EPIDEMIOLOGICAL STUDIES OF CANINE RABIES IN WUKARI METROPOLIS, TARABA STATE, NIGERIA.

BY

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DECLARATION

I declare that the work presented in this thesis titled **'Epidemiological Studies of Canine Rabies in Wukari Metropolis, Taraba State, Nigeria'** has been performed by me in the Department of Veterinary Public Health and Preventive Medicine under the supervision of Dr. A. A. Dzikwi and Professor J.U. Umoh. The information derived from the literature has been duly acknowledged in the text and a list of references provided. No part of this thesis was previously presented for another degree or diploma at any University.

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Signature Date

CERTIFICATION

This thesis titled **"Epidemiological Studies of Canine Rabies in Wukari Metropolis, Taraba State, Nigeria" by** Veronica Odinya AMEH meets the regulations governing the award of **Master of Science** (M.Sc.) degree of Ahmadu Bello University, Zaria and is approved for its scientific contribution to knowledge and literary presentation.

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DEDICATION

This work is dedicated to God Almighty for His infinite mercy, grace and divine favour in my life; and to my family for their continuous love and support.

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My utmost gratitude is to God Almighty for His protection, abundant grace, love and divine favour throughout the period of this study.

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ABSTRACT

Canine rabies is endemic and occurs throughout the year in all parts of Nigeria. A descriptive cross sectional study was designed to assess knowledge, attitude and practice of dog owners towards rabies, to check for the presence of rabies antigens in brain tissue of dogs slaughtered for human consumption and to assess rabies vaccination coverage of dogs in Wukari. Structured questionnaires were prepared and administered to 200 dog owners by face to face interview. The questionnaire sought information on demographic characteristics of the dog owners, their association with dogs, knowledge, attitude and practice of dog owners towards rabies. Associations between demographic variables and knowledge, attitude or practice scores were assessed using χ^2 analysis. Also, 188 brain samples from slaughtered dogs were analysed for presence of rabies antigen using direct fluorescent antibody test. Record files and vaccination certificates of dogs presented to the State Veterinary Hospital Wukari were assessed for anti-rabies vaccination coverage. Out of the 200 dog owners, only 26(13%) knew that rabies virus can be found in nervous tissue, 121 (60.5%) were aware that rabies can be spread through the saliva of a rabid animal, but majority of respondents 172(86%) did not know the age for first vaccination of dogs against rabies. Dog owners who were civil servants were 4.8 times more likely to have good knowledge (OR=4.84, 95% CI on OR 1.09-21.44) than those of other occupation groups. Positive attitude towards rabies increased with increase in age of dog owners, with respondents within the age group 20-30 years more likely to have negative attitude than those over 40 years. Civil servants were 9.8 times more likely to have good practice than other occupation groups. Rabies antigen was detected in 7.98% of slaughtered dogs. Out of 8,370 dogs presented to the State Veterinary Hospital Wukari, between January 2003 and December 2012, only 1,128(13.50%) received anti-rabies vaccine. The findings in this study showed inadequate knowledge, negative attitude and practice of dog owners towards rabies. The presence of rabies antigen in some dogs slaughtered for human consumption and low vaccination coverage in dogs indicate high risk of exposure of dog owners and dog meat processors to rabies. There is therefore a need for educational programmes targeted at dog owners to increase their level of knowledge and reduce the risk of exposure to rabies.

TABLE OF CONTENTS

LIST OF TABLE **PAGE**

LIST OF FIGURES **PAGE**

LIST OF APPENDIX **PAGE**

CHAPTER ONE

INTRODUCTION

1.1 Background Information

Rabies is a viral zoonotic disease of all warm blooded animals, which is worldwide in distribution and causes acute encephalitis. It is also known as hydrophobia and is caused by a neutrophilic bullet-shaped, enveloped RNA virus, of the genus *Lyssavirus* and the family *Rhabdoviridae.* The disease is transmissible to all mammals (WHO 2006). Rabies originated about 3000BC and is one of the most typical zoonoses that have been well known since ancient times (Takayama, 2005). The disease is endemic in developing countries including Nigeria and other parts of sub-Saharan Africa and Asia (Harry *et al*., 1984; WHO, 2005). It is characterized by acute progressive encephalitis, hydrophobia, excitability and hypersalivation.

This disease occurs in more than 150 countries and territories and about 55, 000 people die of rabies every year, mostly in Africa, Asia, and South America (Beard, 2001; WHO, 2010). Forty percent of people who are bitten by suspected rabid animals are children under 15 years of age and dogs are the source of 99% of human rabies deaths (WHO, 2010). Every year, more than 15 million people worldwide receive a post-exposure preventive regimen to avert the disease – this is estimated to prevent 327 000 rabies deaths annually (WHO, 2010).

Rabies was first reported in Nigeria in 1912 in humans (Boulger and Hardy, 1960) but the first laboratory confirmation was in 1925, by demonstration of Negri bodies in the brain smear of a

mad dog (Ekele and Okoh, 1984). The disease has been declared endemic in Nigeria by several authors (Umoh and Belino, 1979; Fagbami *et al*., 1981).

The rabies virus causes acute encephalitis in all warm blooded mammals including man and the outcome is almost always fatal, with a variable incubation period (Nadin-Davies, 2000; Awoyomi *et al.,* 2007; CDC, 2007; WHO, 2010). Although species of mammals are susceptible to rabies virus, only a few serve as reservoirs for the disease (Garba *et al*., 2009). In Nigeria, the domestic dog serves as the principal reservoir host and transmitter of rabies virus to animals and humans (Dzikwi *et al*., 2010; WHO, 2010).

The disease manifests in three classical stages; prodromal stage, excitatory stage and the paralytic stage (Bishop *et al*., 2002). Once symptoms of the disease develop, rabies becomes fatal to both man and animals (WHO, 2005). Humans get infected through close contact with infected saliva via scratches or bites (CDC, 1983; WHO, 2011). Non bite exposure can also occur via abrasions, mucous membranes or open wounds that are exposed to infected saliva or other infective materials such as cerebrospinal fluid or brain tissue (Fearneyhough, 2001). Human to human transmission has been reported through organ transplant from an infected donor, and transmission via inhalation of virus-contained aerosol have been reported (Srinivasan *et al.,* 2005; Takayama, 2005; CDC, 2007; WHO, 2008). Human to human transmission by bite is theoretically possible but has never been confirmed (WHO, 2010).

Vaccination against rabies is an efficient way for its control (Turner *et al.,* 1976), and statistics have shown that successful immunization of 70-80% of dog population in a country can result in control of the disease (Beran, 1971). In Nigeria however, it has not been possible to successfully

control or eradicate rabies, instead evidence shows that the disease is on the increase (Ogunkoya, 1997 and Taiwo *et al*., 1998). This may be as result of presence of several free ranging dogs, poor vaccination rates in dogs and some cultural practices that inhibit control of rabies (Jordona, 2009). Several tests are used in the diagnosis of rabies, but the Direct Fluorescent Antibody test (DFA) is the gold-standard approved by World Health Organization (WHO) and Office International des Epizootics (OIE). The DFA is sensitive, specific and cheap (Dean *et al.,* 1996).

1.2 Statement of Research Problem

Canine rabies is endemic and occurs throughout the year in all parts of Nigeria. About 10,000 persons are exposed to rabies annually in the country (Umoh *et al*., 1988). Rabies remains a serious public health hazard in many developing countries where dog bites continue to be the main mode of transmission of the disease to humans (Widdowson *et al.,* 2002). Although it is a vaccine preventable disease, it still poses a significant problem in many countries in Asia and Africa where 95% of human deaths occur even though safe and effective vaccines for both human and veterinary use exist (WHO, 2010).

In Nigeria, rabies infections both in animals and humans are grossly under reported (Fagbami *et al.,* 1981) and reliable data on rabies are scarce in many parts of the world, making it difficult to assess its impact on human and animal health (WHO, 2006). The epidemiology, virology, transmission, pathology, clinical manifestation, diagnosis and treatment of rabies infection have been described extensively by many authors, yet the incidence of rabies is increasingly on the high side (Adedeji *et al.,* 2010).

Dog meat is consumed as a special delicacy by some communities in Nigeria (Ajayi *et al.,* 2006) and is a common practice in Kaduna, Plateau, Cross River, Kebbi, Taraba and Ondo States (Okonko *et al.,* 2010). The presence of rabies antigen in the saliva and brain tissue of apparently healthy dogs slaughtered for human consumption in some parts of Nigeria and the obvious consequences of bites from healthy dogs resulting in human deaths have been reported (Baba, 2006; Garba, 2007; Garba *et al.,* 2008; and Aliyu *et al*., 2010).

Dog bite is a common medical condition and factors such as non-vaccination of dogs by owners, high proportion of stray dogs and poor first aid treatment of dog bite injuries have made this a serious public health problem (Joshua *et al.,* 2012). Little or no information is available on the epidemiology of rabies in Wukari metropolis even though there is an obvious presence of dogs and dog meat is consumed here. Many dog processors and owners may not know about the devastating effect of rabies in humans and the potential risk of handling dogs. They may engage in some practices that may therefore expose them to the disease.

1.3 Justification of the Study

Several studies have been carried out to show the prevalence of rabies antigens in brain tissue and saliva of apparently healthy dogs slaughtered for human consumption in some parts of Nigeria, but no report is available on the epidemiology of rabies in Wukari Taraba State.

From records of the veterinary hospital in Wukari, in November 1993, two cases of rabies were reported in adult dogs that had no history of previous vaccination, but were said to have been vaccinated nine months before the outbreak. Also, in May and June 2001, two and eleven cases of rabies were reported respectively in the hospital. These cases were confirmed by the rabies

laboratory in National Veterinary Research Institute Vom. These show the presence of the disease in Wukari Taraba State.

From observations made in the State Veterinary Hospital, Wukari, dog bite cases are a frequent occurrence, but these are usually not recorded, hence the need for a study on canine rabies and its associated public health implications in Wukari, Taraba State. It appears many Nigerians still see rabies as insignificant and do not take serious measures to prevent or control its occurrence. Many are still ignorant about the disease and do not vaccinate their dogs because they claim it changes the taste of dog meat and affects the development of canine teeth for hunting and protection (Idachaba *et al*., 2009).

The detection of rabies antigen in slaughtered dogs will give information on the possible role of dogs in the epidemiology and spread of rabies in Wukari Taraba State and serve as basis for design of control and prevention programme for the disease.

1.4 Theoretical Frame Work

Dogs are the main reservoir hosts of rabies and source of infection to humans (WHO, 2010). Dog bites serve as the primary mode of transmission to humans which allow the passage of saliva containing virus across the broken skin (Fearneyhough, 2001). Vaccination against rabies virus is a highly effective method of preventing rabies in animals and humans (Jakel *et al*., 2008). Dog rabies control relies on mass vaccination of dogs in order to achieve population immunity levels sufficient to inhibit rabies transmission (Perry and Wandeler, 1993). This also provides the most

cost-effective and efficient strategy for controlling canine rabies (Clifton, 2007). The likelihood of spread of rabies virus may be increased by free-roaming and unvaccinated dog populations.

Knowledge is the capacity to acquire, retain and use information. It is a mixture of experience, discernment and skill (Badran, 1995). Attitude refers to inclination to react in a certain way to certain situations; to see and interpret events according to certain predispositions; or to organize into coherent and interrelated structures (Badran, 1995). Practice is the application of rules and knowledge that leads to action (Badran, 1995). Lack of sufficient knowledge on rabies and its preventive measures, poor management practices and irresponsible ownership among dog owners are possible factors that may contribute to the spread of rabies virus.

Detection of rabies antigen in slaughtered dogs signifies the presence of the virus which is a significant factor in the transmission of rabies from slaughtered dogs to the processors. The test to be used for this study is the direct fluorescent antibody test (DFA), which is the gold standard for the diagnosis of rabies approved by the WHO and OIE (CDC, 2011). The test is based on the detection of rabies virus antigen by visual observation of specific antigen-antibody reaction. This technique operates on the principle that anti-rabies IgG labeled with fluorescein isothiocyanate reacts with specific antigen in the brain smear and the product is viewed under ultraviolet light as described by Dean *et al.*, (1996). Brilliant apple green fluorescence indicates the presence of the rabies antigen.

The occurrence of a disease in a population is influenced by some determinants which may either represent the host, environment or agent (Pfeiffer, 2002; Martin *et al*., 1987). These determinants can affect the frequency, distribution or dynamics of the disease in a population. Risk factors such as age, gender, breed, season and location have been reported to play significant roles in the epidemiology of rabies (Widdowson *et al.*, 2002; Owai, 2009). Therefore, the assessment of frequency of dog bites and vaccination of dogs, assessment of knowledge, attitude and practice of dog meat processors and dog owners, detection of rabies antigens in dogs slaughtered for human consumption coupled with education of the people on rabies will be very useful in elucidating the epidemiology of rabies in Wukari Taraba State.

1.5 Aim and Objectives

1.5.1 Aim: To elucidate the epidemiology of rabies and assess knowledge, attitude and practice of dog owners to rabies in Wukari, Taraba State, Nigeria.

1.5.2 Objectives

1 To analyse reports on suspected rabies cases recorded in the area.

2 To analyse rabies vaccination records based on age, sex and breed of vaccinated dogs.

3 To assess the knowledge, attitude and practice of dog owners to rabies in the area.

4 To detect the presence of rabies antigen in brain tissue of dogs slaughtered for human consumption.

1.6 Research Questions

1. What is the distribution of reported suspected cases of rabies by age, sex, breed and season in the study area?
2. What is the distribution of rabies vaccination with respect to age, sex, breed of dogs vaccinated and season?
3. What is the level of knowledge, attitude and practice to rabies, of dog owners in the study area?
4. What is the prevalence of antigens to rabies among slaughtered dogs in Wukari?

CHAPTER TWO

LITERATURE REVIEW

2.1 Aetiology

Rabies is caused by rabies virus, which is a type under the genus *Lyssavirus,* family *Rhabdoviridae* and order *Mononegavirales.* Lyssaviruses have helical symmetry, with a length of about 180 nanometres and a cross-section diametre of about 75 nanometres. These viruses are enveloped and have a single-stranded RNA genome with negative-sense. The genetic information is packed as a ribonucleoprotein complex in which RNA is tightly bound by the viral nucleoprotein. The RNA genome of the virus encodes five genes whose order is highly conserved: nucleoprotein (N), phosphoprotein (P), matrix protein (M), glycoprotein (G), and the viral RNA polymerase (L). Of these five proteins, two are of special interest: the RNA nucleoprotein (N), which is a group of specific antigen, and the glycoprotein (G) contained in the spikes projecting from the surface of the virion and is responsible for inducing the production of neutralizing antibodies (Acha and Szyfres 1980). The genus includes the classical rabies virus (genotype 1) and six rabies related viruses, Lagos bat virus (genotype 2), Mokola virus (genotype 3), Duvenhage virus (genotype 4), European bat Lyssaviruses 1 and 2 (genotype 5 and 6) and the Australian bat Lyssavirus, genotype 7 (Bishop *et al*., 2002; Swanepoel, 2005). Other genotypes are Aravan virus (ARVA), Irkut virus (IRKV), Khujand virus (KHUV) and the West Caucasian bat virus (WCBV) (ICTV 2009). Two newly identified lyssavireuses, the Shimoni bat virus (SHIBV) (Kuzmin *et al*., 2010) and the Bokeloh bat lyssavirus (Freuling *et al.,* 2011) have been detected in bats, but not yet classified.

2.2 Pathogenesis

From the point of entry, the virus is neurotropic, traveling quickly centripetally along the neural pathways into the central nervous system (CNS). Once the infection is established in the central nervous system, the virus spreads centrifugally to the salivary gland, other organs and tissues through the peripheral nerves (Bishop *et al*., 2002). Salivary glands receive higher concentrations of the virus, thus allowing further transmission. The rabies virus has been detected in different organs outside the central nervous system such as the supra-renal gland and interscapular gland of bats, kidneys, bladder, ovaries, testicles, sebaceous gland, germinal cells of hair follicle cornea, tongue, pappilae and intestinal wall. This observation indicates that the virus can reproduce outside the central nervous system (Acha and Szyfres 1980). The finding of the virus in the saliva is of special epidemiological interest, because the bite is the principal means by which the virus is transmitted. When ever the virus is isolated from the salivary glands, it will also be found in the central nervous system. The period between infection and the first flu-like symptoms is typically two to 12 weeks, but incubation periods as short as four days and longer than six years have been documented, depending on the location and severity of the inoculating wound and the amount of virus introduced (Fekadu *et al.* 1982).

2.3 Transmission and Epidemiology

All warm-blooded mammals including humans can become infected with the rabies virus and develop symptoms, although birds have only been known to be infected in experiments. The animal hosts that maintain rabies virus in nature are carnivores and bats. Herbivores, rodents, birds and lagomorphs do not play any role in the epidemiology of the disease. The domestic dog (*Canis familiaris)* is the principal vector of urban rabies (Knobels *et al.,* 2005). Approximately

90% of rabies cases in humans in the world are attributed to rabid dogs (WHO 2010). The infection is transmitted from dog to dog, dog to man and dog to other domestic animals via bites (Ezeokoli and Umoh 1987). Humans get infected through close contact with infected saliva via scratches or bites (CDC, 1983; WHO, 2011). Non bite exposure can also occur via abrasions, mucous membranes or open wounds that are exposed to infected saliva or other infective materials such as cerebrospinal fluid or brain tissue (Fearneyhough, 2001). Human to human transmission has been reported through organ transplant from an infected donor, and transmission via inhalation of virus-contained aerosol have been reported (Srinivasan *et al.*, 2005;Takayama, 2005; CDC, 2007; WHO, 2008). Human to human transmission by bite is theoretically possible but has never been confirmed (WHO, 2010). Transmission is also possible following consumption of carcasses of animals that died of rabies and also by consumption of raw dog meat (Wallersein, 1999). Despite the high fatal outcome of the disease, rabies is maintained in the urban areas by the presence of a significant proportion of susceptible dogs. The high population of dogs and the annual reproduction are important factors in the epidemiology of canine rabies (Acha and Szyfres 1980).

The World Health Organization estimates that about 35,000 to 50,000 rabies related deaths occur annually worldwide (WHO, 1999). Rabies remains endemic throughout the world except for certain Western European countries and a number of islands, but about 99% of all human deaths occur in developing countries of Africa and Asia (Warrell and Warrell 1988). An estimated 31,000 human deaths occur annually from rabies in Asia, including about 20,000 in India, which has the highest rate of human rabies in the world primarily due to stray dogs, as a result of the 2001 law that forbade the killing of dogs.

As of 2007, Vietnam had the second-highest rate, followed by Thailand; in these countries, the virus is primarily transmitted through canines (feral dogs and other wild canine species). Another source of rabies in Asia is the pet boom. In 2006 China introduced the "one-dog policy" in Beijing to control the problem (Denduangboripant *et al*.,2005; Harris, 2012). However, not all rabid dogs shed the virus through saliva, and hence, some bites can be non infectious. About 60-75% of rabid dogs shed the virus in saliva and the viraemia may range from traces to high titres (Fishbein and Robinson, 1993). Therefore, risk of the virus being transmitted to man by bite is greater when the viral load being shed is higher. Despite being a highly fatal disease which can threaten the survival of a host species, rabies virus has been able to survive because of limiting factors such as transmission restricted to biting and long and variable incubation periods, thus allowing the virus to persist in a population temporally. Hosts which are not accustomed to biting other animals, such as man, are usually dead end hosts (Mantovani and Marabelli, 2004).

2.4 Rabies in Nigeria

In Nigeria, the dog is responsible for over 96% of rabies cases in animals (WHO, 2005). Rabies remains an endemic and neglected tropical disease in Nigeria and is often misdiagnosed, under-diagnosed and underreported (Adedeji *et al.,* 2010; Ehizibolo *et al*., 2011). In some cases, despite vaccination, the disease has been reported (Adedeji *et al*., 2010; Kujul *et al.,* 2010). Some of the factors responsible for the endemicity of rabies in Nigeria include vaccine and vaccination factors, lack of knowledge and information about the disease and poor public awareness, socio-economic factors and increasing human activities involving dogs e.g. hunting. Dog trade is also gaining popularity in Nigeria. Although available records on rabies in Nigeria are far from complete, reports of human deaths from rabies in the country are a matter of great concern

(Bryceson *et al*., 1975; Fagbami *et al*., 1981). Studies on Knowledge, attitude and practice (KAP) towards rabies among dog meat processors and dog meat consumers have been carried out in different part of the country (Opaleye *et al*., 2006, Isek, 2013 and Odeh *et al*., 2014) and these have shown that KAP is an important factor in the control of rabies in Nigeria.

2.5. Diagnosis

There are no clinical or gross pathognomonic lesions for the diagnosis of rabies, confirmation can be achieved only by laboratory techniques (Anon, 2004a). The nature of rabies disease dictates that laboratory tests be standardized, rapid, sensitive, specific, economical, and reliable. Results generated from tests directly influence the decision whether or not to initiate control strategies or to continue with a course of treatment. Failure to identify the presence of rabies virus or viral antigen in a specimen by a single test does not necessarily confirm the absence of the infection (Anon, 2004a). As a routine, more than one test should be carried out simultaneously to increases the chance of making a correct diagnosis. This is because some tests are more sensitive and specific than others, depending on the type of specimen available, stage of the infection and the genotype of the rabies virus (Anon, 2004b). Although the thalamus has been reported to be positive for the virus, a pool of brain tissue including the brainstem should be used for laboratory examination (Bingham and Merwe, 2002). Examination of salivary gland can also provide epidemiological information on the excretion of the virus by different animal species (Bingham and Merwe, 2002).

Rapid and accurate laboratory diagnosis of rabies in humans and other animals is essential for timely administration of post exposure prophylaxis. Within a few hours, a diagnostic laboratory

can determine whether or not an animal is rabid and inform the responsible medical personnel. The laboratory results may save a patient from unnecessary physical and psychological trauma, and financial burdens, if the animal is not rabid. In addition, laboratory identification of positive rabies cases may aid in defining current epidemiologic patterns of disease and provide appropriate information for the development of rabies control programs.

In humans several tests are necessary to diagnose rabies ante-mortem (before death); no single test is sufficient. Tests are performed on samples of saliva, serum, spinal fluid, and skin biopsies of hair follicles at the nape of the neck. Saliva can be tested by virus isolation or reverse transcription followed by polymerase chain reaction (RT-PCR). Serum and spinal fluid are tested for antibodies to rabies virus. Skin biopsy specimens are examined for rabies antigen in the cutaneous nerves at the base of hair follicles. In the case of rabies, diagnosis often begins with assessing the risk for rabies exposure based on information such as the location where the incident occurred, the type of animal involved, the vaccination status of the animal, and whether or not the animal can be safely captured and tested for rabies. Several tests are used in the diagnosis of rabies, but the direct fluorescent antibody test (DFA) is the most commonly used. Other tests that can be used in diagnosis are: electron microscopy (EM), histologic examination using seller staining, immunohistochemistry (IHC), RT-PCR and viral isolation in cell culture.

2.5.1 The direct fluorescent antibody test (DFA)

The Direct Fluorescent Antibody test (DFA) is the gold-standard for rabies diagnosis approved by World Health Organization (WHO) and Office International des Epizootics (OIE). The DFA is sensitive, specific and cheap (Dean *et al.*, 1996; OIE, 2011). The procedure was first described

by Goldwasser and Kissling (1958) and later modified by (Kissling, 1975; Dean et al., 1996) and is the most widely used test for rabies diagnosis. Virus antigen can be confirmed directly in brain impressions, composite brain smears, frozen sections and the brain mice used for virus isolation. Rabies virus can also be detected in the salivary glands using this technique (Goldwasser and Kissling, 1958).

2.5.2 Seller staining

This is direct microscopic examination of brain tissue for Negri bodies. Seller's stain contain methylene blue and basic fuchsin which are used to stain impression brain smears and it is used to demonstrate the cytoplasmic inclusion bodies also known as Negri bodies. Other viruses such as Canine Distemper virus and Canine Hepatitis virus also produce cytoplasmic inclusion bodies. This makes diagnosis of rabies using this procedure difficult (Lumlertdacha, 2005).

2.5.3 Mouse inoculation technique (MIT)

This is another technique recommended by WHO, it uses mice between 3-6 weeks of age. Mice will be observed for 30 days for the presence of clinical signs after intra-cerebral injection of 20% tissue suspension (WHO, 1996). If mice die of rabies infection, rabies virus can be identified by DFA test for the detection of viral antigen in the brain. According to the length of observation period, this technique is employed for confirmation (Lumlertdacha, 2005).

2.5.4 Tissue culture infection technique (TCIT)

This is an in vitro laboratory test with susceptible tissues to rabies infection such as murine neuroblastoma cells (MNA) or baby hamster kidney cells (BHK-21) suspended in agarose (Bourhy and Sureau, 1991; Meslin *et al*., 1996). Propagation of rabies virus in the tissue produces cytoplasmic inclusion bodies which are observed by DFA stain. Some laboratories

have replaced the MIT with TCIT for rabies viral demonstration. This test may not be reliable if the source specimens are decomposed or contaminated.

2.5.5 direct rapid immunohistochemical test (dRIT)

This test was developed in the Rabies Section of the Centers for Disease Control and Prevention (CDC) by incorporating various components of existing immunoperoxidase techniques (Niezgoda and Rupprecht, 2006). Like the DFA, the RIT is performed on brain touch impressions, but the product of the reaction can be observed by light microscopy, and RABV antigen appears as magenta inclusions against a blue neuronal background. The test recognizes all genotype 1 variants of RABV examined to date and all representative lyssaviruses. Modifications of a former indirect test have led to a direct test (dRIT) that uses a cocktail of highly concentrated and purified biotinylated anti-nucleocapsid monoclonal antibodies produced in vitro in a direct staining approach and allows a diagnosis to be made in less than1 hour. For the routine diagnosis of rabies, glycerol saline is a convenient preservative in situations in which refrigeration or freezing facilities are not promptly available (Barrat, 1996).

The dRIT is as reliable a diagnostic method as the gold standard (DFA) for fresh samples. It has an advantage of requiring only light microscopy, which is 10 times less expensive than a fluorescence microscope. Reduced cost suggests high potential for making rabies diagnosis available in other cities and rural areas of Africa for large populations for which a capacity for diagnosis will contribute to rabies control (Dürr *et al*., 2008).

2.5.6 Polymerase chain reaction (PCR)

Molecular techniques demonstrate genetic substrates of the target virus and are well adapted for testing in tissue or fluid with high accuracy and sensitivity. A very small amount of the brain

sample is required. Fresh brain is preferred to decomposed ones. PCR can yield positive result in decomposed tissues, however, the result is not very consistent or reliable. Due to the high cost of carrying out this test, it is limited to confirmation of human rabies. This technique consists of 3 major processes; denaturation, annealing, extension (Kalmonvarin *et al*., 1993). The amplified product will then be characterized with a gel-electrophoresis technique and is compared with a known control. The nested PCR technique which is the double step amplification was introduced to increase sensitivity. It should be noted that viral RNA secretion in saliva, urine and cerebrospinal fluid is intermittent. One negative test, whether DFA, TCIT, nested PCR or other recommended molecular techniques must not be considered reliable for diagnosis and must be repeated (Lumlertdacha, 2005).

2.6 Vaccination

Vaccination against rabies has been shown to be an efficient way for its control (Tuner *et al*., 1976), and statistics have shown that successful immunization of 70% - 80% of dog population in a country places rabies under control (Beran, 1971). Mass vaccination has been used successfully in Western Europe and North America (Wandeler, 2000; WHO, 2004), showing that the disease can be controlled and eliminated by vaccination of reservoir animal populations. Japan was the first country to implement mass vaccination of dogs, successfully eliminating the disease in 1956 (WHO 1996). In Malaysia, compulsory vaccination and destruction of stray dogs brought the disease under control in 1952 (Wells, 1954).

In Nigeria however, it has not been possible to successfully control and eradicate rabies, instead evidences show that the disease is on the increase (Ogunkoya, 1997). Furthermore there have been several reports of rabies occurring in dogs vaccinated with low egg passage (LEP) – flurry

strain anti-rabies vaccine (Okoh, 1981; Ogunkoya, 1989), which is the official vaccine produced by National Veterinary Research Institute (NVRI) Vom – Nigeria and used in Nigeria.

Despite the availability of safe, effective and relatively cheap vaccines for dogs, rabies remains uncontrolled in most African and Asian countries (Cleaveland, 1998; King, 1999; WHO, 2001). Insufficient funding compounded by lack of awareness about the true burden of the disease may be responsible for failure of current control programmes. It appears many Nigerians still see rabies as insignificant and do not take serious measures to prevent or control its occurrence. Many are still ignorant about the disease and do not vaccinate their dogs because they claim it changes the taste of dog meat and affects the development of canine teeth for hunting and protection (Idachaba *et al*., 2009).

2.7 Control and Prevention

All human cases of rabies were fatal until a vaccine was developed in 1885 by Louis Pasteur and Émile Roux (Geison G L, 1978). Their original vaccine was harvested from infected rabbits, from which the virus in the nerve tissue was weakened by allowing it to dry for five to 10 days. Similar nerve tissue-derived vaccines are still used in some countries, as they are much cheaper than modern cell culture vaccines (Srivastava A K *et al*., 2004).

Vaccination against rabies is an efficient way for its control (Turner *et al.*, 1976), and statistics have shown that successful immunization of 70-80% of dog population in a country can result in control of the disease (Beran, 1971). Animal rabies control consists of vaccination of dogs and cats, elimination of stray animals, health education for public etc. Mass vaccination of dogs is not implemented in some countries and effective coverage rate is not known, this and the

elimination of stray dogs by shooting, has a minimal effect on transmission of rabies (Knobel *et al*., 2005). For traveling purposes, vaccination of domestic carnivores is obligatory. Some countries require testing for neutralizing antibodies against rabies. The minimum threshold level accepted by OIE/WHO is 0.5IU/ml (Jackel *et al*., 2008).

In Nigeria, where dogs serve as the main reservoir of rabies virus and dog bites continue to be the main mode of transmission, the disease remains a serious public health problem (Awoyomi *et al*., 2007). The most effective approach to control of rabies in Nigeria is by mass vaccination of at least 80% of dog population in country, within the shortest possible time, combined with elimination of stray and ownerless dogs (Awoyomi *et al*., 2007), but this high level of immunity is rarely achieved in most African countries, due to socio-economic barriers.

Post-Exposure treatment in humans usually involves combined active and passive immunization immediately after exposure, this helps in elimination of the virus before it enters the nervous system (Wandeler, 2000). This treatment in humans should be done as soon as the exposure occurs. The treatment for rabies prevention in man must consist of thorough wound cleaning for about 15minutes with soap and clean water; a virucidal antiseptic such as povidone iodine or ethanol should be applied on the wound surface. This is then followed immediately by the administration of rabies passive immunization and cell culture or purified embryonated egg rabies vaccine of proven efficacy (WHO, 2004).

In dogs, vaccination after infection does not significantly alter the clinical picture or prevent the development of the disease (Fooks and McElihnney, 2000). This is in contrasts to post-exposure treatment in humans which is effective after infection. It is possible that an animal infected

before vaccination may continue to incubate the disease even after developing a high antibody titre (Fooks and McElihnney, 2000).

2.8 Knowledge, Attitude and Practice towards Rabies

As vaccines and post-exposure prophylaxis are both available in Nigeria, the level of public awareness about the preventable and treatable aspects of this disease and public perceptions and attitudes towards vaccination and post-exposure prophylaxis are important factors in planning for effective control strategies (Wasay *et al*, 2012). There are many myths and beliefs associated with management of wounds inflicted by a rabid animal; these include the application of oils, herbs, red chill and other substances. There have been reports of more faith in indigenous medicines that are of unproven efficacy, rather than washing the wound properly with soap and water because of fear that the wound will get infected (Sekhon *et al.,* 2002). Knowledge about rabies, proper pet care practices and responsible dog ownership should be emphasized to dog owners in order to adequately control this disease (Matibag *et al.*, 2007).

People's perception about risk factors, seriousness and fatality of the disease, importance of vaccination and post-exposure prophylaxis and affordability of vaccines is not well known in Nigeria. As vaccines and post-exposure prophylaxis are both available in Nigeria, the level of public awareness about the preventable and treatable aspect of this disease and public perceptions and attitudes towards vaccination and post-exposure prophylaxis are important factors in planning for effective intervention (Wasay *et al*., 2012). Most people have basic knowledge about anti-rabies treatment where dog bite victims receive 14 injections, but are usually not aware of the disease that can occur if dog bites are not properly managed (Isek, 2013).

C HAPTER THREE

MATERIALS AND METHODS

3. 1 Study Area

This study was carried out in Wukari metropolis of Taraba State. Wukari metropolis is a large town which is the Headquarters of Wukari Local Government Area of Taraba State. The Rivers Donga and Benue pass through this area. It shares boundary with Benue State to the south. Geographically, it lies between latitude 7° 53' 42" North and longitude 9° 47' 59" East. It is one of the major towns in Taraba State and has an area of 4,308 km² and a population of 241,546 at the 2006 census. The town is the base of the Wukari Federation, a traditional state. Wukari is home to Federal University Wukari and the Jubilee University (Kwararafa University). It has a State Veterinary Hospital, a General Hospital and other private clinics. The major languages spoken are Jukun, Kutep, Tiv, Hausa and the Fulani. The predominant occupation of the people is agriculture, commerce and civil service.

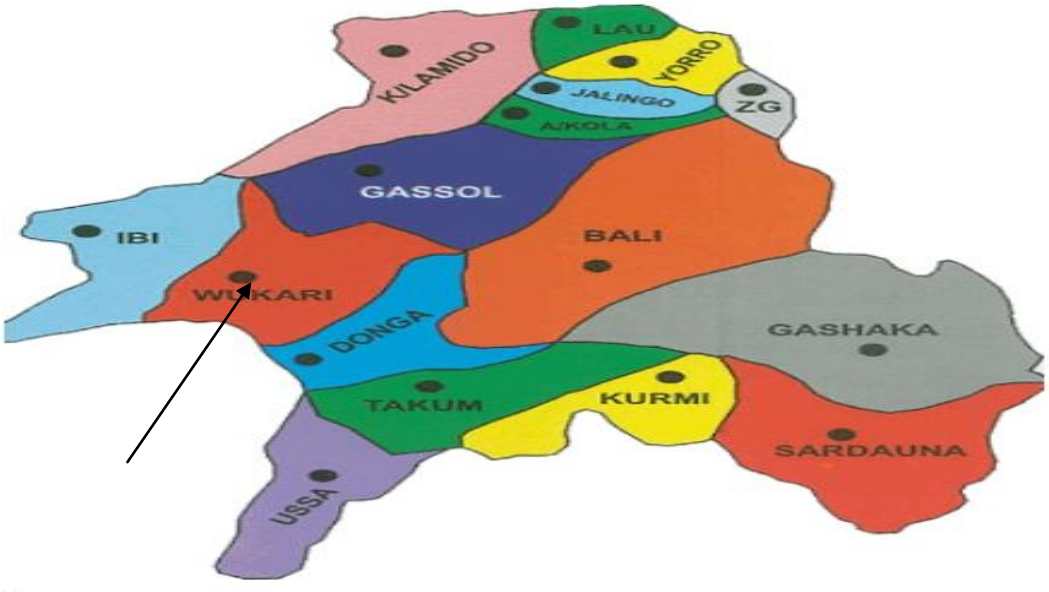

Fig. 1 Map of Taraba State, with arrow showing Wukari local government area. (Google maps.com)

3.2 Study Design

Descriptive epidemiology was used to evaluate vaccination records, while cross-sectional study was carried out to assess the knowledge, attitude and practice of dog owners on rabies and for the detection of rabies antigens in brain of slaughtered dogs.

3.3 Information on Vaccination of Dogs

Information on rabies vaccination was collected from the State Veterinary Hospital located in the study area. The records were reviewed for a period of ten years (2003-2012). Reports on sex, age, breed and number of dogs vaccinated were assessed.

Available records on suspected cases of rabies in animals were also collected from the State Veterinary Hospital for the same period.

3.4 Information on Knowledge, Attitude and Practice

A **s**tructured questionnaire was designed, pretested and administered to 200 dog owners within the study area between June - September 2013. These persons were found by visiting different residential areas within the study area (Anguwan dujukun, Filin jirgi, GRA, and New Jerusalem). Streets were selected by picking every other street along major streets within the study area. Dog owners were found by going house to house along selected of streets within these areas and an adult in the household was interviewed. Households without dogs and those unwilling to participate in the study were excluded. The options for the choice questions were “Yes”,” No”, “Don’t know” or “Undecided”. The questionnaire was made up of five (5) sections. The demographic information of respondent was contained in section A. Information on association of respondent with dogs was contained in section B, this had questions on number of dogs

owned, period of dog keeping and reasons for keeping dogs. Section C contained information about knowledge of rabies, which included questions on mode of transmission, clinical signs/symptoms & preventive measures. Questions on attitude of respondent towards rabies were provided in section D and these attitudes concerning stray dogs, confining of dogs and children playing with dogs. Section E contained questions on practice of the respondent towards rabies. The questionnaire was explained to the respondents by the researcher and their responses were recorded. The questionnaire was administered only to dog owners who were present and willing to participate at the time of study.

3.5 Sample Size Determination, Collection and Processing of Dog Brain

3.5.1 Sample size determination

The sample size was determined using the formula; (Thrusfield, 2007)

$$n = \frac{Z^2P(1-P)}{d^2}$$

Where Z = 1.96 standard normal value for desired confidence of 95%

P = prevalence rate (15.8%) Akombo, 2009

d = allowable error 5%

n= sample size

$$\frac{1.96^2 \times 0.158(1-0.158)}{0.05^2} = 204.44$$

3.5.2 Sample collection

A total of 188 brain samples were collected from slaughtered dogs between May and July 2013, from various slaughter points within the study area. The brain was removed from each dog head as described by Atanasiu, (1975). Information on age of the dogs, sex, breed and source of dogs slaughtered were also collected. Samples were placed in sterile plastic bottles, preserved at -20^{o}C and transported in a cold box to the Viral Zoonoses Laboratory of the Department of Veterinary Public Health and Preventive Medicine, Ahmadu Bello University Zaria, for fluorescent antibody test. Each slaughter point was visited every morning and samples were collected based on availability.

3.5.3 Direct Fluorescent Antibody test procedure

Direct Fluorescent Antibody test (DFA) as described by Dean *et al*., (1996) was performed on the brain samples collected from slaughtered dogs. Rabies direct fluorescent antibody assay (DFA) monoclonal antibody reagent (Fujirebio Diagnostic Inc. Malvern, P.A 19355, USA) was used. Working dilution of 1:40 was prepared according to manufacturer's recommendation and used. An impression smear of the brain sample was made on a clean glass slide, air dried and fixed in cold acetone for 30 minutes at -20^{o}C. The slide was then air -dried for 5 minutes and a drop of the rabies conjugate was applied on the smear using a micro pipette and incubated for 30 minutes at 37^{o}C in a humid chamber, after which excess conjugate was removed by washing with PBS (pH 7.4) for about 5 minutes three times and allowed to air dry. The slides were examined using the fluorescent microscope at X 40 magnification. The presence of brilliant apple green fluorescence or greenish-yellow objects against a dark background was regarded as

positive and the intensity was noted (as +, ++, +++ or ++++), while the absence of specific apple green fluorescence was regarded as negative for rabies.

3.6 Data Analysis

Data generated were analyzed using Statistical Package for Social Sciences (SPSS) version 17.0 to carry out descriptive analysis. Chi square test was used to test for associations between categorical variables (age, gender, marital status, level of education and occupation) and level of knowledge. Values of $p<0.05$ were considered to be significant. Data on vaccination were presented on graphs and tables to reveal distribution by age, sex, breed and number of dogs vaccinated per year. Time series decomposition using moving average was carried out to reveal seasonal variation in dog vaccination. For knowledge, attitude and practice, a marking scheme containing expected correct answers was prepared and used to mark and score the responses. Don't know/undecided responses were considered as wrong answers. For each correct and incorrect answer one and zero points were assigned respectively. The mean knowledge, attitude and practice scores were calculated (14.3, 6.95 and 3,13 respectively). The maximum obtainable scores for knowledge, attitude and practice were 20, 9 and 4 respectively. Respondents with knowledge, attitude and practice scores equal or greater the mean scores were considered to have good knowledge, attitude and practice while those who had scores below the mean were categorized as having poor knowledge, attitude and practice. Demographic variables were presented using descriptive statistics. Associations between demographic variables and the categorized scores were assessed using χ^2 test of association and odds ratio; confidence intervals (95%) were calculated for odds ratios. Categorical variables that showed statistical significance by χ^2 test and odds ratio where further subjected to multinomial logistic regression. Values of $p<0.05$ were considered significant in the χ^2 analysis. Using raw scores, multiple regression

analysis was performed to show if linear relationships existed among knowledge, attitude and practice. Brain samples positive for rabies antigen were expressed as a percentage of the total sample examined.

CHAPTER FOUR

RESULTS

4.1 Vaccination of Dogs

The results on vaccination profile showed that out of the 8,370 cases presented to the State Veterinary Hospital during the period under review, 1,128 (13.50%) dogs received anti- rabies vaccination. The year 2012 had the highest proportion of dogs vaccinated (21.73%) in relation to number of cases presented (Fig. 4.1). Local breeds had the highest vaccination coverage of 921(81.6), exotic breed and others were 76 (6.7%) and 131 (11.6) respectively (Fig. 4.2). From the records available, more male dogs 589 (52.2%) were vaccinated within the period under review than female dogs 539 (47.8%). Most of the dogs vaccinated were within 3-12 months of age 664(58.9%), followed by those within the age group >12-36 months 385(34.1%) and dogs

greater than 36 months of age 79(7.0%). There was an increase in vaccination rate of dogs in 2005, 2009, 2010, 2011 and 2012 as compared to other years (Fig 4.1). Fig. 4.3 shows the average monthly seasonal variation in vaccination of dogs within Wukari, with a peak in vaccination occurring around February and March.

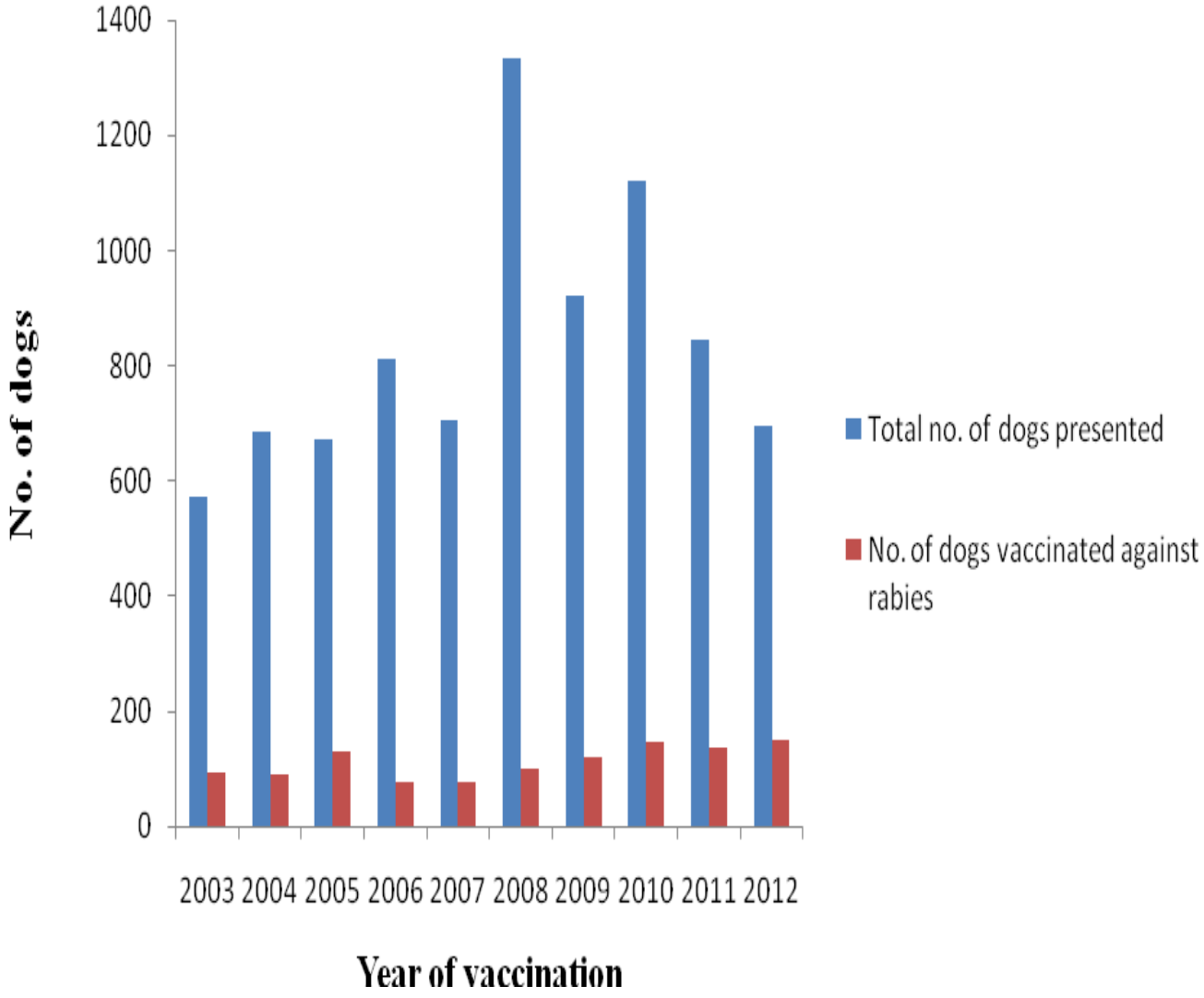

Fig 4.1 Annual distribution of total number of dogs vaccinated against rabies in Wukari from 2003-2012.

Table 4.1. Sex specific distribution of dogs vaccinated in Veterinary Hospital Wukari, Taraba State, Nigeria.

YEAR	SEX(%)		TOTAL
	MALE	FEMALE	
2003	49(52.7)	44(47.3)	93
2004	53(58.2)	38(41.8)	91
2005	75(56.8)	57(43.2)	132
2006	36(46.2)	42(53.8)	78
2007	40(51.3)	38(48.7)	78
2008	46(45.5)	55(54.5)	101
2009	50(41.0)	72(59.0)	122
2010	59(40.4)	87(59.6)	146
2011	96(70.6)	40(29.4)	136
2012	85(56.3)	66(43.7)	151
TOTAL	**589(52.2)**	**539(47.8)**	**1128**

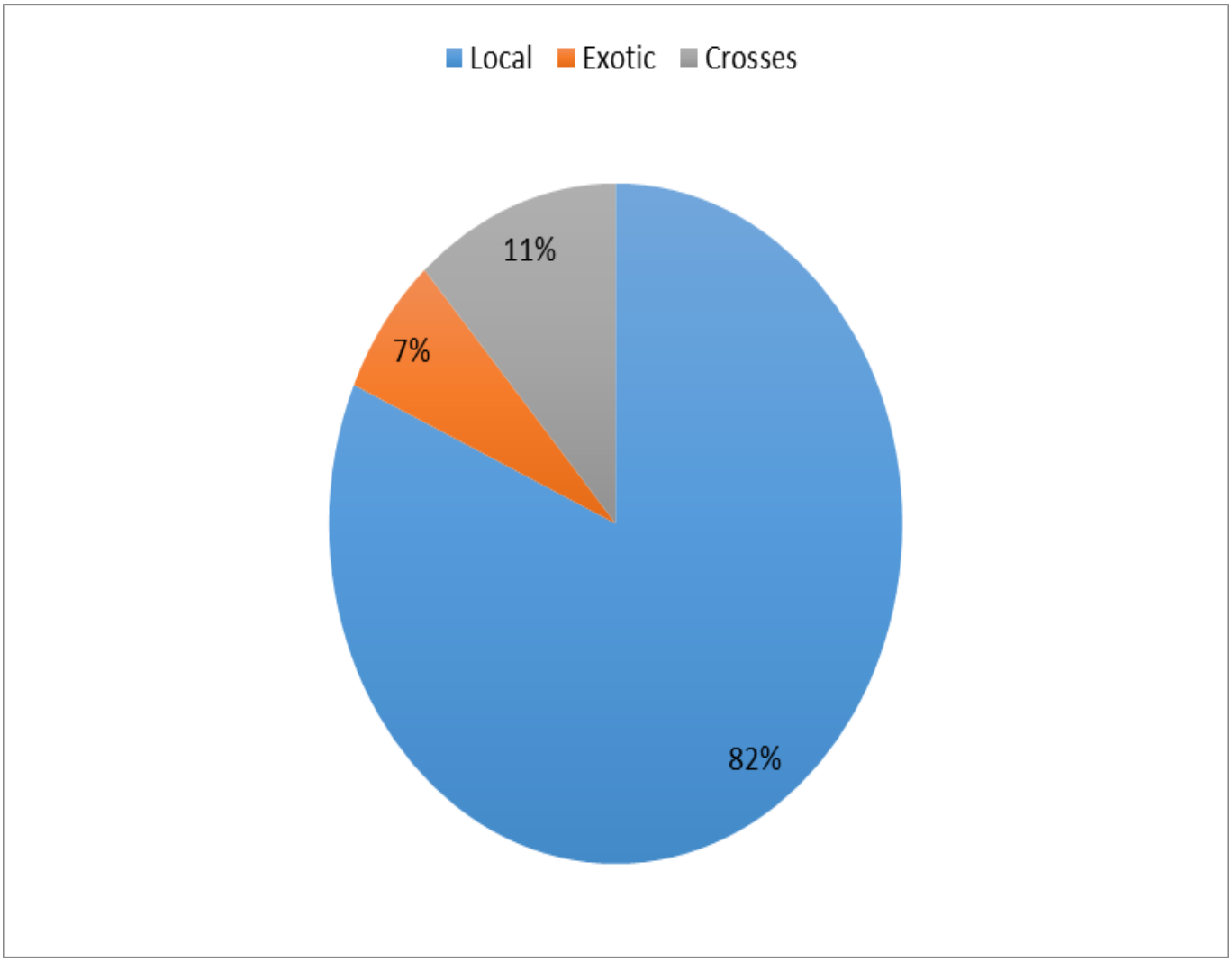

Fig. 4.2 Distribution of total number of dogs vaccinated by breed in Wukari Taraba State Nigeria. 2003-2012.

Table 4.2. Age specific distribution of vaccinated dogs in State Veterinary Hospital, Wukari, Taraba State Nigeria, 2003-2012.

YEAR	Age of vaccination in months (%)			TOTAL
	3-12	>12-36	>36	
2003	59(63.4)	31(33.3)	3(3.2)	93
2004	75(82.4)	15(16.5)	1(1.1)	91
2005	72(54.5)	50(37.9)	10(7.6)	132
2006	39(50.0)	17(21.8)	22(28.2)	78
2007	51(65.4)	22(28.2)	5(6.4)	78
2008	39(38.6)	60(59.4)	2(2)	101
2009	61(50)	46(37.7)	15(12.3)	122
2010	77(49.3)	64(43.8)	5(3.4)	146
2011	68(50)	58(42.6)	10(7.4)	136
2012	123(81.5)	22(14.6)	6(3.9)	151
TOTAL	**664(58.9)**	**385(34.1)**	**79(7.0)**	**1128**

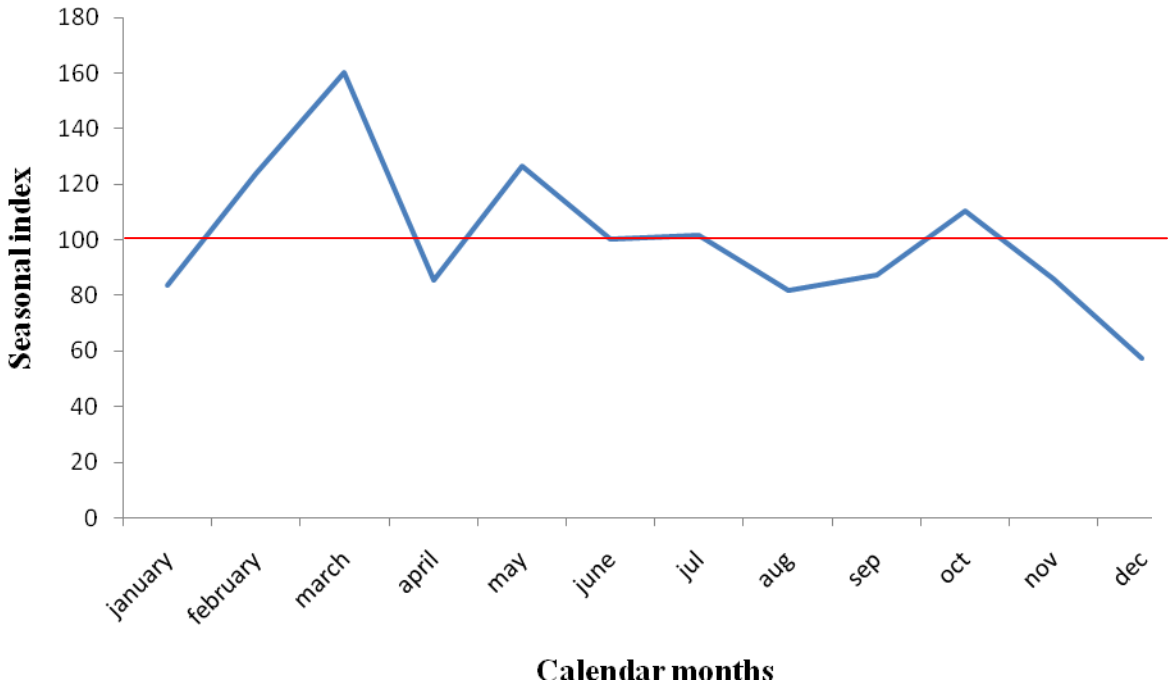

Fig. 4.3 Average monthly seasonal variation of vaccinated dogs in Wukari, Taraba State, Nigeria. 2003-2012

4.2 Knowledge, Attitude and Practice

4.2.1 Demographic characteristic of dog owners

Out of the 200 respondents that participated in the study, 101(50.5%) were males and 99 (49.5%) were females. Respondents 0<19 years of age were 36(18.0%), 20-30years 59(29.5%), 31-40 years 55(27.5%) and those above 40 years were 50(25 %). Sixty seven (33.5%) were single while 133(66.5%) were married. Respondents that were unemployed were 11(5.5%), 61(30.1%) were civil servants, 86(43.0%) were self employed and 42(21.0%) were students. Based on level of education of respondents, 29(14.5%) had no formal education, 42(21.0%) had primary school education, 58(29.0%) had secondary education, and the majority 71(35.5%) had tertiary education. Majority of respondents 125(62.5%) were of the Jukun tribe, 7(3.5%) were Kutep, 3 (1.5%) were Tiv and 65(32.5%) were of other tribes which includes: Idoma, Yoruba, Ibibio, Tarok, Igbo,Bura, Montol, Kaka, Mambila and Tangale (Table 4.3).

4.2.2. Association with Dogs

Respondents who owned one dog only were 68(34%), those with two dogs were 90(45%), those with three dogs were 29(14.5%) and those with more than three dogs were 13(6.5%). Majority of the respondents 190 (95%) kept dogs for protection, 8 (4%) kept dogs for companionship while 2 (1%) kept dogs for hunting. Forty seven (23.5%) said they have been keeping dogs for 1-5year, 40 (20%) for 6-10 years, 88(44%) for 11-15 years and 25 (12.5%) have been keeping dogs for over 15 years. Only 23 (11.5%) had specially constructed cages for their dogs, 177(88.5%) said their dogs slept anywhere on the premises and on passage ways. Majority of respondents (160 80%) let their dogs roam freely within the neighborhood. Only 40 (20%) were able to confine

their dogs within the premises. Respondents who reported that they had been previously bitten by a dog were 43(21.5%) (Table 4.4).

Table 4.3. Demographic characteristics of dog owners in Wukari, Taraba State Nigeria.

Characteristics	Total number of respondents N=200	Specific rates (%)
Gender		
Male	101	50.5
Female	99	49.5
Age (years)		
<19	36	18.0
20-30	59	29.5
31-40	55	27.5
>40	50	25.0
Marital status		
Single	67	33.5
Married	133	66.5
Occupation		
Unemployed	11	5.5
Civil servant	61	30.5
Self employed	86	43.0
Student	42	21.0
Educational level		
No formal education	29	14.5
Primary	42	21.0
Secondary	58	29.0
Tertiary	71	35.5

Table 4.4. Associations of dog owners with dogs in Wukari Taraba State Nigeria.

Association item	Total number of respondents N=200	Specific rates (%)
Number of dogs owned		
One	68	34.0
Two	90	45.0
Three	29	14.5
>three	13	6.5
Reason for keeping dogs		
Protection	190	95.0
Companionship	8	4.0
Hunting	2	1.0
Period of dog keeping (years)		
1-5	47	23.5
6-10	40	20.0
11-15	88	44.0
>15	25	12.5
Dog housing		
Specially constructed cages	23	11.5
Anywhere on the premises	177	88.5
Control of dog movement		
Never allowed to leave the premises	40	20.0
Allowed to roam freely in the neighborhood	160	80.0
Have you been bitten by a dog		
Yes	43	21.5
No	157	78.5

4.2.3 Knowledge of dog owners towards rabies

The mean knowledge score of respondents was 14.3 out of 20 items scored. Majority 171(85.5%) agreed that rabies does not kill only animals, 26 (13%) knew that the rabies virus can be found in the nervous tissue, 121(60.5%) agreed that rabies can be spread through the saliva of a rabid animal and 163(81.5%) agreed that dogs are the possible common source of rabies in Nigeria. One hundred and fifty- nine (71.5%) affirmed that humans can be infected with rabies, but majority of respondents 172(86%) did not know the age when dogs receive their first dose of anti-rabies vaccine. Only 54(27%) knew that dog meat processors are at risk of becoming infected with rabies virus. One hundred and sixty two (81%) knew that a mad dog should not be slaughtered for human consumption, 101(50.5%), affirmed that dog registration and licensing help in control of rabies and 114 (57%) knew that vaccination of dogs against rabies should be repeated yearly (Table 4.5). The association of demographic characteristics of dog owners with categorized knowledge scores was assessed (Table 4.6). This shows statistical significant association between occupation (χ^2 =29.304, df=3, p=0.000), dog owners who were civil servants were 4.8 times more likely to have good knowledge (OR=4.84, 95% CI on OR 1.09-21.44) than other occupation groups (Table 4.7.). Level of knowledge on rabies increased with increase in age of dog owners.

Table 4.5 Responses of dog owners to knowledge of rabies in Wukari, Taraba State, Nigeria.

Knowledge item N=200	Frequency	(%)
Rabies kills only animals		
Yes	29	14.5
No	171	85.5
Rabies virus can be found in the nervous tissue		
Yes	26	13.0
No	174	87.0
The virus can be spread through the saliva of a rabid animal		
Yes	121	60.5
No	79	39.5
Dogs are common source of rabies in Nigeria		
Yes	163	81.5
No	37	18.5
Humans can be infected with rabies		
Yes	159	79.5
No	41	20.5
At what age should dogs receive first dose of rabies vaccine?		
3 months	28	14.0
9 months	172	86.0
Dog meat processors are at more risk of being infected with rabies virus		
Yes	54	27.0
No	146	73.0
A mad dog should not be slaughtered for human consumption		
Yes	162	81.0
No	38	19.0
Dog registration and licensing helps in control of rabies		
Yes	101	50.5
No	99	49.5
Vaccination of dogs against rabies should be repeated yearly		
Yes	114	57.0
No	86	43.0

Table 4.6 Association of demographic variables of dog owners with categorized knowledge scores of rabies in Wukari, Taraba State, Nigeria.

	Categorized scores N=200				
Variables	**Poor**	**Good**	χ^2	**(df)**	**p-value**
Age (years)					
<19	25(69.4)	11(30.6)			
20-30	28(47.5)	31(52.5)	5.384	3	0.146
31-40	27(49.1)	28(50.9)			
>40	24(48.0)	26(52.0)			
Gender					
Male	46(45.5)	55(54.5)	3.407	1	0.65
Female	58(58.6)	41(41.4)			
Marital status					
Single	40(59.7)	27(40.3)	2.394	1	0.122
Married	64(48.1)	69(51.9)			
Occupation					
Unemployed	9(81.8)	2(18.2)			
Civil servant	15(24.6)	46(75.4)	29.304	3	0.000
Self employed	50(58.8)	35(41.2)			
Student	30(69.8)	13(30.2)			
Educational level					
No formal education	19(65.5)	10(34.5)			
Primary	25(59.5)	17(40.5)	29.313	3	0.000
Secondary	41(70.7)	17(29.3)			
Tertiary	19(26.8)	52(73.2)			

***Percentages in parentheses and numbers in front*

Table 4.7 Multivariable logistic regression analysis of demographic variables and categorized knowledge scores of dog owners in Wukari, Taraba State, Nigeria.

Variables	Categorized scores N=200 Poor	Good	Crude odds ratio (95% CI)	Adjusted odds ratio (95% CI) Poor	Adjusted odds ratio (95% CI) Good
Age (years)					
<19	25(69.4)	11(30.6)	2.46(1.00-6.09)	0.32(0.07-1.54)	3.09(0.65-14.76)
20-30	28(47.5)	31(52.5)	0.98(0.46-2.08)	0.42(0.17-1.07)	2.36(0.93-5.97)
31-40	27(49.1)	28(50.9)	1.04(0.49-2.25)	0.84(0.36-1.98)	1.19(0.50-2.82)
>40	24(48.0)	26(52.0)	1	1	1
Gender					
Male	46(45.5)	55(54.5)	0.59(0.34-1.03)		
Female	58(58.6)	41(41.4)	1		
Marital status					
Single	40(59.7)	27(40.3)	1.60(0.88-2.90)		
Married	64(48.1)	69(51.9)	1		
Occupation					
Unemployed	9(81.8)	2(18.2)	1.95(0.37-10.30)	1.40(0.21-9.39)	0.72(0.11-4.81)
Civil servant	15(24.6)	46(75.4)	0.14(0.06-0.34)	0.21(0.05-0.91)	4.84(1.09-21.44)
Self employed	50(58.8)	35(41.2)	0.62(0.28-1.35)	0.27(0.08-0.99)	3.65(1.02-13.12)
Student	30(69.8)	13(30.2)	1	1	1
Educational level					
No formal education	19(65.5)	10(34.5)	5.20(2.05-13.16)	4.49(0.94-21.57)	0.22(0.46-1.07)
Primary	25(59.5)	17(40.5)	4.02(1.79-9.05)	4.11(0.90-18.84)	0.24(0.53-1.12)
Secondary	41(70.7)	17(29.3)	6.60(3.05-14.28)	4.52(0.95-21.54)	0.22(0.46-1.05)
Tertiary	19(26.8)	52(73.2)		1	1

4.2.4 Attitude of dog owners towards rabies

Majority of respondents 178(89.0%) said they would not nurse an unknown sick dog, 155(77.5%) said they do not allow stray dogs roam freely into their compounds, 22(11.0%) said they would use traditional medication if bitten by a dog and 115 (57.5%) were in favour of letting dogs roam around for food because it makes them stronger. Most of the respondents 113(56.5%) were of the opinion that children should not be allowed to play with dogs; 76(38%) said it was bad to confine dogs while majority 195(97.5%) affirmed that they do not play with unknown dogs (Table 4.8). Categorized attitude scores showed an association with occupation and educational qualification of dog owners (χ^2 =28.866, df=3, p=0.000 and χ^2=38.597, df=3, p=0,000 respectively) (Table 4.9). Positive attitude towards rabies increased with increase in age of dog owners, however, respondents within the age group 20-30 were more likely to have negative attitude (OR=3.97, 95% CI on OR =1.35-11.66) (Table 8) than those in the >40year age group, (Table 4.10).

Table 4.8 Responses of dog owners on attitude towards rabies in Wukari, Taraba State, Nigeria.

Attitude items N=200	Frequency (%)
It is good to nurse an unknown sick dog	
Yes	22(11.0)
No	178(89.0)
I do not allow stray dogs roam freely into my compound	
Yes	155(77.5)
No	45(22.5)
If I am bitten by a dog I will go to the hospital	
Yes	178(89.0)
No	22(11.0)
It is good to let dogs roam to get food because it makes them stronger	
	115(57.5)
Yes	85(42.5)
No	
Children should be allowed to play with dogs	
Yes	87(43.5)
No	113(56.5)
It is inhumane to confine your dog	
Yes	76(38.0)
No	124(62.0)

***Percentages in parentheses and numbers in front*

Table 4.9 Summary of demographic variables with categorized attitude scores of dog owners in Wukari, Taraba State, Nigeria.

Variable	Negative attitude N= 200	Positive attitude	χ^2	df	P-value
Age (years)					
<19	11(31.4)	24(68.6)			
20-30	29(50.0)	29(50.0)	9.773	3	0.021
31-40	17(30.9)	38(69.1)			
>40	11(22.4)	38(77.6)			
Gender					
Male	36(35.6)	65(64.4)	0.116	1	0.733
Female	32(33.3)	64(66.7)			
Marital status					
Single	24(36.9)	41(63.1)	0.248	1	0.618
Married	44(33.3)	88(66.7)			
Occupation					
Unemployed	6(54.5)	5(45.5)			
Civil servant	6(9.8)	55(90.2)	28.866	3	0.000
Self employed	43(51.2)	41(48.8)			
Student	13(31.7)	28(68.3)			
Educational level					
No formal education	18(62.1)	11(37.9)			
Primary	26(61.9)	16(38.1)	38.597	3	0.000
Secondary	14(25.0)	42(75.0)			
Tertiary	10(14.3)	60(85.7)			

***Percentages in parentheses and numbers in front*

Table 4.10 Multivariable logistic regression analysis of demographic variables and categorized attitude scores of dog owners in Wukari, Taraba State, Nigeria.

	Categorized scores				
Variables	**Negative attitude N= 200**	**Positive attitude**	**Crude odds ratio (95% CI)**	**Adjusted odds ratio (95% CI) Negative**	**Adjusted odds ratio (95% CI) Positive**
Age (years)					
<19	11(31.4)	24(68.6)	1.58(0.59-4.22)	9.17(1.31-64.17)	0.11(0.02-0.76)
20-30	29(50.0)	29(50.0)	3.45(1.48-8.05)	3.97(1.35-11.66)	0.25(0.09-0.74)
31-40	17(30.9)	38(69.1)	1.55(0.64-3.73)	1.49(0.53-4.23)	0.67(0.24-1.89)
>40	11(22.4)	38(77.6)	1	1	1
Gender					
Male	36(35.6)	65(64.4)	1.11(0.62-1.99)		
Female	32(33.3)	64(66.7)	1		
Marital status					
Single	24(36.9)	41(63.1)	1.17(0.63-2.18)		
Married	44(33.3)	88(66.7)	1		
Occupation					
Unemployed	6(54.5)	5(45.5)	2.28(0.67-10.03)	4.90(0.80-30.02)	0.20(0.03-1.25)
Civil servant	6(9.8)	55(90.2)	0.24(0.08-0.68)	0.33(0.06-1.69)	3.03(0.59-15.55)
Self employed	43(51.2)	41(48.8)	2.26(1.03-4.95)	1.56(0.40-6.05)	0.64(0.17-2.49)
Student	13(31.7)	28(68.3)	1	1	1
Educational level					
No formal	18(62.1)	11(37.9)	9.82(3.59-26.83)	2.96(0.58-15.27)	0.34(0.07-1.74)
education	26(61.9)	16(38.1)	9.75(3.91-24.33)	3.13(0.63-15.71)	0.32(0.06-1.60)
Primary	14(25.0)	42(75.0)	2.00(0.81-4.93)	0.21(0.03-1.31)	4.83(0.76-30.57)
Secondary	10(14.3)	60(85.7)	1	1	1
Tertiary					

***Percentages in parentheses and numbers in front*

4.2.5. Practice of dog owners towards rabies

From this study, 172(86%) reported that it was good to vaccinate dogs against rabies, 163 (83.5%) said dog handlers should wear protective clothing, 182(91.0%) said it was good to wash dog bite wounds with soap and water. Most of the respondents 151(75.5%) advised that dog handlers should take human anti-rabies vaccine (Table 4.11). Respondents in the <19 year age group (OR=8.09, 95% CI on OR 2.11-31.07) and the 20-30 year age group (OR=5.15, 95% CI on OR 1.99-13.31) (Table 4.13) were significantly more likely to have better practice scores than those above 40 years of age. There was statistically significant difference in the occupational characteristic of respondent, with civil servants and those who were self employed having higher practice scores (χ^2=9.983, df=3, p=0.019) than students (Table 4.12). Good practice increased with increasing level of education. Civil servants were 9.8 times more likely to have good practice than other occupation groups (OR=9.83, 95% CI on OR 2.77-34.95) (Table 4.13).

Table 4.11. The responses of dog owners on practice towards rabies in Wukari, Taraba State Nigeria.

Practice items N=200	Frequency (%)
It is good to vaccinate your dog	
Yes	172(86.0)
No	28(14.0)
Dog handlers should wear protective clothing	
Yes	167(83.5)
No	33(16.5)
It is good to wash dog bite wounds with soap	
Yes	182(91.0)
No	18(9.0)
Dog handlers should take human anti-rabies vaccine	
Yes	151(75.5)
No	49(24.5)

*****_Percentages in parentheses and numbers in front_

Table 4.12 Association of demographic variables of dog owners with categorized practice scores in Wukari, Taraba State Nigeria

Variables	Poor Practice N=200	Good Practice	χ^2	df	P-value
Age (years)					
<19	16(44.4)	20(55.6)			
20-30	23(39.0)	36(61.0)	4.965	3	0.174
31-40	30(54.5)	25(45.5)			
>40	29(50.0)	21(42.0)			
Gender					
Male	48(47.5)	53(52.2)	0.178	1	0.673
Female	50(50.5)	49(49.5)			
Marital status					
Single	31(46.3)	36(53.7)	0.301	1	0.583
Married	67(50.4)	66(49.6)			
Occupation					
Unemployed	7(63.6)	4(36.4)			
Civil servant	20(32.8)	41(67.2)	9.983	3	0.019
Self employed	49(57.6)	36(42.4)			
Student	22(51.2)	21(48.8)			
Educational level					
No formal education	19(65.5)	10(34.5)			
Primary	20(47.6)	22(52.4)	7.502	3	0.057
Secondary	32(55.2)	26(44.8)			
Tertiary	27(38.0)	44(62.0)			

*****_Percentages in parentheses and numbers in front_

Table 4.13 Multivariable logistic regression analysis of demographic variables and categorized practice scores of dog owners in Wukari, Taraba State, Nigeria.

	Categorized scores N=200				
Variables	**Poor Practice**	**Good Practice**	**Crude odds ratio (95% CI)**	**Adjusted odds ratio (95% CI) Poor**	**Adjusted odds ratio (95% CI) Good**
Age (years)					
<19	16(44.4)	20(55.6)	0.57(0.24-1.38)	0.12(0.03-0.48)	8.09(2.11-31.07)
20-30	23(39.0)	36(61.0)	0.46(0.21-0.99)	0.19(0.08-0.50)	5.15(1.99-13.31)
31-40	30(54.5)	25(45.5)	0.87(0.40-1.88)	0.68(0.30-1.57)	1.47(0.64-3.37)
>40	29(50.0)	21(42.0)	1	1	1
Gender					
Male	48(47.5)	53(52.2)	0.89(0.51-1.55)		
Female	50(50.5)	49(49.5)	1		
Marital status					
Single	31(46.3)	36(53.7)	0.85(0.47-1.53)		
Married	67(50.4)	66(49.6)	1		
Occupation					
Unemployed	7(63.6)	4(36.4)	1.67(0.43-6.55)	1.08(0.23-5.05)	0.92(0.20-4.31)
Civil servant	20(32.8)	41(67.2)	0.47(0.21-1.04)	0.10(0.03-0.36)	9.83(2.77-34.95)
Self employed	49(57.6)	36(42.4)	1.30(0.62-2.70)	0.41(0.14-1.24)	2.42(0.06-7.28)
Student	22(51.2)	21(48.8)	1	1	1
Educational level					
No formal	19(65.5)	10(34.5)	3.09(1.25-7.64)		
education	20(47.6)	22(52.4)	1.48(0.68-3.21)		
Primary	32(55.2)	26(44.8)	2.01(0.99-4.06)		
Secondary	27(38.0)	44(62.0)	1		
Tertiary					

***Percentages in parentheses and numbers in front*

4.3 Detection of Rabies Antigen in Slaughtered dogs by Direct Fluorescent Antibody (DFA) Technique

The results showed that a total of 15(7.98%) were positive for rabies antigen. The rate of infection was higher in younger dogs 9(4.79%) than in older dogs 6(3.19%). Also, male dogs had higher infection rate 9(4.79%) than the female dogs 6 (3.19%) (Table 4.14).

Table 4.14. Sex and age distribution of dogs slaughtered for human consumption in Wukari whose brain tissue samples tested positive for rabies antigen.

Gender	Age*		No. Tested (%)	No. Positive Sex specific rates (%)
	1-24months	>24months		
Male	4/32	5/88	120(63.83)	9(4.79)
Female	5/25	1/43	68(36.17)	6(3.19)
Total (%)	**9/57**	**6/131**	**188(100)**	**15(7.98)**

Age Number positive/Number tested*

CHAPTER FIVE

DISCUSSION

Hospital records on suspected cases of rabies for the period under review in the study area were unavailable. But from previous years, the records showed that in November 1993, twomsuspected cases of rabies were reported in adult dogs that were said to have been vaccinated 9 months prior to the onset of the disease. Also in the months of May and June 2001, two and eleven suspected cases of rabies respectively were reported in the State Veterinary Hospital Wukari, Taraba State. These cases were confirmed by the Rabies Laboratory in National Veterinary Research Institute Vom. This indicated the presence of the disease in this region, but poor reporting and record keeping make studying of the disease over a period difficult.

In this study, the vaccination profile indicates that local dogs have higher vaccination coverage (81.6%) than exotic and other breeds of dogs in the study area. This can be attributed to the high population of local dogs in the area compared to exotic and other breeds which are more expensive to acquire and maintain. This is in agreement with the study carried out by Isek (2013), but differs from previous study carried out by Awoyomi *et al*.,(2007), which says that local breeds stand a higher chance of being unvaccinated compared to exotic breeds. Dogs within the age group of 3-12 months had the highest vaccination coverage (58.9%), compared to older dogs of the age group >12-36 months and >36 months. This agrees with previous work by Isek (2013) which states that the high vaccination rate in these young dogs may be connected to frequent advice to dog owners to vaccinate their dogs from 3 months of age and above. Studies have also shown that inclusion of puppies in rabies vaccination campaign is likely to result in substantial epidemiological and economic benefits (Cleaveland, 1998). Younger dogs less than 6

months are very important in transmission or rabies to humans and are more likely to be accessible for parenteral vaccination than older dogs (Mitmoonpitak *et al.*, 1998). From the results in this study, more male dogs (52.2%) were vaccinated than female dogs (47.8%), this shows that sex of the dog may affect vaccination coverage in the study area. This observation is in agreement with previous study by Isek (2013). This may be due the preference of acquiring male dogs by owner solely for security. The increase in number of dogs vaccinated in recent years (2009-2012) in this study may be as a result of increased awareness of dog owners on the need to vaccinate their dogs and the possible dangers of rabies to humans and animals. Observation made in this study using monthly seasonal variation showed a peak in dog vaccination around the month of March and increase in vaccination exercise occurring within the dry season. This agrees with the findings in studies carried out by Owai (2009), Umoh and Belino (1979) and Tomori (1980) who reported that most outbreaks of rabies occur in the dry season which coincides with the breeding season of dogs in most parts of Nigeria. Presence of these outbreaks could stimulate dog owners to vaccinate their dogs against rabies during this period.

Dog owners in this study showed an acceptable level of knowledge on mode of transmission of rabies, clinical signs of the disease and effects of licensing and registration of dogs, but had poor knowledge of age of first vaccination of dogs, with a mean knowledge score of 14.3. Most of the respondents did not agree that dog meat processors were at risk of being exposed to the disease. There was statistically significant association between occupation, educational level and level of knowledge of respondents, with civil servants and those with secondary and tertiary education having higher knowledge scores. This may be because they are more enlightened educationally than those in other occupational categories and is in agreement with study done by Isek (2013).

Age of respondents also had an effect on the level of knowledge. Dog owners within the age group 20-30 were more likely to have poor knowledge of the disease than older respondents. Knowledge increased with increase in age of the respondents, this is unconnected with increased awareness of the disease with age.

Respondents' attitude of not playing with unknown sick dogs, not allowing stray dogs to roam freely in their compounds, seeking medical assistance if bitten by a dog and not allowing children play with dogs are good signs of the people's involvement in the control of rabies. Positive attitude of respondents towards the control of rabies increased with age. Occupation and educational qualification of dog owners also had statistical significant association with their attitude, with civil servant and respondents with tertiary education having higher attitude scores. This may be because they are more exposed and have better knowledge of the disease.

Practices of good vaccination of dogs, advising dog handlers to wear protective clothing (such as hand gloves, coveralls and protective boots) and take human anti-rabies vaccine and washing of dog bite wounds with soap and water are also indicators that the community is involved in the control of the disease. Poor practices of seeking traditional medicine and non-washing of dog bite wounds go against the WHO recommendation of instituting medical treatment on victims of dog bite. These negative practices may be as a result of inadequate awareness of the possible dangers of rabies. Individuals involved in the handling and processing of dog meat are constantly being exposed to rabies virus through bites from dogs, cuts or wounds that are not well protected from infective tissue or saliva of these dogs, thereby constituting a great risk of rabies exposure.

Presence of antigens to rabies in brain of dogs slaughtered for human consumption is very significant in the epidemiology of the disease. This means that dog meat processors and handlers are at risk of being exposed to rabies either from bites from dogs before slaughter or by coming in contact with infective tissue or saliva. This agrees with previous studies carried out in different locations in Nigeria (Sabo *et al*., 2008; Garba *et al*., 2008; Akombo, 2009; Aliyu *et al*., 2010; Isek, 2013). This study shows that more male dogs and younger dogs (1-24months) were positive for rabies than the females and older dogs. This may be because more male dogs were presented for slaughter than female dogs at the time of this study. This disagrees with the study carried out by (Baba, 2006; Aliyu *et al*., 2010; Isek (2013), which showed that more adult dogs tested positive for rabies antigen compared to younger dogs.

CHAPTER SIX

CONCLUSION AND RECOMMENDATION

6.1 Conclusion

This study was conducted to examine vaccination of dogs by analyzing records of dog anti-rabies vaccination in the State Veterinary Hospital in Wukari, assess knowledge, attitude and practice of dog owners to rabies through structured questionnaires and to check for presence of antigens to rabies in brain tissues of dogs slaughtered for human consumption using the fluorescent antibody technique. Vaccination profile of dogs showed that local breed of dogs (81.6%), dogs within 3-12months of age (58.9%) and male dogs (52.2%) had higher vaccination coverage compared to others. More anti-rabies vaccination of dogs occurred during the dry season than the raining season, with a peak in vaccination in March.

Respondents in this study showed acceptable level of knowledge about rabies. Age, educational status and occupation had a significant effect on the level of knowledge, attitude and practice of respondents. Most of the respondents (86%) did not know the age for first anti-rabies vaccination in dogs; this leaves most dogs that are of eligible for vaccination exposed and vulnerable to disease. Attitude of not nursing unknown sick dogs, keeping stray dogs away from their compounds and seeking medical help if bitten by a dog can help in the control of rabies in this region. The practice of dog handlers towards rabies in the area is not encouraging, as they do not wear protective clothing when handling and processing dogs for human consumption, they do not receive pre or post exposure prophylaxis against rabies and some of the respondents affirmed that they will process and consume mad dogs. These practices go against WHO guide lines for the control and prevention of rabies and can expose them to the disease.

The presence of antigen to rabies virus (7.98%) in brain tissues of dogs slaughtered for human consumption is a clear indication of the presence of rabies virus and plays a significant role in the epidemiology of the disease in the area. Factors such as lack of awareness on availability of human anti-rabies vaccines, cost of these vaccines, non-wearing of protective clothing by dog meat processors, dog bites and exposure of cuts or wounds to saliva and brain tissue during dog meat processing all put dog meat processors at high risk of being exposed to rabies virus during processing.

6.2 Recommendation

From this study, the following recommendations are made:

1. Public enlightenment on the dangers of rabies, its mode of transmission and how it can be controlled and prevented should be instituted, especially among dog meat processors and do owners. Knowledge about rabies, proper pet care practices and responsible dog ownership should be emphasized to dog owners in order to adequately control the disease.

2. Dog bite victims should be encouraged take post exposure treatment, while dog handlers and dog meat processors should be advised to take pre-exposure prophylaxis from qualified medical personnel instead of using traditional medicine to treat dog bite injuries.

3. Mass vaccination campaign against rabies should be carried out to ensure coverage of at least 70-80% of dog population in the area. This can help control and eliminate rabies in dog population in the area.

4. Enforcement of regulations concerning dog registration, licensing, leashing of dogs to manage stray dog population.

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APPENDIX

DEPARTMENT OF PUBLIC HEALTH AND PREVENTIVE MEDICINE
FACULTY OF VETERINARY MEDICINE
AHMADU BELLO UNIVERSITY ZARIA

KNOWLEDGE, ATTITUDE AND PRACTICE OF DOG OWNERS TOWARDS RABIES

INSTRUCTION: Please kindly tick [ ] the following boxes below accordingly. The information obtained will be used strictly for academic purpose only and absolute confidentiality will be ensured.

SECTION A: DEMOGRAPHIC INFORMATION OF RESPONDENT

1. Location(town) _____
2. Age (year) a.<19[ ] b.20-30[ ] c. 31-40[ ] d. >40 [ ]
3. Marital status: a. single [ ] b. married [ ]
4. Sex: a. male [ ] b. female[ ]
5. Occupation: a. unemployed [ ] b. civil servant [ ] c. businessman/woman[ ] d. farmer [ ] e. hunter [ ] f.others _____
6. Tribe a. Jukun [ ] b. Kuteb [ ] c. Tiv [ ] d. Hausa [ ] e. Fulani [ ] f. others _____

7. Qualification: a .no formal education[ ] b. primary[ ] c. secondary [ ] d. tertiary [ ]
8. Religion a. Christian [ ] b. Islam [ ] c. others _____

SECTION B: ASSOCIATION WITH DOGS

9. Do you keep dogs? a.yes [ ] b. no [ ]
10. How many dogs do you own? a. none [ ] b. 1[ ] c.2 [ ] d.3 [ ] e. >3[ ]
11. Why do u keep dogs? a. for companionship [ ] b. for protection [] c. for hunting [ ] d.other reasons……
12. For how long have u been keeping dogs? a.1-5yrs[ ] b. 6-10yrs[ ]
c. 11-15yrs [ ] d. others
13. How are the dogs in your premises housed? a. specially constructed house/cage [ ] b. on house passage way/corridor[ ] c. any were on the premises [ ]
14. How do you control your dog(s) movement? a. never allowed to leave the premise [ ] b. allowed to roam freely in the neighborhood[ ]
15. Have you ever been bitten by a dog? a. yes [ ] b. no [ ]

SECTION C: KNOWLEDGE

16. Have you heard of rabies before? A. yes [ ] b no [ ]
17. Rabies kills only animals a. yes[ ] b. no [ ] c. don't know[ ]
18. The virus that cause rabies is found in the nerves a. yes [ ] b. no [ ] c. no idea [ ]
19. Rabies can be spread through the saliva of a rabid animal a. yes [ ] b. no [ ] c. don't know [ ]
20. All dogs can be infected with rabies and can transmit the disease as well a. yes [ ] b. no [ ] c. no idea [ ]
21. Dogs are the possible common source of rabies virus in Nigeria a. yes [ ] b. no [ ] c. no idea [ ]
22. If a dog bites you with out provocation, it is likely to be a rabid dog a yes [ ] b. no [ ] c. no idea [ ]
23. All human beings can be infected with rabies. a. yes [ ] b. no[]
24. Bite from an infected animal can not spread rabies to other animals a. yes [ ] b. no [ ] c. no idea[ ]
25. At what age should dogs receive the first dose of rabies vaccination? a. 9 months [ ] b. 3 months [ ] c. don't know [ ]
26. Those involved in slaughtering and processing of dog meat for human consumption are at more risk of becoming infected with rabies virus a. yes [ ] b. no [ ] c. don't know [ ]
27. An infected human being can transmit rabies to another a. yes [ ] b. no [ ] c. don't know [ ]
28. A mad dog should not be slaughtered for human consumption a. yes [ ] b. no [ ] c. don't know [ ]
29. A friendly dog that suddenly turns aggressive may have rabies a. yes [ ] b. no [ ] c. no idea [ ]
30. A man/woman that has rabies may not like to drink water a. yes [ ] b. no [ ] c. don't know [ ]
31. Excessive foamy salivation and tendency to bite anything are not signs of rabies in dogs a. yes [ ] b. no [ ] c. no idea [ ]
32. It is right to vaccinate my dog(s) against rabies. a. yes [ ] b. no[ ] c. no idea [ ]
33. Dog registration and licensing helps in control of rabies. a. yes [ ] b. no [ ] c. don't know [ ]

34. Vaccination of dogs against rabies should be repeated every year a. yes [ ] b. no [ ] c. don't know [ ]
35. Rabies is transmitted through a. Hand shaking [ ]b. dog bite[ ]
36. What is rabies is called in your tribe? _____
37. Can contact with a sick dog (mad dog) cause danger to your health? a. yes [ ] b. no[ ]

SECTION D: ATTITUDE

38. Is it good to nurse an unknown sick dog? a. yes[ ] b. no [ ] c. undecided [ ]
39. I do not allow stray dogs to roam freely into my compound a. yes [ ] b. no [ ] c. undecided [ ]
40. If I am bitten by a dog, I would go to the hospital a. yes [ ] b. no [ ]
41. Is it good to let dogs roam to get food, because it makes them grow stronger a. yes[ ] b. no [ ] c. undecided [ ]
42. Children should be allowed to play with dogs a. yes[ ] b. no[ ]
43. It is inhumane/ bad to confine your dogs a. yes [ ] b. no [ ] c. undecided [ ]
44. I do not play with unknown dogs a. yes [ ] b. no[ ] c. undecided [ ]
45. Keeping dogs that are not vaccinated against rabies is dangerous and should be avoided a. yes[ ] b. no[ ] c. undecided[ ]
46. It is right to vaccinate my dog for rabies a. yes[ ] b. no[ ] c. no idea[ ]

SECTION E: PRACTICE

47. It is good to vaccinate your dog against rabies a. yes[ ] b. no[ ]
48. Dog handlers should always wear protective clothing a. yes[ ] b. no [ ] c. undecided [ ]
49. It is good to wash dog bite wounds with soap and water a. yes [ ] b. no [ ]c. undecided[ ]
50. Dog handlers should receive human anti rabies vaccine a. yes[ ] b. no[ ] c. undecided[ ]