankhambo, L., Molyneux, E., Molyneux, M. E. & Solomon, T. (2007). Rabies Encephalitis in Malaria-Endemic Area, Malawi, Africa. *Emerging Infectious Diseases*, vol. 13(1), pp.136-139.
- Matibag, G. C., Ohbayashi, Y., Kanda, K., Yamashina, H., Kumara W R, Bandula., Perera, I. N. G., De Silva Niranjala, D. D., Panduka De S Gunawardena, G. S., Jayasinghe, A., Ditangco, R. A. & Tamashiro, H. (2009). A pilot study on the usefulness of information and education campaign materials in enhancing the knowledge, attitude and practice on rabies in rural Sri Lanka. *Journal of Infection in Developing Countries*, vol. 3(1), pp. 55-64.
- McQuiston, J. H., Wilson, T., Harris, S., Bacon, R. M., Shapiro, S., Trevino, I., Sinclair, J., Galland, G. & Marano, N. (2008). Importation of Dogs into the United States: Risks from Rabies and Other Zoonotic Diseases. *Zoonoses and Public Health*, vol. 55(8-10), pp. 421-426.
- Menache, S. (1997). Dogs: God's Worst Enemies?. *Society and Animals*, vol. 5(1), pp. 23-42.
- Miura, A., Bradshaw, J. W. S. & Tanida, H. (2002). Childhood Experiences and Attitudes Towards Animal Issues: A Comparison of Young Adults in Japan and the UK. *Animal Welfare*, vol. 11, pp. 437-448.
- Morgan, E. R. (2013). Dogs and Nematode Zoonoses. In: *Dogs, Zoonoses and Public Health*. In: Macpherson, C. N. L., Meslin, F-X. & Wandeler, A. I. *Dogs, Zoonoses and Public Health*. 2nd ed. United Kingdom, Croydon: CPI Group, pp. 153-161.
- Office International des Epizooties, OiE. (2010). *Chapter 7.7 Stray Dog Population Control*. http://web.oie.int/eng/normes/mcode/en_chapitre_1.7.7.pdf. [2013-12-07]
- Ojwang, J., Akumonyo, J., Okello, W. & Onyango, S. (2010). Improving Animal Welfare by Educating Schoolchildren: The Kenyan Experience. In: *International Colloquium on Working Equids: learning from others. Proceedings of an International Colloquium*. 6 ed. New Delhi, India. London, United Kingdom: The Brooke, pp. 354-356.
- Palamar, M. B., Peterson, M. N., Deperno, C. S., Correa, M. T. (2013). Assessing Rabies Knowledge and Perceptions Among Ethnic Minorities in Greensboro, North Carolina. *The Journal of Wildlife Management*, vol. 77(7), pp. 1321-1326.
- Permpalung, N., Wongrakpanich, S., Korpaisarn, S., Tanratana, P. & Angsanakul, J. (2013). Trend of human rabies prophylaxis in developing countries: Toward optimal rabies immunization. *Vaccine*, vol. 31, pp. 4079-4083.

- Prager, K. C., Mazet, J. A. K., Dubovi, E. J., Frank, L. G., Munson, L., Wagner, A. P. & Woodroffe, R. (2012). Rabies Virus and Canine Distemper Virus in Wild and Domestic Carnivores in Northern Kenya: Are Domestic Dogs the Reservoir?. *Ecohealth*, vol. 9, pp. 483-498.
- Quinn, P. J., Markey, B. K., Carter, M. E., Donnelly, W. J. & Leonard, F. C. (2002). *Veterinary Microbiology and Microbial Disease*. Pp. 390-392. Oxford: Blackwell Science.
- Rohlf, V. I., Bennett, P. C., Toukhsati, S. & Coleman, G. (2012). Beliefs Underlying Dog Owners' Health Care Behaviors: Results from a Large, Self-Selected, Internet Sample. *Anthrozoös*, vol. 25(2), pp. 171-185.
- Schenk, S. A., Templer, D., Peters, N. B. & Schmidt, M. (1994). The Genesis and Correlates of Attitudes Toward Pets. *Anthrozoös*, vol. 7(1), pp. 60-68.
- Schneider, M. C., Romijn, P. C., Uieda, W., Tamayo, H., da Silva, D. F., Belotto, A., da Silva, J. B. & Leanes, L. F. (2009). Rabies transmitted by vampire bats to humans: An emerging zoonotic disease in Latin America?. *Rev Panam Salud Publica/Pan American Journal of Public Health*. vol. 25(3), pp. 260-269.
- Serpell, J.A. (2004). Factors influencing human attitudes to animals and their welfare. *Animal Welfare*, vol. 13, pp. 145-151.
- Singer, A., Kauhala, K., Holmala, K. & Smith, G. C. (2009). Rabies in Northeastern Europe – The Threat from Invasive Raccoon Dogs. *Journal of Wildlife Diseases*, vol. 45(4), pp. 1121-1137.
- Spiegel, I. B. (2000). A Pilot Study to Evaluate an Elementary School-based Dog Bite Prevention program. *Anthrozoös*, vol. 13(3), pp. 164-173.
- Taylor, S. M. (2009). Part nine Neuromuscular Disorders: Chapter 69 Encephalitis, Myelitis and Meningitis. In: Nelson, R. W. & Couto, C. G. *Small Animal Internal Medicine*. 4:th ed. St. Louis: Elsevier, pp. 1060-1061.
- Thomas, D., Delgado, A., Louison, B., Lefrancois, T. & Shaw, J. (2013). Examining dog owners' beliefs regarding rabies vaccination during government-funded vaccine clinics in Grenada to improve vaccine coverage rates. *Preventive Veterinary Medicine*, vol. 110, pp. 563-569.
- Tietjen, S., Kaufhold, B., Müller, T. & Freuling, C. M. (2011). Case report: illegal puppy trade and transport, Germany. In: Freuling, C. *Rabies Bulletin Europe*. Vol. 35(3). Werder: Lübke Druck&Design. pp. 8-10.

Velasco-Villa, A., Messenger, S. L., Orciari, L. A., Niezgoda, M., Blanton, J. D., Fukugawa, C. & Rupprecht, C. E. (2008) Identification of New Rabies Virus Variant in Mexican Immigrant. . *Emerging Infectious Diseases*, vol. 14(12), pp. 1906-1908

Vizek Vidović, V., Arambašić, L., Keresteš, G., Kuterovac-Jagodić, G. & Vlahović-Štetić, V. (2001). Pet Ownership in Childhood and Socio-Emotional Characteristics, Work values and Professional Choices in Early Adulthood. *Anthrozoös*, vol.14(4), pp. 224-231.

Vizek Vidović, V., Vlahović Štetić, V. & Bratko, D. (1999). Pet Ownership, Type of Pet and Socio-Emotional Development of School Children. *Anthrozoös*, vol. 12(4), pp. 211-217.

World Health Organization, WHO(a). (July 2013). *Rabies*.

<http://www.who.int/mediacentre/factsheets/fs099/en/index.html>. [2013-11-25].

World Health Organization, WHO(b). (2013). FAQs Frequently asked questions on rabies. New Delhi, India: World Health Organization, WHO. (SEA-CD-278). Available:

http://www.who.int/rabies/resources/SEA_CD_278_FAQs_Rabies.pdf .[2013-12-05].

Zachary, J. F. (2007). Nervous System In: McGavin, M. D. & Zachary, J. F. *Pathologic Basis of Veterinary Disease*. 4:th ed. St Lois: Elsevier, pp.887-890.

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