EPIDEMIOLOGICAL STUDIES OF CANINE RABIES IN OGOJA, CROSS RIVER STATE, NIGERIA

BY

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DECLARATION

I declare that the work presented in this thesis titled **'Epidemiological Studies of Canine Rabies in Ogoja, Cross River State, Nigeria'** has been performed by me in the Department of Veterinary Public Health and Preventive Medicine under the supervision of Professor J. U. Umoh and Dr. A. A. Dzikwi.

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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CERTIFICATION

This thesis titled "**Epidemiological Studies of Canine Rabies in Ogoja, Cross River State, Nigeria** " by **ISEK THOMAS IGUT** 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 Almighty God who gave me the inspiration and grace to accomplish it.

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My special thanks go to Almighty God for His abundant grace, love and guidance throughout the period of my study in this University. I give him all the glory.

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ABSTRACT

Rabies is a viral zoonotic disease which affects both humans and animals. It is worldwide in distribution and its control remains a public health challenge. There is paucity of information on the epidemiology and public health significance of canine rabies in Ogoja, hence the need for a study of canine rabies and its associated public health implications in the area. A descriptive and cross sectional study was set up to examine factors associated with dog bites and vaccination of dogs, to assess knowledge, attitude and practice of processors and consumers of dog meat through structured questionnaires. The study also checked for the presence of rabies antigen in the brain tissues of dogs slaughtered for human consumption and educates processors and consumers of dog meat on the dangers of rabies. Information was obtained from the State Veterinary Hospital, Ogoja on dog bites and dog vaccination records covering a period of 11 years (2001-2011). Out of 183 human dog bite cases, 68(37.2%) were in persons between 10-19 years of age, 95(51.9%) from males and 88(48.1%) from females. Anatomical location of bites indicated higher frequency on lower extremities (65%) than other parts of the body. The highest rate of vaccination in dogs 464(67.5%) was within the ages of 3-12 months. Out of 200 respondents, 109(54.5%) knew the source of rabies in Nigeria, 78(39.5%) were aware that it was unlawful not to vaccinate dogs against rabies, 134(67%) indicated that vaccination of dogs should be repeated yearly, 147(73.5%) knew that keeping dogs that were not vaccinated against rabies were dangerous to human health. Majority of the respondents 116(58%) said dog handlers should be vaccinated against rabies and a significant proportion 128(64%) reported that they would not allow the bite victim to be treated with traditional medicine. The age group >40 years had highest acceptable knowledge (77.5%) scores and practice scores of (75.0%). Also, civil servants had higher acceptable knowledge scores of (65.5%) and practice scores of (74.1%) than

other occupational categories. Respondents with secondary and tertiary education had significantly higher acceptable attitude (81.3%) and practice (77.0%) scores towards rabies than respondents with non-formal and primary education. Rabies antigen was detected in 6(3.4%) out of 177 brain samples examined by fluorescent antibody technique. The findings in this study indicated that frequent dog bites, insufficient vaccination coverage, inadequate knowledge of rabies, poor attitude and practice, and presence of rabies antigen in dogs slaughtered for human consumption were suggestive of high public health risk of rabies to dog meat processors and requires strategic intervention.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND INFORMATION

Rabies is a viral zoonotic disease which is worldwide in distribution and affects both humans and animals. The disease is endemic in the developing countries including Nigeria and other parts of sub-Saharan Africa and Asia (Harry *et al.,* 1984; Enurah *et al.,* 1988; WHO, 2005). It is characterized by acute progressive encephalitis, hydrophobia, excitability and hypersalivation.

Rabies was first documented in Nigeria in humans in 1912 and in dogs in 1925 (Bougler and Hardy,1960) and since then many authors (Umoh and Belino, 1979; Fagbami *et al.,*1981; Harry *et al.,*1984; Okoh, 1986; Enurah *et al.,*1988; Okoh *et al.,*1988; Oboegbulem, 1994; Bello *et al.,* 2007) have established that the disease is endemic in the country with some reports (WHO, 2008; 2010) showing that the prevalence of the disease is on the increase.

The disease is caused by a virus of the family *Rhabdoviridae* and genus *Lyssavirus*, now called lyssa virus 1 (RABV gen 1). It manifests in three clinical stages, prodromal stage, excitatory stage and paralytic or silent stage (Idachaba *et al.,* 2009). Rabies virus causes acute encephalitis in all warm blooded hosts including humans and the outcome is almost always fatal (Nadin-Davies, 2000; WHO, 2010). Although all species of mammals are susceptible to rabies virus infection, only a few species are important as reservoirs for the disease (Garba *et al.,* 2009). The domestic dog is the accepted reservoir for rabies virus (RABV) in Nigeria and the virus is maintained in this host (Dzikwi *et al.*, 2010; WHO, 2010). It is the principal reservoir and transmitter host for rabies to animal and humans (Oboegbulem, 1994; Osinubi *et al.,* 2009).

Rabies occurs in more than 150 countries and territories, and annually over 55,000 people die from this disease worldwide (WHO, 2010). Every year, over 15 million people worldwide receive post-exposure preventive regimen to avert the disease (WHO, 2010) and this is estimated to prevent 327,000 rabies deaths annually. Although all age groups are susceptible, fourty percent of people who are bitten by suspected rabid animals are children between 15-19 years of age (WHO, 2010; Fagbami *et al.,* 1981). Dogs are the source of 99% of human rabies deaths and once symptoms of the disease develops, it is nearly always fatal. The disease affects domestic and wild animals and is spread to people through close contact with infected saliva via bites or scratches (Acha and Szyfres, 1980; CDC, 1983; Fearneyhough, 2001; Bishop *et al.,* 2002; Swanepoel, 2005; WHO, 2010). Non bite exposure by means of abrasions, open wounds or mucous membranes that are exposed to saliva or other infective material (brain tissue, cerebrospinal fluid) may also constitute an exposure (Fearneyhough, 2001). Transmission by inhalation of virus-containing aerosol or transplantation of infected organ have been reported (Srinivasan *et al.,* 2005; Takayama, 2005; CDC, 2007; WHO, 2008). Direct human to human transmission by bite is theoretically possible but has never been confirmed (WHO, 2010).

A case of rabies in an African captive civet cat (*Civetticus civetta*) and domestic cat in Jos, Nigeria has been reported (Enurah *et al.,* 1988). This further confirms the role of cats in the epidemiology of rabies as elucidated in several studies (Acha and Szyfres, 1980; Hanlon and Rupprecht, 1998; Fearneyhough, 2001).

The high incidence of the disease found within the low socio-economic and illiterate group, lack of awareness of the consequences and seriousness of the disease coupled with inadequate

facilities for the post-exposure anti-rabies treatment especially in rural areas have been identified as some risk factors contributing to the high prevalence of the disease (Fagbami *et al.*, 1981; Fearneyhough, 2001; WHO, 2010).

1.2 STATEMENT OF RESEARCH PROBLEM

Although rabies is a vaccine-preventable disease, it still poses a significant public health problem in many countries in Asia and Africa where 95% of human deaths occur even though safe effective vaccines for both human and veterinary use exist (WHO, 2010). Developing countries including Nigeria are considered risk areas for rabies exposure and the vaccination status of the suspected animal alone should not be used or considered whether to initiate post-exposure prophylaxis or not (CDC, 1983; WHO, 2008; 2010) as human deaths have resulted even from bites of dogs reported to have been adequately immunized against rabies. The Centers for Disease Control and Prevention (1983) has reported confirmed deaths of two persons after being exposed to rabies from a dog bite in Nigeria before travelling to the United States and another died in Belgium from rabies acquired from a dog bite received in Africa. It has also been reported by Blyth (2007) that there are cases where pets have developed rabies in compounds or homes where missionaries live in Nigeria, thus further confirming the endemicity of rabies in the country.

Hundreds of people have died of rabies in rural Cambodia as reported by Irin (2011) because dog bite victims have little or no access to rabies treatment and the rural poor often cannot afford lengthy and expensive visits to a health facility to receive post exposure treatment for rabies.

The presence of rabies antigen in the saliva and brain tissues of apparently healthy dogs slaughtered for human consumption in some parts of Nigeria and the obvious consequences of bites from these healthy dogs have been reported (Baba, 2006; Garba, 2007; Garba *et al.,* 2008 and Aliyu *et al.,* 2010). Dogs are usually slaughtered for human consumption in some parts of Ogoja, thus there is a risk of exposure to rabies.

A survey of hospital records of human rabies and anti-rabies prophylaxis in Nigeria between 1969-1978 revealed that 99% of the rabies cases were associated with dog bites, one by a cat and one by a monkey in captivity (Fagbami *et al.,* 1981). Evidence of cases of rabies have been confirmed and reported in Calabar (Owai, 2009). In a rural community (Okoyong) in Cross River State, the prevalence of dog bites have been reported (Asuquo *et al.,* 2005). The situation may apply to other rural communities in the study area as there is increase in dog bite cases reported to the veterinary clinic in Ogoja.

Reliable data on rabies are scarce in many parts of the world, making it difficult to assess its full impact on humans and animal health (WHO, 2006). 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). Dog meat is regarded as a special delicacy and is consumed by some communities in Nigeria, thus constituting a public health risk as these dog handlers and butchers are frequently exposed to rabies virus (Ajayi *et al.,* 2006). Risky behaviours such as not wearing personal protective coverings during handling and processing of dog meat have been observed among dog meat processors in Ogoja.

1.3 JUSTIFICATION OF THE STUDY

A survey by Fagbami *et al.* (1981) recorded 169 cases of human rabies from 38 hospitals and five states epidemiological units in Nigeria over a 10-year period (1969–1978). The prevalence of rabies and dog bite cases have been reported in Cross River State (Owai, 2009; Asuquo *et al.*, 2005). Indeed rabies infection in both human and animals are under-reported (WHO, 2006) and the status of canine rabies is still unknown. There is dearth of information on the epidemiology and public health significance of canine rabies in Ogoja, the study area. Diagnosis of human rabies in hospitals is mostly based on expression of specific symptoms by patients who are exposed to rabid dogs as there are no diagnostic tests carried out, thus making the disease to be misdiagnosed. Low anti-rabies vaccination tendency builds up susceptible dog populations and favours large-scale epizootic or focal outbreaks with an increase of rabies risk to veterinarians and their assistants, dog owners and their family members as well as the general public (Adeyemi *et al.,* 2005).

Several reports and studies (Ajayi *et al.*, 2006; Garba *et al.*, 2008; Sabo *et al.*, 2008; Akombo, 2009) have documented the prevalence of rabies antigens in the brain tissues of apparently healthy dogs slaughtered for human consumption in some parts of the country. Idachaba *et al.* (2009) had also reported positive results for rabies in Plateau State, thus confirming the presence of the disease and its health risk to the general public.

From personal observations in the State Veterinary Hospital, Ogoja, dog bite cases are a frequent occurrence, hence the need for a study on canine rabies and its associated public health implications in the area. The detection of rabies antigen in slaughtered dogs will give

information on the possible role of these dogs in the epidemiology and spread of rabies in the area.

The information on canine rabies status will serve as an epidemiological tool and a basis for successful control and prevention or intervention strategy towards the disease. According to Widdowson *et al.* (2002), controlling rabies in urban dog populations is seen as a more cost effective, long term approach to prevent human rabies than reliance on post-exposure human treatment. To achieve this control, knowledge of the epidemiology of rabies in dog population is crucial (Widdowson *et al.,* 2002). Knowledge of risk factors for canine rabies in urban settings is needed to assess the danger to public health.

1.4 THEORETICAL FRAMEWORK

Dog bites constitutes the primary mode of rabies transmission to humans which allows the passage of virus-containing saliva across the broken skin (Fearneyhough, 2001). Dogs are the main reservoir hosts of rabies and source of infection to humans.

Vaccination against rabies virus is a highly effective method of preventing rabies in humans and animals (Jakel *et al.*, 2008). Dog rabies control relies principally on the mass vaccination of dogs in order to achieve herd immunity levels sufficient to inhibit rabies transmission (Perry and Wandeler, 1993) and also provides the most cost- effective and efficient strategy for controlling canine rabies (Clifton, 2007). Free roaming and unvaccinated dog population may increase the likelihood of spread of rabies virus (RABV).

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 dog management practices and irresponsible ownership attitude or practice are possible factors that could contribute to the epidemiology of rabies in Ogoja.

The Direct Fluorescent Antibody (DFA) test is the gold standard for rabies diagnosis (CDC, 2011). This is based on 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 ultra violet light as described by Dean *et al.* (1996). Apple green fluorescence indicates the presence of rabies.

Detection of rabies antigen indicates presence of the virus which is a significant factor in transmission of rabies from slaughtered dogs to the processors and/or consumers. The occurrence of a disease in a population is influenced by some determinants or risk factors 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 had been reported to play a significant role in the epidemiology of rabies (Widdowson *et al.*, 2002; Owai, 2009).

Therefore, the assessment of frequency of dog bites and vaccination of dogs, knowledge, attitude and practice (KAP) of processors and consumers of dog meat, detection of rabies antigen in dogs slaughtered for human consumption coupled with health education of the people all tied together will be useful in elucidating the epidemiology of rabies, and could achieve effective preventive and control strategy against rabies transmission in the study area.

1.5 AIM AND OBJECTIVES OF THE STUDY

1.5.1 Aim: To study the epidemiology of canine rabies and assess the knowledge, attitude and practice of processors and consumers of dog meat in Ogoja Local Government Area, Cross River State.

1.5.2 Specific Objectives

The objectives of this study are:

1. To analyse factors associated with dog bites such as age, sex and season.
2. To analyse the rabies vaccination records based on age, sex and breed of dogs vaccinated.
3. To assess the knowledge, attitude and practice of processors and consumers of dog meat towards rabies in the study area.
4. To detect the presence of rabies antigen in the brain tissues of dogs slaughtered for human consumption.
5. To educate processors and consumers of dog meat on the dangers of rabies.

1.6 RESEARCH QUESTIONS

i. What is the distribution of dog bites by age and sex of persons and season of the year in the study area?

ii. What is the distribution of rabies vaccination with respect to age, sex and breed of dogs vaccinated?

iii. What are the levels of knowledge, attitude and practice of processors and consumers of dog meat about rabies in the study area?

iv. What is the prevalence of rabies antigen among slaughtered dogs in Ogoja?

v. What are the risk factors associated with rabies disease amongst the high risk groups in the area.

CHAPTER 2

LITERATURE REVIEW

2.1 AETIOLOGY

The causative agent of rabies is a member of the *Lyssavirus* genus of the *Rhabdoviridae* family of bullet-shaped viruses, which have a single-stranded RNA genome. 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 (genotypes 5 and 6), and the recently discovered Australian bat genotype 7 (Bishop *et al*., 2005; Swanepoel, 2005). Other genotypes include Irkut virus (IRKV), Aravan virus (ARAV), Khujand virus (KHUV) and West Caucasian bat virus (WCBV) (Kuzmin *et al.*, 2010). The virion averages 180 nm in length and measures 75 nm in diameter. Each particle contains a helicoid nucleocapsid with a bilayered lipid envelope. Glycoprotein spikes project from the surface of the envelope. Of the five proteins that have been identified, two are of special interest: the RNA nucleoprotein (N), which is a group specific antigen, and the glycoprotein (G) contained in the spikes projecting from the surface of the virion, which is responsible for inducing the production of neutralizing antibodies (Acha and Szyfres, 1980).

2.2 PATHOGENESIS

When the rabies virus is innoculated subcutaneously or intramuscularly, as happens in nature with a bite, it spreads along peripheral nerves from the site of innoculation to the central nervous system. Once the infection is established in the central nervous system, the virus spreads centrifugally to the salivary glands and other organs and tissues via peripheral nerves just as it had earlier traveled centripetally (Bishop *et al.*, 2005). Much higher viral titers have been found

in the salivary glands than in the brain, and high titers have also been seen in the lungs. These observations would indicate that the agent can reproduce outside the central nervous system. The virus has been isolated or detected in a number of different organs and tissues, such as the supra-renal glands, brown fat (interscapular gland) of bats, kidneys, bladder, ovaries, testicles, sebaceous glands, germinal cells of hair follicles, cornea, tongue papillae, and intestinal wall (Acha and Szyfres, 1980). Although distribution of the virus is not uniform and the frequency of infection observed in different organs is variable, it is important to point out that whenever the virus is isolated from the salivary glands it will also be found in the central nervous system. The finding of virus in saliva is of special epidemiologic interest because the bite is the principal means by which the infection is transmitted. In most cases, shedding of the virus in saliva starts with the onset of disease, but in many animal species the agent's appearance in saliva has been confirmed before the development of clinical symptoms. Thus, for example, in dogs it has been possible to detect the virus 1 to 3 days and even as long as 14 days before symptoms appeared (Fekadu *et al.*, 1982).

2.3 TRANSMISSION AND EPIDEMIOLOGY

The animal hosts that maintain rabies virus in nature are carnivores and bats. Herbivores and other nonbiting animals, rodents, and lagomorphs do not play any role in the epidemiology of the disease. The dog is the main vector of urban rabies. Approximately 90% of all human cases of rabies in the world are attributed to rabid dogs (WHO, 2010). The infection is transmitted from one dog to another and from dog to man and domestic animals via bites (Ezeokoli and Umoh, 1987). Despite the fatal outcome of the disease, rabies is maintained in urban areas by the presence of a significant proportion of susceptible dogs. The high density of dogs and their high

rate of annual reproduction are important factors in the canine rabies epizootics in many parts of the world (Acha and Szyfres, 1980). Another important factor in maintenance of the virus is the long incubation period of the disease in some dogs: on several occasions it has been demonstrated that the virus appears in saliva 2, 3, and even as long as 13 days before onset of the disease and that the agent may continue to be shed by this route until the animal dies (Acha and Szyfres, 1980). However, not all rabid dogs shed the virus through saliva, and hence some bites are not infectious. It is estimated that 60% to 75% of all rabid dogs shed the virus in saliva, and the viraemia may range from scarcely a trace to very high titers (Fishbein and Robinson, 1993). Obviously, the risk of the virus being transmitted to man by a bite or through an abrasion is greater when the viral dose being shed is higher. Likewise, the risk of contracting the infection increases when the bite is on the face, neck, or hands and the risk diminishes when it is on the trunk or lower extremities. Many minor bites or scratches fail to introduce enough viruses to cause disease, especially if the wound is inflicted through clothing (Fishbein and Robinson, 1993). Transmission can also occur when an infectious material (usually saliva or brain tissue) comes into direct contact with human mucosa or fresh skin wounds. Human-to- human transmission by bite is theoretically possible but has never been confirmed (Takayama, 2005; WHO, 2010).

Rabies is an ongoing scourge exacting an unnecessarily large toll on human life. It is estimated to cause 30,000 deaths each year in India alone, while the World Health Organization estimates that between 35,000 and 50,000 rabies deaths occur worldwide annually (WHO, 1998; Haupt, 1999). Rabies remains endemic throughout the world except for certain Western European countries and a number of islands, but more than 99 % of all human rabies deaths occur in the

poorest developing countries (Warrel and Warrel, 1988). Reasons underlying the preponderance of rabies cases in poor countries are complex, but include competing needs and limited resources for veterinary control, the prohibitive cost of post-exposure vaccine and immunoglobulin, inadequately trained health and veterinary staff, and inaccessibility of health-care facilities (Metzer and Rupprecht, 1998). Of considerable concern is the re-emerging status of rabies in Africa (Cleaveland, 1998). This trend has been attributed to rapid population growth with parallel dog population growth directed by security concerns, mobility of human populations particularly political refugees, high rates of urbanisation and a disintegration of veterinary rabies control (Brooks, 1990). Rabies viruses are well adapted to persist in large populations of species with high intrinsic growth rates, that are capable of recovering rapidly after an epizootic wave has reduced population density to a level at which the reproductive rate of the disease falls below one (Wandeler, 2004). Despite being a highly fatal disease, which might 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 incubations, allowing the virus to persist in a population temporally. Hosts which are not accustomed to biting other animals, such as man, are dead end hosts (Mantovani and Marabelli, 2004).

An understanding of the importance of the virus-host-environment relationship is crucial to understanding the complex epidemiology of animal rabies (Seghaier *et al*, 1999). With recent developments in monoclonal antibody technology and gene sequencing, it is possible to demonstrate that distinct variants of rabies viruses (Lyssavirus type 1) have become adapted to specific hosts. Dog rabies is almost exclusively endemic in developing countries where control measures are difficult to apply and education of the public is complicated by competing

priorities. Dog rabies has often erroneously been referred to as "urban" rabies but the disease is clearly a rural problem in many parts of Africa. The term "urban" may have originated with the belief that urban domestic dogs maintained a rabies cycle that originated from sylvatic mongoose rabies spreading to dogs in South Africa (Seghaier *et al.*, 1999). But the identification of different rabies variants by means of monoclonal antibody typing and gene sequencing has put this postulate to rest.

2.4 RABIES VACCINATION

Rabies is one of the world's major zoonoses whose control continue to pose global public health challenges. Mass vaccination has been used successfully in Western Europe and North America (Wandeler, 2000; WHO, 2004), illustrating that the disease can be controlled and eliminated by vaccination of reservoir animal populations. Japan, the first country to implement mass vaccination of dogs, successfully eliminated rabies in 1956 (WHO, 1996). Compulsory vaccination and destruction of strays in Malaysia in 1952 brought rabies under control (Wells, 1954), demonstrating that the disease could be controlled even in less developed countries. In Africa, both Zimbabwe (Shone, 1962) and Uganda (Arvo and Kaumba, 1971) reported dramatic declines in canine rabies cases over the 10 years prior to 1961.

In developing countries, the majority of confirmed and reported cases and over 90% of human exposures are from domestic dogs (WHO, 1999). Despite the availability of safe, relatively cheap and effective vaccines for dogs, rabies remains uncontrolled throughout most of Africa and Asia (Cleaveland, 1998; King, 1999; WHO, 2001). The failure of current control programmes may be attributed to insufficient funding compounded by lack of awareness about

the true burden of the disease which has resulted in rabies being perceived as a low priority relative to other health programmes. This may have been exacerbated by the adoption of inappropriate strategies (e.g. dog culling) which highlights the need to develop appropriate and cost-effective strategies.

To qualify as epidemiologically worthwhile, a vaccine delivery strategy needs to be effective in both coverage and cost. Theoretical and empirical analyses indicate that vaccination of 70% of dogs should be sufficient to prevent epidemics and eliminate endemic rabies infection (Coleman and Dye, 1996), but this level of coverage is rarely achieved in dog vaccination programmes in Africa (Perry *et al.*, 1995; Kitala *et al.*, 2002) and indeed Nigeria. Dog accessibility for parenteral vaccination, hence coverage levels and cost per dog vaccinated, vary in different settings. Accessibility of domestic dogs for parenteral vaccination is likely to be affected by various socio-economic, cultural and spatial factors and dog characteristics (i.e. age and degree of restriction), which need to be accounted for in the design of control strategies (Kaare *et al*., 2009). In the case of domestic dog vaccination, socio-economic and cultural factors are likely to influence dog–human relationships and community awareness of and attitudes towards rabies. In some situations in Africa, attitudes towards dogs (e.g. religious and cultural beliefs) can compromise dog vaccination programmes (Kaare *et al*., 2009).

Theoretical and empirical studies have shown that inclusion of pups in rabies vaccination campaigns is likely to result in substantial epidemiological and economic benefits (Cleaveland, 1996; Coleman, 1999). Dogs less than 6 months old are significantly important in rabies transmission to humans (Mitmoonpitak *et al*., 1998) and more likely to be accessible for parenteral vaccination than older dogs. However, dog owners are apparently doubtful about the

appropriateness of vaccinating pups, with low vaccination coverage in this age class, despite advertising efforts. Of all age classes, pups suffer highest mortality, sometimes exceeding 50% (Coleman, 1999; Kitala *et al.*, 1993). Consequently vaccinating pups would result in some vaccine wastage and there is a potential danger that pup deaths could erroneously be linked to vaccination, which could generate hostility towards future campaigns. Nonetheless, the active inclusion of pups in rabies vaccination programmes would be the single most effective way to improve coverage levels (Kaare *et al*., 2009). Improving education efforts to encourage owners to bring puppies for vaccination should therefore be considered. According to Kaare *et al.* (2009), one of the critical factors for the sustainability of vaccinations programmes is their affordability by developing country governments. For rabies, the question of the frequency of vaccination campaigns to maintain critical coverage levels required to prevent rabies outbreaks and eliminate endemic infections is likely to be paramount. Vaccination in already infected animals does not significantly alter the clinical picture or development time of the disease (Fooks and McElhinney, 2000). This is in contrast to prompt post-exposure prophylaxis in man, which is effective after natural infection. It is possible that an animal infected before vaccination would continue to incubate the disease despite developing a high antibody titre (Fooks and McElhinney, 2000).

2.5 DOG BITES

Rabies remains a significant public health problem in many countries, causing approximately 50,000 to 100,000 human deaths per year worldwide, almost exclusively in Asia and Africa (WHO, 2006). More than 99.9% of human deaths reported worldwide result from the bite of a rabid dog, and 30-50% of them concern children less than 15 years of age (WHO, 2006). Rabies

is maintained in nature by several domestic and wild animals, including dogs, foxes, mongooses, raccoons, skunks, and many bat species. Although the main route of transmission is through the bites of rabid dogs, the epidemiology of the disease varies from one region or country to another and therefore all animal bites warrant medical evaluation (CDC, 2011; WHO, 2008).

Many dogs are not properly cared for, are unvaccinated against rabies and are allowed to roam freely (Adaba *et al.*, 2004), leading to frequent dog bites and potential exposure to the disease. Presently, rabies is endemic in the canine population in the country and poses a serious threat to public health. It is estimated that about 10,000 persons are exposed to rabies each year in Nigeria from dog bites (Okoh, 2007). Socio-economic factors influence the distribution of rabies cases, with people who are poor, less well educated and those living far from treatment centres least able to access prompt and appropriate post exposure prophylaxis. Children of less than 16 years of age are the major victims of dog rabies, as they are more often bitten by dogs than adults and, when bitten, are frequently bitten on the head and neck, sites which carry a much higher risk than bites to other parts of the body (Cleaveland *et al.,* 2002; Fevre *et al.,* 2005; Knobel *et al.,* 2005).

Although safe and highly effective cell culture vaccines are available for post exposure prophylaxis (WHO, 2004), the high cost of treatment is resulting in the continued use of cheaper nerve-tissue origin vaccines in parts of Asia, with the attendant risks of severe neurological side effects. First-aid care, such as washing the bite wound with soap and water, can significantly reduce the risk of rabies infection; however, many bite victims do not receive even this simple treatment (Parviz *et al.,* 2004). Aside from the physical trauma, the psychological impacts of

rabid dog bite injuries are not trivial. In many parts of Africa and Asia, the post-exposure prophylaxis given to animal bite victims is deficient by all World Health Organization (WHO) standards (Parviz *et al.,* 2004; Fevre *et al.,* 2005). Access to human rabies post exposure prophylaxis is often undependable, rabies immunoglobulin is unavailable and the provision of a full course of vaccination is not only extremely costly but also logistically demanding. As a result, post exposure prophylaxis is often unreliable and the bite from a suspect rabid dog can cause great distress, with months of anxiety as the individual awaits an uncertain outcome.

2.6 CONSEQUENCES OF DOG BITES

The pattern of rabies in Nigeria still implicates dogs as the principal vector of the disease (Tomori, 1980). Dogs are listed as only moderately susceptible but are without any doubt the animals most likely to spread infection to human beings, while squirrels and other rodents are also susceptible ((Nadin-Davis *et al.,* 2000). In Nigeria, particularly in Maiduguri, a survey of the apparently healthy dogs showed positive results of the rabies virus (Baba, 2006) and in other studies carried out in the Northwestern states of Nigeria, positive results for rabies were also revealed (Garba, 2007). In the USA, Canada, and Western Europe, where canine rabies has been controlled, dogs are responsible for very few cases. Rather, human rabies develops from bites of wild animals (especially bats, squirrels, rats, raccoons, skunks and foxes) or occurs in travelers bitten by dogs elsewhere in the world (Smith, 1995). Between 1980 to 1998, rabies was reported in eleven children in Sokoto, Nigeria (6 males, 5 females, aged 3 to 13 years old) all of whom had history of dog bites but in only 2 cases was post exposure anti-rabies vaccination commenced (Ahmed *et al.*, 2000). The incubation period was between 1-3 months and mortality was 100%. Oboegbulem (1994) cited 6 cases of fatal rabies in children bitten by apparently

healthy dogs. Raghavan (2008) observed that some biting dogs remained healthy even after the children developed clinical rabies and populations of free- roaming owned dogs which are either never or occasionally restrained are largely accountable for dog bites to humans. Similarly, in Vietnam, clinical rabies occurred in 2 out of 10 persons bitten by the same apparently healthy puppy over a period of 26 days. One survey of apparently healthy dogs in Thailand revealed that 4 percent were carriers of rabies virus (Kaplan, 1969).

Dog bites in humans are a serious public health problem and have been well documented worldwide (Overall and Love, 2001; Ozanne-Smith *et al.,* 2001). In the United States, 4.7 million people were estimated to have been bitten by dogs in 1994 (an incidence rate of 16.1/1000 in adults and 24.5/1000 in children), of whom 800,000 required medical treatment (Sacks *et al.,* 1996). Later, a survey conducted during 2001–2003 in the USA estimated 4.5 million dog bites each year (an incidence rate of 16.6/1000 in adults and 13.1/1000 in children), an increase of 3% in adults and a decrease of 47% in children (Gilchrist *et al.*, 2008). There have been similar reports of human victims of dog bites in the United Kingdom (Morgan and Palmer, 2007), in the United Republic of Tanzania (Cleaveland *et al.,* 2002) and in Nigeria (Abubakar and Bakari, 2012). There are also several reports of dog bite incidents from other countries (Bhanganada *et al.,* 1993; Hossain *et al.,* 2011) but most cases are believed to be unreported, especially in developing countries.

The consequences of dog bites to humans are many. Although the most common issue is the direct physical injury, sometimes the injuries may cause permanent disfigurement of the victims requiring reconstructive surgery (Gilchrist *et al.*, 2008), psychological trauma and post-traumatic

stress (Peters *et al.,* 2004; Schalamon *et al.,* 2006). Rarely attacks can be fatal. Dog bites also result in a large monetary expense for treatment, emergency hospitalization and post-exposure treatment for rabies (Sriaroon *et al*., 2006; Daniels *et al.,* 2008). Globally over 15 million people receive rabies prophylaxis annually, mainly for dog bite injuries (WHO, 2010). In addition, dog bite incidents also have direct impacts on the dogs involved in the bites, resulting in their relinquishment to shelters and euthanasia (Schalamon *et al.,* 2006). Legislative action (e.g. Dangerous Dog Acts) have also been implemented in some developed countries to ban specific breeds of dogs because of the issue of increased bite incidents (Jackson, 2005); such legislation does not appear to have been effective in reducing the incidence and severity of the bites. However, the severity of dog bite incidents is striking in developing countries; majority of dog bite victims die from rabies infection. There are an estimated 55,000 human deaths annually, particularly in Asia and Africa, due to endemic canine rabies (Knobel *et al*., 2005). Like other countries, dog bites are common in Nigeria because of the presence of a large number of stray dogs in the streets. Although no cases of directly fatal dog attacks on humans have been documented, deaths due to rabies from dog bites have been reported in south Bhutan (Kuensel, 2011) and recently in Cross River State, Nigeria (personal communication).

Dog bites and the presence of rabies in the south border areas of Bhutan also results in substantial cost to the government (Tenzin *et al*., 2010). In addition, rabies outbreaks also cause a substantial cost to farmers from the deaths of farm animals as a result of spill over infection from dogs (Tenzin *et al*., 2010). Therefore, knowing the consequences of dog bites and the number of human deaths caused by rabies is important for public health planning programs.

One of the approaches to understanding the scale of human deaths due to rabies is the use of decision tree models. This methodology has been developed by Cleaveland *et al.* (2002) using active rabies surveillance data in Tanzania. The model is designed based on a series of probability steps using the distribution of bite injury on different body parts and the probability of developing rabies. More recently this decision tree model has been used by the World Health Organization to estimate human deaths from rabies in Asia and Africa overall. Globally, a total of 55,000 (90% CI: 24,000–93,000) human rabies deaths annually was predicted (Knobel *et al*., 2005). All these studies have provided clear information about the burden of rabies for proper planning program.

2.7 DIAGNOSIS OF RABIES

There are no clinical or gross pathognomonic lesions for the diagnosis of rabies in animals, therefore, confirmation of infection can only be achieved by laboratory techniques (Anon, 2004a). Rapid and reliable laboratory confirmation of rabies using readily available diagnostic assays is vital for the identification and control of disease. Results generated in the laboratory directly influence the decision whether or not to initiate control strategies and/or to continue with a course of treatment. Failure to identify the presence of rabies virus or virus antigen in a specimen by a single test does not necessarily confirm absence of infection (Anon, 2004a). Some assays are more sensitive and specific than others depending on the type of sample, the rabies genotype, and the stage of infection (Anon, 2004b). As a routine, more than one assay system should be employed simultaneously to increase the chance of making a rabies diagnosis and increase confidence in negative results. Rabies lesions, virus and virus antigen are reported to be particularly abundant in the thalamus, pons and medulla. The hippocampus, cerebellum and

various regions of the cerebrum have been reported to be negative in 3.9-11.1% of rabies positive brains (Anon, 2004b). Although the thalamus has been reported to be the most likely positive tissue, a pool of brain tissue including the brainstem should be used for laboratory examination (Bingham and Merwe, 2002). Occasionally, virus antigen or infectious virus can only be detected in the salivary glands. Examination of salivary glands can also provide valuable epidemiological information on the excretion of virus by different vertebrate species (Bingham and Merwe, 2002).

2.7.1 The Fluorescent Antibody Test (FAT)

The FAT as first described by (Goldwasser and Kissling, 1958), and later modified by (Kissling, 1975; Dean *et al.,* 1996) is still the most widely used test for rabies diagnosis. The test, often referred to as the gold standard for rabies diagnosis is recommended by WHO and OIE (Anon, 2005). Interestingly, the results of a survey of different testing laboratories assaying samples with public health implications revealed that a number of divergent modifications were being made to virtually every step of the test (Smith, 1995). Virus antigen can be confirmed directly in brain impressions, composite brain smears, frozen sections and the brains of mice used for virus isolation. Rabies antigen can also be detected in salivary glands (Goldwasser and Kissling, 1959). The inclusion bodies frequently lose their intracellular position in impression smears, so much so that the structures demonstrated by immunofluorescence range from the characteristic Negri bodies to fine particles. Microwave fixation has been used successfully as an alternative to acetone fixation of tissues for examination by immunofluorescence (Davis and Neill, 1997). The FAT is also ideally suited for the confirmation of virus antigen in acetone-fixed cell cultures.

2.8 CONTROL AND PREVENTION

Rabies in domestic and wild animals represents a significant threat to public health and can cause economic losses among livestock. Animal rabies control consists of the vaccination of dogs and cats, the elimination of stray animals, health education for the public, etc. In some countries, mass vaccination of dogs is not implemented, and the effective coverage rate is not exactly known. The elimination of stray dogs and other animals by shooting and poisoning is still implemented in certain countries; however, this has a minimal effect on rabies transmission (Knobel *et al*., 2005). Preventive vaccination against rabies virus is a highly effective method for preventing rabies in humans and animals (Jakel *et al*., 2008). For travel purposes, vaccination of domestic carnivores is obligatory. In addition, some countries require testing for neutralizing antibodies against rabies. The minimal threshold level accepted by WHO/OIE is 0.5 IU/ml. Despite proper vaccination some animals do not reach the threshold (Jakel *et al*., 2008). Despite the availability of effective human and animal vaccines against rabies, and other measures for its control, rabies continues to account for at least 55,000 human deaths each year, mainly in the developing countries of Africa (Knobel *et al.,* 2005). In these countries, most human rabies infections result from exposure to infected dogs, by bites, scratches, and mucosal exposures (Cohen *et al.,* 2007). Rabies vaccination of animals and post exposure prophylaxis (PEP) for humans is prohibitively expensive for most African governments, and it has long been contended that the effects of rabies are underestimated in Africa (Cohen *et al.,* 2007).

In Nigeria where dog bites continue to be the main mode of transmission of the disease to man, it remains a serious public health hazard (Awoyomi *et al*., 2007). Since the dog has been

established as the predominant vector of rabies in Nigeria, the most logical and cost–effective approach to rabies control is elimination of stray and ownerless dogs combined with a programme of mass immunization in the shortest possible time, targeting at least 80% of the entire dog population (Awoyomi *et al*., 2007). Dog rabies control relies principally on the mass immunization of dogs in order to achieve population immunity levels sufficient to inhibit rabies transmission (Perry and Wandeler, 1993). In Nigeria and Africa generally, such high levels of population immunity are rarely achieved due to a number of reasons. Although highly effective if administered correctly, post exposure prophylaxis is much more costly than vaccination of domestic dogs (Rupprecht and Gibbons, 2004; Cohen *et al*., 2007).

2.8.1 Post- Exposure treatment in Man

In man, combined active and passive immunisation shortly after exposure mediates the elimination of virus before it enters the nervous system (Wandeler, 2004). Treatment for the prevention of rabies in humans exposed to rabies should begin as soon as possible after the exposure occurs. Treatment should consist of thorough wound cleansing using soap, water and a virucidal antiseptic (povidone, iodine or ethanol) followed by the administration of rabies passive immunization and cell culture or purified embryonated egg rabies vaccine of proven efficacy (WHO, 2004).

2.8.2 Post- Exposure treatment of Dogs by Vaccination

Vaccination in already infected animals does not significantly alter the clinical picture or development time of the disease (Fooks and McElhinney, 2000). This is in contrast to prompt

post-exposure prophylaxis in man, which is effective after natural infection. It is possible that an animal infected before vaccination would continue to incubate the disease despite developing a high antibody titre (Fooks and McElhinney, 2000).

2.9 KNOWLEDGE, ATTITUDE AND PRACTICE TOWARDS RABIES

People's perception about risk factors, seriousness and fatality of this disease, importance of vaccination and post-exposure prophylaxis and affordability of vaccination is not well known in our society. 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 interventional strategies (Wasay *et al*., 2012).

People have very basic knowledge about anti-rabies treatment getting 14 injections after dog bite, as per the old concept, but not aware of the disease which could occur if they do not manage dog bites. About 0.40 million people continue to receive the sheep brain vaccine despite the fact WHO has recommended for discontinuation (Seghal *et al*., 1994).

There are many myths and false beliefs associated with wound management. These include application of oils, herbs, and red chillies on the wounds inflicted by rabid animals. More faith in indigenous medicines that are of unproven efficacy and not washing the wound properly because of fear that it would get infected had been reported (Sekhon *et al.*, 2002). In order to control the disease, knowledge about rabies, proper and adequate pet care practices and responsible dog ownership should be emphasized to dog owners, especially those in rural areas (Matibag, *et al.,* 2007).

CHAPTER 3

MATERIALS AND METHODS

3.1 STUDY AREA.

This study was carried out in Ogoja Local Government Area of Cross River State. The state is a coastal state in South Eastern Nigeria and is located in the Niger Delta. The State occupies an estimated area of 20,156 Sq Km and lies between latitudes $5^{0}45$N and between longitudes $8^{o}30$E. It shares boundary with Benue State to the North, Enugu and Abia State to the West, Akwa Ibom and the Atlantic Ocean to the South, and Cameroon Republic to the East. The State has a human population of 2,888,966 million and density of 92.6/km (NPC, 2006). Ogoja, the study area is a home to the Faculty of Management Science of the Cross River University of Technology and it is about 40 km from Vandeikya in Benue State. It has a State Veterinary hospital, a General hospital, a Maternity hospital and private clinics, School of Nursing and Midwifery and other primary health care facilities. Dogs are slaughtered mainly in the urban town and some villages in Ogoja. The major languages spoken are Bakor, Ekajuk and Mbube. The predominant occupation of the people is agriculture, commerce and civil service.

3.2 STUDY DESIGN

A descriptive epidemiology was used to evaluate dog bite cases and vaccination records while a cross sectional study was carried out to assess the knowledge, attitude and practice of processors and consumers of dog meat and detection of rabies antigen in the brain of slaughtered dogs.

3.3 INFORMATION ON VACCINATION OF DOGS

Records of vaccination and dog bite cases on humans were analysed to obtain an overview of risk factors for rabies in the state. Information on rabies vaccination status was obtained from the State veterinary clinic located in the study area, Ogoja. The existing vaccination records for a period of eleven years (2001-2011) were evaluated. Records of age, sex, breed and the number of dogs vaccinated were assessed.

The existing records of reported cases of dog bite on humans were obtained from the State veterinary clinic for the same period stated above. The age and sex of dog bite victims, the site of bite and season of occurrence of dog bite was also assessed.

3.4 INFORMATION ON KNOWLEDGE, ATTITUDE AND PRACTICE

A structured questionnaire was prepared and administered to two hundred (200) dog processors and consumers of dog meat within the study area. These persons were found at relaxation places popularly called 'Joints' or places where dog meat is being processed and sold. The questionnaire was validated by pretesting to twenty (20) respondents. The options for the choice questions were "Yes", "No", "Don't know, or "undecided". They were divided into four (4) sections. The demographic information or data of the respondents was contained in Section A. Information about the knowledge of rabies was contained in Section B which included questions about means of transmission of rabies, vaccination, symptoms/clinical signs of rabies, prevention and control. Questions about attitude of respondents towards rabies were provided in Sections C and this included attitudes concerning stray dogs, confined dogs, dog bites, keeping unvaccinated dogs and children playing with dogs. Section D contained questions on practice of respondents towards rabies and this included practice of keeping and handling dogs, dog bite wounds and/or

victims. The questionnaire was explained to illiterate respondents by the researcher and their responses were recorded. The questionnaire was administered only to processors and consumers who were present and willing to participate at the time of the survey.

3.5 SAMPLE SIZE DETERMINATION, COLLECTION AND PROCESSING

3.5.1 Sample Size Determination

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

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

Where n = Sample size

Z= 1.96 standard normal value for desired confidence (normal distribution table)

P= prevalence rate (15.8%) Akombo, 2009

d = desired absolute precision (0.05)

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

3.5.2 Sample Collection

Using the formula by Thrusfield (2007), a total of 205 brain stem samples from slaughtered dogs were collected between August, 2011 and March, 2012 from various slaughter points (relaxation places called 'Joints' where dogs are slaughtered and processed for consumption) within the study area. Information on the source and sex of the dogs presented for slaughtering were obtained. The brain samples were collected by inserting a 5mm drinking straw through the occipital foramen in the direction of an eye according to World Health Organisation recommendation (Barrat, 1996). In this technique, samples can be collected from the base of the cerebellum, hippocampus, cortex and medulla oblongata (Shankar, 2009). Each slaughter point

was visited twice daily (morning and afternoon) and brain samples were collected based on availability. The brain samples obtained were stored in a pre labelled EDTA free bottle containing phosphate buffered 50% glycerol solution. Some specimens were frozen at -20^0C and transported in cold flask containers with ice packs to maintain cold chain. All the samples were transported to the Viral Zoonoses Laboratory of the Department of Veterinary Public Health and Preventive Medicine, Ahmadu Bello University, Zaria for fluorescent antibody test as described by Dean *et al.* (1996).

3.5.3 Fluorescent Antibody Test Procedure:

Rabies direct fluorescent antibody assay (DFA) monoclonal antibody conjugate reagents (Fujirebio Diagnostic Inc. Malvern, P.A 19355, USA) were used and the working reagents dilution prepared according to the manufacturer's recommendation and as described by Flamand *et al.* (1980). A small fraction of the brain sample was smeared on one part of a slide and then air dried and fixed in cold acetone for one hour at -20^{o}C. The slide was then air-dried for 3 minutes and two drops of the rabies conjugate was applied using a micro pipette. The slides were incubated for 30 minutes at 37^{o}C in a humid chamber after which excess conjugate was removed from the slides by rinsing it with PBS (7.4 pH) for about 5 minutes and allowed to air dry. The slides were examined using a fluorescence microscope within 2 hours after staining. The presence of brilliant apple green fluorescence or greenish-yellow objects against a dark background was regarded as positive result for rabies while absence of specific apple green fluorescence was regarded as negative for rabies (Flamand *et al*., 1980).

3.6 PUBLIC HEALTH ACTION

Public health education pamphlets were prepared and distributed to processors and consumers of dog meat. These materials contained information on rabies transmission, prevention and control. Discussions with processors and consumers of dog meat about the danger of the disease, the use of pre- or post- exposure prophylaxis and personal protective clothing during operations were also carried out.

3.7 RESULT ANALYSIS

In this study, data generated were analysed using the Statistical Packages for Social Sciences (SPSS) Version 17.0 to carry out descriptive analysis. Chi-square test was used to test for association between categorical variables. Values of $p < 0.05$ were considered significant.

Data on dog bite were reduced and presented as tables and graphs to show distribution by age, sex and site of bite on the victim. Time series decomposition using ratio to moving average was carried out to reveal seasonal variations of dog bites. Data on vaccination were expressed as tables and graphs to reveal distribution by age, sex, breed and number of dogs vaccinated per year. The levels of knowledge, attitude and practice (KAP) of the respondents were assessed by marking the responses using a marking scheme of correct answers. Scores from KAP were categorized as follows: knowledge: 15-20 (Very good), 10-14 (Good), 5-9 (Fair) and 0-4(Poor). Attitude: 7-9 (Very good), 5-6 (Good), 3-4 (Fair), 0-2 (Poor).Practice: 10-12 (Very good), 7-9 (Good), 4-6 (Fair), 0-3 (Poor). Scores in the category of 'poor and fair' were merged together and regarded as unacceptable while the score for 'good and very good' were also merged together and were regarded as acceptable. Associations of demographic variables with categorized scores were assessed as acceptable and unacceptable using frequencies. The

relationship between knowledge, attitude and practice were assessed using multiple regression analysis with ‘practice’ as a dependent variable.

The rate of rabies antigen detection was calculated as a proportion of the total number of dogs examined.

CHAPTER 4

RESULTS

4.1 HUMAN EXPOSURE

The results of distribution of dog bites by age of persons showed that out of 183 reported cases of dog bite from 2001-2011, 38 (18.0%) were victims above 30 years while 46 (25.1%) were victims between 20-30 years of age, 68(37.2%) and 36(19.7%) represent persons between 10-19 years and less than 10 years of age respectively. Occurrence of dog bite among persons in relation to sex revealed that males had higher frequency 95(51.9%) than females 88(48.1%) [Table 4.1]. The anatomical location of the bite indicated higher frequency on the legs 20 (64.5%) than other parts of the body (hand 29.1%, head 3.2% and back 3.2%) [Fig.4.1]. Seasonal distribution of dog bites indicated that the highest frequency of dog bite cases occurred in the months of October and March peaking in October with 22 (12.0%) followed by January and March with 19 (10.4%) and December had 18 (9.8%) while the least cases of dog bite was in the month of June with 9 (4.9%)[Table 4.2]. Time series decomposition using ratio to moving average method revealed seasonal fluctuations (Fig.4.2). Seasonal changes expressed as seasonal index showed the greatest values during the months of October, January and February. The lowest indices were observed in April.

4.2 VACCINATION OF DOGS

When annual rabies vaccination profile was considered, the results showed that out of 1,562 cases presented during the period of review, 687(43.9%) dogs received anti-rabies vaccination and the highest number of anti-rabies vaccine 114(67.1%) was administered in 2008 (Table 4.3 and Fig.4.3). Local breed had the highest vaccination rate 644 (93.7%) while 24 (3.5%) and

19(2.8%) of the vaccinated dogs were exotic and other breeds respectively [Fig.4.4]. The available records indicated that more male dogs 396(57.6%) were vaccinated than females 291(42.4%). There were statistically significant differences in the mean frequency of dog vaccination between male and female dogs ($t=3.6110$, $df= 10$, $p= 0.0024$) at $P < 0.05$[Table 4.4]. Most of the dogs 464(67.5%) vaccinated were within the ages of 3-12 months followed by 131(19.1%) dogs in the ages of >12- 36 months and 92(13.4%) dogs > 36 months. There was an increase in vaccination of dogs in 2008 and 2009 compared to other years during the period of review (Table 4.5). There were no statistically significant differences among ages of dogs vaccinated.

TABLE 4.1. Distribution of Dog bites in Humans by Age and Sex of Bite victims in Ogoja from 2001- 2011.

YEAR	Age (yrs)				Sex	
	<10	10- 19	20- 30	>30	M	F
2001	1	7	2	1	6	5
2002	4	10	9	6	20	9
2003	5	7	8	5	13	12
2004	5	11	7	6	13	16
2005	1	1	0	2	4	0
2006	3	8	2	2	8	7
2007	8	4	5	3	11	9
2008	0	3	3	1	2	5
2009	5	3	4	0	5	7
2010	3	5	2	4	6	8
2011	1	9	4	3	7	10
TOTAL	36	68	46	33	95	88
%	19.7	37.1	25.1	18.0	51.9	48.1

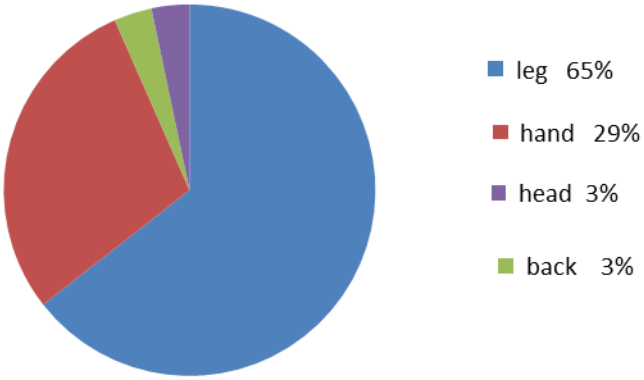


Fig 4.1. Distribution of dog bites by anatomical location on Humans in Ogoja from 2001- 2011.

Table 4.2. Monthly dog bite cases in Humans reported to the Veterinary Hospital, Ogoja from 2001- 2011.

YEAR	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
2001	2	0	1	1	2	0	0	0	1	4	0	0	11
2002	6	2	3	4	0	0	2	2	2	3	3	2	29
2003	1	3	6	2	2	0	0	1	2	6	1	1	25
2004	3	2	4	0	5	1	2	1	4	2	0	5	29
2005	1	2	0	0	1	0	0	0	0	0	0	0	4
2006	1	1	0	0	0	2	3	1	0	1	2	4	15
2007	1	0	4	1	2	0	1	3	2	3	1	2	20
2008	0	2	0	1	1	1	2	0	0	0	0	0	7
2009	0	1	0	0	1	3	1	1	1	1	1	2	12
2010	1	2	0	0	1	2	3	0	1	1	2	1	14
2011	3	1	1	1	0	0	1	2	2	1	4	1	17
Total	19	16	19	10	15	9	15	11	15	22	14	18	183
%	10.4	8.7	10.4	5.5	8.2	4.9	8.2	6.0	8.2	12.0	7.7	9.8	100

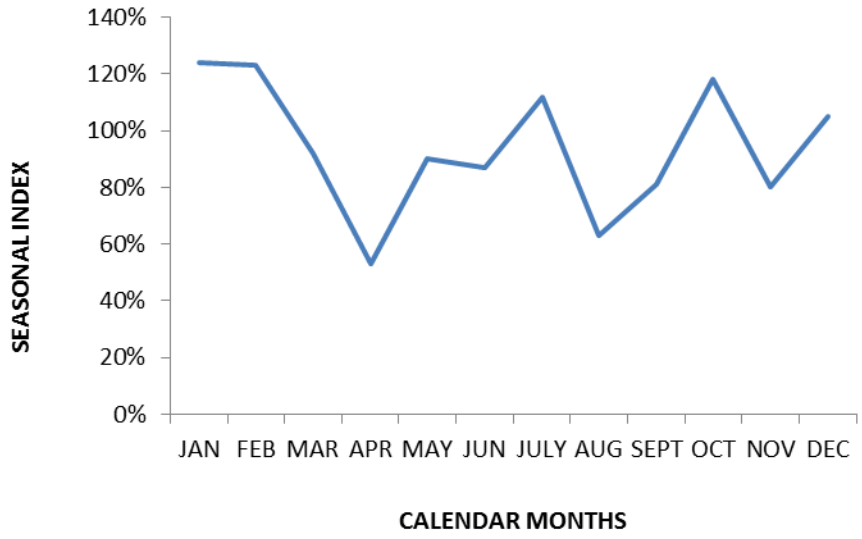


Fig. 4.2. Seasonal index of Monthly dog bite cases in Humans reported to the Veterinary Hospital, Ogoja from 2001- 2011.

TABLE 4.3. Annual Anti-Rabies Vaccination of Dogs in the Veterinary Hospital, Ogoja from 2001- 2011.

YEAR	No. of Cases	No. of ARV	percentage
2001	99	9	9.1
2002	150	45	30
2003	154	67	43.5
2004	145	42	29.0
2005	71	32	45.1
2006	118	51	43.2
2007	161	69	42.9
2008	170	114	67.1
2009	177	103	58.2
2010	144	63	43.8
2011	172	92	53.5
TOTAL	**1562**	**687**	**43.9**

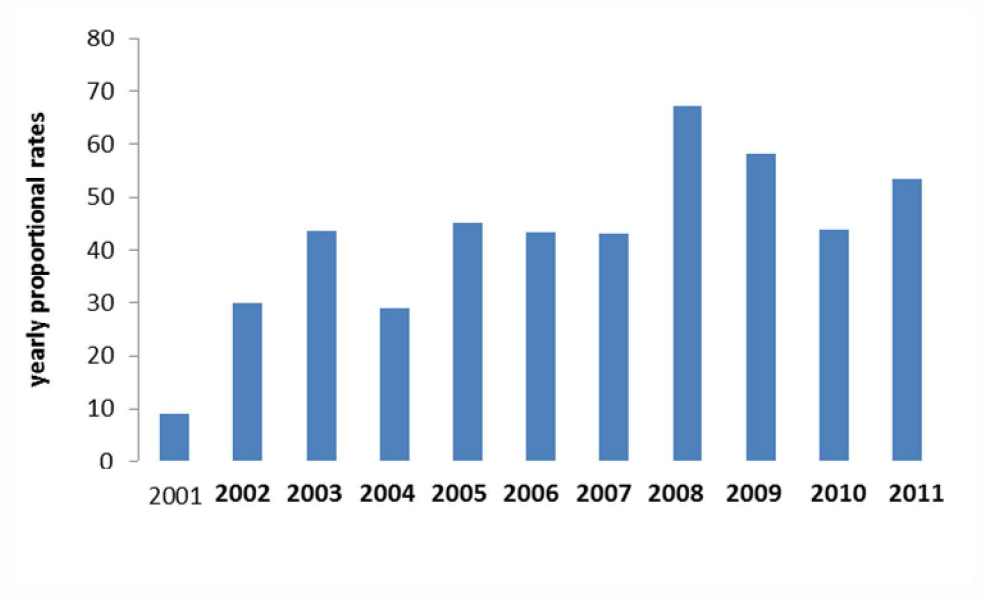


Fig 4.3. Annual distribution of total number of dogs vaccinated in Ogoja from 2001- 2011.

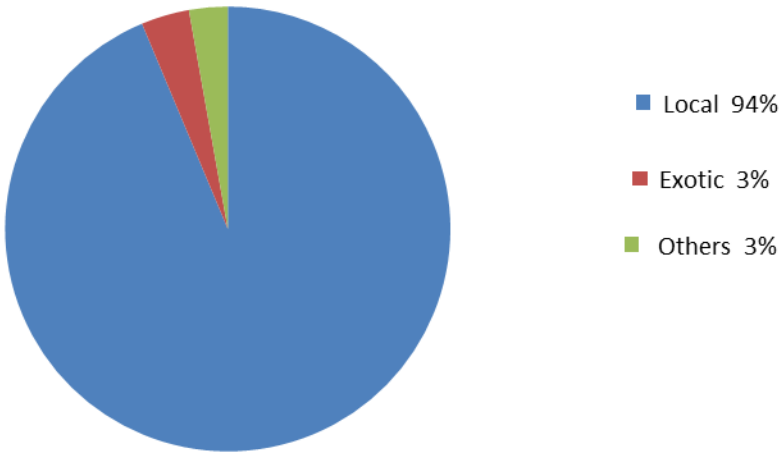


Fig 4.4. Distribution of total number of dogs by breed involved in Vaccination in Ogoja from 2001- 2011.

TABLE 4.4. Distribution by Sex of dogs vaccinated against rabies in the Veterinary Hospital, Ogoja from 2001- 2011.

YEAR	SEX		
	Male	Female	TOTAL
	Frequency (%)	Frequency (%)	Frequency (%)
2001	3 (33.3)	6 (66.7)	9(100)
2002	30 (66.7)	15 (33.3)	45(100)
2003	43 (64.2)	24 (35.8)	67(100)
2004	26 (61.9)	16 (38.1)	42(100)
2005	20 (62.5)	12 (37.5)	32(100)
2006	36 (70.6)	15 (29.4)	51(100)
2007	44 (63.8)	25 (36.2)	69(100)
2008	54 (47.4)	60 (52.6)	114(100)
2009	53 (51.5)	50 (48.5)	103(100)
2010	38 (60.3)	25 (39.7)	63(100)
2011	49 (53.8)	42 (46.2)	91(100)
TOTAL	**396 (57.6)**	**291(42.4)**	**687(100)**

(t= 3.6110, df= 10, p= 0.002)

TABLE 4.5. Age specific distribution of vaccinated dogs in the Veterinary Hospital, Ogoja from 2001- 2011.

YEAR	Age of vaccination In months (%)			TOTAL
	3-12	>12-36	>36	
2001	8 (88.9)	0(0)	1(11.1)	9
2002	25 (55.6)	10(22.2)	10(22.2)	45
2003	45 (67.2)	16 (23.9)	6 (8.9)	67
2004	35(83.3)	4(9.5)	3(7.1)	42
2005	23 (71.9)	5 (15.6)	4 (12.5)	32
2006	33 (64.7)	9(17.6)	9 (17.6)	51
2007	44 (63.8)	21(30.4)	4 (5.8)	69
2008	77 (67.5)	25(21.9)	12(10.5)	114
2009	81 (78.6)	10(9.7)	12(11.7)	103
2010	45(71.4)	11(17.5)	7(11.1)	63
2011	48(52.2)	20(24.4)	24(26.1)	92
TOTAL	**464(67.5)**	**131(19.1)**	**92(13.4)**	**687**

4.3 KNOWLEDGE, ATTITUDE AND PRACTICE

4.3.1 Demographic Characteristics of Respondents

Demographic characteristics of respondents showed that out of the 200 respondents who participated in the study, 144(72%) were males and 56(28%) were females. Respondents of <19 years were 34 (17.0%), 20-30 years 76(38%), 31-40 years 50(25%) and those above 40 years were 40(20%). Differences in the age of respondents was statistically significant (χ^2=13.294, df= 3, P= 0.004). Based on marital status, 88(44%) were singles, 97(48.5%) were married and 10(5.0%) and 5(2.5%) were divorced and widowed respectively. Respondents engaged in various businesses were 53(26.5%), civil servants 58(26%), unemployed 61(30.5%) and farmers were 28(14%). Educational level showed that respondents with non-formal education were 20(10%), primary education were 28(14%) and majority 91(45.5%) had secondary education and tertiary education 61(30.5%). Respondents who reported being previously bitten by a dog were 44(22%). Except for age, there were no significant differences between the distributions of the various categories within each demographic characteristic [Table 4.6].

4.3.2 Knowledge of Respondents towards Rabies

Based on the knowledge about rabies, majority of the respondents 109 (54.5%) said that dogs are possible common source of rabies in Nigeria. Respondents who affirmed that a friendly dog that suddenly turned aggressive might have rabies were 117 (56.5%). Majority of the respondents 142(71.0%) did not know that excessive foamy salivation and tendency to bite anything were signs of rabies in dogs. When asked, if non vaccination of dogs against rabies is against the law, 78(39.0%) of the respondents said yes, while 54(27%) said no and 68(34%) said they don't know. There were statistically significant differences between these responses (χ^2=7.63, df= 2,

p= 0.02). Respondents who thought that dog registration and licensing cannot help in the control of rabies were 79(39.5%) while majority 121(60.5%) had no knowledge about dog registration. There was a statistically significant difference between these responses (χ^2=6.26, df= 2, p=0.04). Those who knew that vaccination of dogs should be repeated yearly were 134(67%) and 66(33.0%) did not know. These responses were statistically significant (χ^2= 7.23, df= 2, p= 0.00) [Table 4.7].

The association of demographic characteristics of respondents with categorized knowledge scores was assessed (Table 4.8). The result showed that respondents above 40 years of age had the higher knowledge scores (77.5%). There was a highly statistically significant differences in the responses (χ^2= 18.57, df= 3, p= 0.000). Sex of respondents did not show statistically significant differences in the categorized knowledge score. Marital status showed statistically significant differences (χ^2=8.892, df=3, p= 0.031) with married category having the highest acceptable categorized knowledge scores 55(56.7%) followed by single category 37(42%). Occupation of respondents also showed a statistically significant differences (χ^2= 12.287, df=3, p= 0.006). Civil servants had higher acceptable knowledge scores 38(65.5%) than other occupational category. Those who had secondary and tertiary education had higher acceptable scores 48(52.7%) and 31(50.8%) respectively than respondents with non-formal and primary education (Table 4.9).

TABLE 4.6. Demographic characteristics of respondents to Knowledge, Attitude and Practice towards rabies in Ogoja, Cross River State.

Characteristics	Total number of respondents N= 200	Specific rates (%)	χ^2	df	p- value
Gender			2.541	1	0.08
Male	144	72.0			
Female	56	28.0			
Age (years)			13.294	3	0.004
< 19	34	17.0			
20-30	76	38.0			
31-40	50	25.0			
>40	40	20.0			
Marital Status					
Single	88	44.0	4.900	3	0.179
Married	97	48.5			
Divorced	10	5.0			
Widowed	5	2.5			
Occupation			7.371	3	0.061
Commerce	53	26.5			
Civil servant	58	29.0			
Unemployed	61	30.5			
Farmer	28	14.0			

Educational level					
Non formal	20	10.0	2.816	3	0.421
Primary	28	14.0			
Secondary	91	45.5			
Tertiary	61	30.5			
Reason for consumption			3.079	3	0.380
Delicacy	72	36.0			
Protein	39	19.5			
Medicinal	18	9.0			
others	71	35.5			
No. of dogs owned			4.105	4	0.392
None	121	60.5			
One	38	19.0			
Two	13	6.5			
Three	12	6.0			
>three	16	8.0			
Have you been Bitten by a dog			0.992	1	0.319
Yes	44	22.0			
No	156	78.0			

TABLE 4.7. Responses of respondents on knowledge towards rabies in Ogoja.

Knowledge item	**Frequency (%)**	χ^2	**df**	**p-value**
Dogs are common source of rabies in Nigeria				
Yes	109(54.5)			
No	33(16.5)	1.184	2	0.553
Don't know	58(29)			
A friendly dog that suddenly turns aggressive may have rabies				
Yes	117(56.5)			
No	24(12)	1.046	2	0.593
Don't know	59(29.5)			
Excessive foamy salivation and tendency to bite anything are not signs of rabies in dogs				
Yes	58(29)			

No	47(23.5)	0.743	2	0.690
Don't know	95(47.5)			
I know that it is against the law not to vaccinate my dogs				
Yes	78(39.0)			
No	54(27.0)	7.627	2	0.022
Don't know	68(34.0)			
Dog registration and licensing cannot help in the control of rabies				
Yes	79(39.5)	6.257	2	0.044
No	60(30.0)			
Don't know	61(30.5)			
Vaccination of dogs against rabies should be repeated yearly				
Yes	134(67)	7.227	2	0.027
No	13(6.5)			
Don't know	53(26.5)			

N = 200

Table 4.8. Association of demographic variables with categorized knowledge scores of respondents in Ogoja.

	Categorized scores			
	Poor	**Fair**	**Good**	**Very good**
Age (years)				
<19	5(14.7)	16(47.1)	10(29.4)	3(8.8)
20-30	16(21.1)	31(40.8)	24(31.6)	5(6.6)
31-40	8(16.0)	20(40.0)	16(32.0)	6(12.0)
>40	3(7.5)	6(15.0)	17(42.5)	14(35.0)
Sex				
Male	24(16.7)	51(35.4)	47(32.6)	22(15.3)
Female	8(14.3)	22(39.3)	20(35.7)	6(10.7)

Marital status				
Single	17(19.3)	34(38.6)	30(34.1)	7(8.0)
Married	12(12.4)	30(30.9)	34(35.1)	21(21.6)
Divorced	2(20.0)	6(60.0)	2(20.0)	0(0)
Widowed	1(20.0)	3(60.0)	1(20.0)	0(0)
Occupation				
Commerce	13(24.5)	20(37.7)	17(32.1)	3(5.7)
Civil servant	7(12.1)	13(22.4)	22(37.9)	16(27.6)
Unemployed	7(11.5)	26(42.6)	20(32.8)	8(13.1)
Farmer	5(17.9)	14(50.0)	8(28.6)	1(3.6)
Educational Level				
Non formal	4(20.0)	10(50.0)	6(30.0)	0(0)
Primary	5(17.9)	13(46.4)	10(35.7)	0(0)
Secondary	11(12.1)	32(35.2)	34(37.4)	14(15.4)
Tertiary	12(19.7)	18(29.5)	17(27.9)	14(23.0)

Number in front and percentages in parentheses

Table 4.9. Summary of demographic variables with categorized knowledge scores of respondents in Ogoja.

	Unacceptable	Acceptable	χ^2	df	p-value
N=200					
Age (years)					
<19	21(61.8)	13(38.2)			
20-30	47(61.8)	29(38.2)			
31-40	28(56.0)	22(44.0)	18.51	3	0.000
>40	9(22.5)	31(77.5)			
Sex					
Male	75(52.1)	69(47.9)	0.036	1	0.850
Female	30(53.6)	26(46.4)			
Marital status					
Single	51(58.0)	37(42.0)			
Married	42(43.3)	55(56.7)	8.892	3	0.031
Divorced	8(80.0)	2(20.0)			
Widowed	4(80.0)	1(20.0)			
Occupation					
Commerce	33(62.3)	20(37.7)			
Civil servant	20(34.5)	38(65.5)			
Unemployed	33(54.1)	28(45.9)	12.287	3	0.006
Farmer	19(67.9)	9(32.1)			
Educational level					
Non formal	14(70.0)	6(30.0)			
Primary	18(64.3)	10(35.7)			
Secondary	43(47.3)	48(52.7)	5.290	3	0.152
Tertiary	30(49.2)	31(50.8)			

4.3.3 Attitude of Respondent towards Rabies

The majority of respondents 143(71.5%) accepted that they do not allow stray dogs to roam freely into their compound while 28.5% were undecided. There was a statistically significant difference (χ^2= 7.430, df=2, P= 0.024) in the responses. In this study, 93(46.5%) responded that the dog that bites someone should be caught and killed. Most of the respondents 147(73.5%) were in favour of going to hospital if bitten by a dog and 35(17.5%) were undecided. The respondents who said it was not good to nurse an unknown sick dog were 125(62.5%). Majority of the respondents 142(71%) reported that they did not play with unknown dogs and most of them 147(73.5%) affirmed that keeping dogs not vaccinated against rabies was dangerous and should be avoided. Only 47(23.5%) of the respondents agreed that children should be allowed to play with dogs (Table 4.10).

The responses of categorized attitude scores with demographic characteristics of respondents are shown in Table 4.11. There were no statistically significant differences between age categories. However, respondents above 40 years had higher acceptable attitude scores 31(77.5%). Similarly, males had significantly higher acceptable attitude scores 102(70.8) than females 35(62.5). Married respondent also showed significantly higher attitude scores 73(75.3%) than singles 57(64.8%) and divorced 3(30%). Occupational characteristics revealed high acceptable attitude scores among civil servants 44(75.9%). Educational level of respondents showed a highly statistically significant differences (χ^2= 29.987, df= 3, p= 0.000). Respondents with secondary and tertiary education had higher acceptable attitude scores 74(81.3%) and 45(73.8%) respectively than other educational categories (Table 4.12).

TABLE 4.10. The responses of respondents on attitude towards rabies in Ogoja.

Attitude item	Frequency (%)	χ^2	df	p-value
I do not allow stray dogs roam freely into my compound				
Yes	143(71.5)	7.430	2	0.024
No	22(11)			
Undecided	35(17.5)			
A dog that bites someone should be caught and killed				
Yes	93(46.5)			
No	58(29.0)	0.890	2	0.641
Undecided	49(24.5)			
It is not good to nurse an unknown sick dog				
Yes	125(62.5)			
No	46(23.0)	0.616	2	0.735
Undecided	29(14.5)			
If I am bitten by a dog I will go to the hospital				
Yes	147(73.5)			
No	18(9.0)	3.551	2	0.169
Undecided	35(17.5)			
It is good to let dogs roam to get food because it makes them stronger				
Yes	76(38)			
No	88(44)	0.109	2	0.947
Undecided	36(18)			
It is inhuman to confine your dog				
Yes	95(47.5)			
No	76(38.0)	0.754	2	0.686
Undecided	29(14.5)			
I do not play with unknown dogs				
Yes	142(71)			
No	38(19)	1.459	2	0.482
Undecided	20(10)			
Keeping dogs unvaccinated against rabies is dangerous and should be avoided				
Yes	147(73.5)			
No	23(11.5)	1.485	2	0.476
Undecided	30(15.0)			
Children should be allowed to play with dogs				
Yes	47(23.5)			
No	118(59.0)	1.918	2	0.38
Undecided	35(17.5)			

N = 200

Table 4.11. Association of demographic variables with categorized attitude score of respondents in Ogoja.

	Categorized scores			
	Poor	**Fair**	**Good**	**Very good**
Age (years)				
<19	8(23.5)	7(20.6)	9(26.5)	10(29.4)
20-30	8(10.5)	14(18.4)	34(44.7)	20(26.3)
31-40	2(4.0)	15(30.0)	19(38.0)	14(28.0)
>40	2(5.0)	7(17.5)	13(32.5)	18(45.0)
Sex				
Male	12(8.3)	30(20.8)	50(34.7)	52(36.1)
Female	8(14.3)	13(23.2)	25(44.6)	10(17.9)
Marital status				
Single	10(11.4)	21(23.9)	29(33.0)	28(31.8)
Married	6(6.2)	18(18.6)	42(43.3)	31(32.0)
Divorced	3(30.0)	4(40.0)	1(10.0)	2(20.0)
Widowed	1(20.0)	0(0)	3(60.0)	1(20.0)
Occupation				
Commerce	4(7.5)	17(32.1)	17(32.1)	15(28.3)
Civil servant	4(6.9)	10(17.2)	23(39.7)	21(36.2)
Unemployed	6(9.8)	10(16.4)	23(37.7)	22(36.1)
Farmer	6(21.4)	6(21.4)	12(42.9)	4(14.3)
Educational level				
Non formal	5(25.0)	9(45.0)	5(25.0)	1(5.0)
Primary	5(17.9)	11(39.3)	8(28.6)	4(14.3)
Secondary	5(5.5)	12(13.2)	40(44.0)	34(37.4)
Tertiary	5(8.2)	11(18.0)	22(36.1)	23(37.7)

Number in front and percentages in parentheses

Table 4.12. Summary of demographic variables with categorized attitude scores of respondents in Ogoja.

	Unacceptable	Acceptable	χ^2	df	p- value
N=200					
Age (years)					
<19	15(44.1)	19(55.9)			
20-30	22(28.9)	54(71.1)	4.385	3	0.223
31-40	17(34.0)	33(64.0)			
>40	9(22.5)	31(77.5)			
Sex					
Male	42(29.2)	102(70.8)			
Female	21(37.5)	35(62.5)	1.298	1	0.255
Marital status					
Single	31(35.2)	57(64.8)			
Married	24(24.7)	73(75.3)	9.795	3	0.020
Divorced	7(70.0)	3(30.0)			
Widowed	1(20.0)	4(80.0			
Occupation					
Commerce	21(39.6)	32(60.4)			
Civil servant	14(24.1)	44(75.9)	5.537	3	0.136
Unemployed	16(26.2)	45(73.8)			
Farmer	12(42.9)	16(57.1)			
Educational level					
Non formal	14(70.0)	6(30.0)			
Primary	16(57.1)	12(42.9)	29.987	3	0.000
Secondary	17(18.7)	74(81.3)			
Tertiary	16(26.2)	45(73.8)			

4.3.4 Practice of Respondents towards Rabies

Majority of the respondents 137(63.5%) indicated that they did not like keeping dogs, that it was good to vaccinate dogs against rabies 159(79.5%) and dog handlers should wear protective clothing 132(66%). Respondents who said that it was good to wash dog bite wounds with soap and water were 95(47.5%). Also most respondents 116(58%) advised that dog handlers should take human anti-rabies vaccine and that it was good to have a cage for a dog 164(82%). Also 85(42.5%) responded that it was not a good practice to castrate/spay dogs. Although most respondents 120(60%) were willing to see to treatment of victims of dog bite, a significant number of them 136(68%) opted to take victim to a chemist for treatment while 72(36%) of the respondents were likely to use traditional herbs. Majority of the respondents preferred taking a dog bite victim to a veterinary clinic 170(85%). Also 148(74%) considered the option of taking victim to seek therapy from a hospital. A significant proportion of the respondents (64.0%) reported that they would not allow the bite victim to be treated with traditional medicine (Table 4.13).

The results of categorized practice score with demographic variables were assessed (table 4.14). Respondents above 40 years of age had higher acceptable practice scores 30(75%) than other age categories. There were statistically significant differences (χ^2= 13.338, df=3, p= 0.038). Sex and marital status of respondents did not show statistically significant differences in categorized practice scores. However there was a statistically significant difference (χ^2 =14.452, df= 3, p= 0.025) among occupational categories of respondents. Civil servants had higher acceptable practice scores 43(74.1%) than other occupational categories. Also those with tertiary education had 77% acceptable practice score, secondary education 59.3%, primary 32.1% and non-formal 30%. There was a highly statistically significant differences (χ^2 =28.409, df=3, p=0.000) among

educational level of respondents. Based on reason for consumption of dog meat, 51.4% of the respondents prefer it as a delicacy and 66.7% eat it due to its protein content, 55.6% for its medicinal value while 60.6% gave other reasons such as good health, protection against poison (Table 4.15). There was no significant correlation between knowledge and attitude scores with practice score ($P< 0.05$) [Table 4.16].

TABLE 4.13. The responses of respondents on Practice towards rabies in Ogoja.

Practice item	Frequency (%)	χ^2	df	p-value
Do you like keeping dogs?				
Yes	137(63.5)	1.417	2	0.492
No	45(22.5)			
Undecided	18(9.0)			
It is good to vaccinate your dog				
Yes	159(79.5)	2.765	2	0.251
No	24(12.0)			
Undecided	17(8.5)			
Dog handlers should wear protective clothing?				
Yes	132(66)	0.674	2	0.714
No	38(19)			
Undecided	30(15)			
It is good to wash dog bite wounds with soap				
Yes	95(47.5)	1.450	2	0.484
No	76(38)			
Undecided	29(14.5)			
Dog handlers should take human anti rabies vaccine				
Yes	116(58)	2.280	2	0.320
No	54(27)			
Undecided	50(15)			
It is good to have a cage for your dog				
Yes	164(82)	2.216	2	0.330
No	28(14)			
Undecided	8(4.0)			
It is not a good practice to castrate/spay dogs				
Yes	85(42.5)	3.136	2	0.208
No	71 (35.5)			
Undecided	44 (22)			
How will you handle a victim of dog bite, Do nothing?				
Yes	80 (40)	0.069	1	0.792
No	120 (60)			
Take the victim to a chemist for treatment				
Yes	136 (68)	0.049	1	0.825
No	64 (32)			
Treat using traditional medicine (herbs)				
Yes	72 (36)	4.448	1	0.035
No	128 (64)			
Take the victim to a veterinary clinic				
Yes	170 (85)	0.130	1	0.718
No	30 (15)			
Take the victim to a hospital				
Yes	148 (74)	0.037	1	0.848
No	52 (26)			

N = 200

Table 4.14. Association of demographic variables with categorized practice score of respondents in Ogoja.

	Categorized scores			
	Poor	**Fair**	**Good**	**Very good**
Age (years)				
<19	3(8.8)	18(52.9)	13(38.2)	0(0)
20-30	4(5.3)	27(35.5)	40(52.6)	5(6.6)
31-40	3(6.0)	19(38.0)	26(52.0)	2(4.0)
>40	0(0)	10(25.0)	29(72.5)	1(2.5)
Sex				
Male	7(4.9)	58(40.3)	71(49.3)	8(5.6)
Female	3(5.4)	16(28.6)	37(66.1)	0(0)
Marital status				
Single	6(6.8)	31(35.2)	47(53.4)	4(4.5)
Married	3(3.1)	34(35.1)	57(58.8)	3(3.1)
Divorced	1(10.0)	6(60.0)	2(20.0)	1(10.0)
Widowed	0(0)	3(60.0)	2(20.0)	0(0)
Occupation				
Commerce	4(7.5)	23(43.4)	24(45.3)	2(3.8)
Civil servant	3(5.2)	12(20.7)	40(69.0)	3(5.2)
Unemployed	3(4.9)	22(36.1)	34(55.7)	2(3.3)
Farmer	0(0)	17(60.7)	10(35.7)	1(3.6)
Educational level				
Non formal	2(10.0)	12(60.0)	6(30.0)	0(0)
Primary	2(7.1)	17(60.7)	8(28.6)	1(3.6)
Secondary	6(6.6)	31(34.1)	49(53.8)	5(5.5)
Tertiary	0(0)	14 (23.0)	45(73.8)	2(3.3)
Reason for consumption of dog meat				
Delicacy	6(8.3)	29(40.3)	35(48.6)	2(2.8)
Protein	1(2.6)	12(30.8)	25(64.1)	1(2.6)
Medicinal	0(0)	8(44.4)	7(38.9)	3(16.7)
Others	3(4.2)	25(35.2)	41(57.7)	2(2.8)

Number in front and percentages in parentheses

Table 4.15. Summary of demographic variables with categorized practice scores of respondents in Ogoja.

	Unacceptable	Acceptable	χ^2	df	p- value
	N=200				
Age (years)					
<19	21(61.8)	13(38.2)			
20-30	31(40.8)	45(59.2)	13.338	3	0.038
31-40	22(44.0)	28(56.0)			
>40	10(25.0)	30(75.0)			
Sex					
Male	65(45.1)	79(54.9)	2.337	2	0.311
Female	19(33.9)	37(66.1)			
Marital status					
Single	37(42.0)	51(58.0)			
Married	37(38.1)	60(61.9)	5.767	3	0.450
Divorced	7(70.0)	3(30.0)			
Widowed	3(60.0)	2(40.0)			
Occupation					
Commerce	27(50.9)	26(49.1)			
Civil servant	15(25.9)	43(74.1)	14.452	3	0.025
Unemployed	25(41.0)	36(59.0)			
Farmer	17(60.7)	11(39.3)			
Educational level					
Non formal	14(70.0)	6(30.0)			
Primary	19(67.9)	9(32.1)	28.409	3	0.000
Secondary	37(40.7)	54(59.3)			
Tertiary	14(23.0)	47(77.0)			
Reason for consumption of dog meat					
Protein	13(33.3)	26(66.7)			
Medicinal	8(44.4)	10(55.6)	4.711	3	0.581
Delicacy	35(48.6)	37(51.4)			
Others	28(39.4)	43(60.6)			

TABLE 4.16. Means, standard deviations and regression coefficients for knowledge, attitude and practice score among respondents in Ogoja.

Variable	M	SD	Knowledge score	Attitude score
Practice score	6.80	1.805	0.394*	0.420*
Knowledge score of respondent	9.14	4.462		0.401*
Attitude score of respondent	5.28	2.098		

* indicates not significant at P< 0.05

4.4 DETECTION OF RABIES ANTIGEN AMONG SLAUGHTERED DOGS BY DIRECT FLUORESCENT ANTIBODY (DFA) TECHNIQUE

Out of the 177 dogs tested for rabies antigen by direct fluorescent antibody technique, 98(55.4%) were males, [94(95.9%) adults and 4(4.1%) young dogs], while 79(44.6%) were females, [76(96.2%) adults and 3(3.8%) young dogs]. The results showed that a total number of 6 samples (3.38%) were positive for rabies antigen. The rate of infection was higher in females 5(2.82%) than in males 1(0.56%) [Table 4.17]. All the positive samples were from adult dogs.

4.5 DISTRIBUTION OF DOGS BY SOURCES

The results of the distribution of dogs by sources showed that out of 177 dogs tested, 4(2.2%) were sourced from Ogoja, 14(7.9%) from Okuku, 6(3.3%) from Obudu, all in Cross River State while 146(82.4%) from Benue State and 7(3.9%) from Adamawa State. The highest number of positive samples 4(2.26%) were from Benue State while the remaining 2(1.12%) were from Ogoja and its environs (Table 4.18).

After distributing pamphlets and flyers to respondents, and educating them on the dangers of rabies and the need for taking pre and post exposure prophylaxis, washing dog bite wounds swith soap and water, wearing protective coverings during processing of dog meat and other risky behaviours, the respondents expressed interest in changing their attitude and practices towards rabies. This public health education had helped to increase their awareness about the disease.

TABLE 4.17. Sex and Age distribution of dogs slaughtered for human consumption in Ogoja whose brain tissue samples tested positive for rabies antigen.

Gender	Age*		No. tested (%)	No. positive Sex specific rates (%)
	1-24mths	>24mths		
Male	0/4	1/94	98(54.6)	1 (0.56)
Female	0/3	5/76	79(45.4)	5 (2.82)
Total (%)	**0/7**	**6/170**	**177(100)**	**6 (3.38)**

Age Number positive / Number tested*

Table 4.18. Distribution of brain tissue samples by origin of dogs slaughtered in Ogoja.

Source	No. examined (%)	No. positive (%)
1. Cross River State		
Ogoja	4 (2.2)	1(0.56)
Okuku	14 (7.9)	1(0.56)
Obudu	6 (3.3)	0 (0)
2. Benue State	146 (82.4)	4 (2.26)
3. Adamawa State	7 (3.9)	0 (0)
Total	**177(100)**	**6 (3.38)**

CHAPTER 5

DISCUSSION

In this study there was high prevalence of dog bites among males (51.9%) and individuals between 10-19 years (37.2%). This may be due to the fact that people of this category have frequent contact with dogs resulting in the high rate of exposure to bites. This finding is in agreement with other reports (Owai, 2009., WHO, 2010., Lunney *et al.,* 2011) where children of less than 20 years were found to be the major victims and more vulnerable to dog bites. Other authors (Ahmed *et al.*, 2000; Hampson *et al.,* 2008; Abubakar and Bukari, 2012) had also reported higher bite frequencies among boys compared with girls. Defensive aggression is likely a major contributing factor to dog bites. Bites to the legs and feet of humans may be correlated to territory protection by dogs. This study found a high frequency of dog bites on the legs (65%) and majority of the bite cases were associated with local breed of dogs which are predominantly found in the study area. The occurrence of dog bites mostly on the legs may be due to proximity of this part of the body to the animal. Also it is likely that victims would have used legs in an attempt to separate fighting dogs or defending themselves against dog attacks resulting in more bites on the lower extremities. Local dogs are in most cases not confined and so they roam freely. All of these factors may increase the rate of interaction between dogs and humans, hence the bites. In this study, seasonal variation in dog bites seemed to play a role in the epidemiology of rabies. The frequency of dog bites increased significantly during the dry season, from October to March. This could be attributed to the hunting expeditions by dog owners which are a common practice during this period and people use these dogs for that purpose thereby increasing the chances of breeding or exposure to bites as they frequently interact with other dogs. This finding agrees with the results of similar studies 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. Available records within the period of review identified 7 suspected rabies cases in the dogs that have bitten people. This is an indication of the presence of rabies in the area.

The vaccination profile showed that local dogs had higher vaccination coverage (93.7%) than exotic and other breeds of dogs in the study area. This is because the population of local dogs is more predominant in the area compared to the exotic breeds which are more expensive to acquire and maintain. This observation, however, differs from the results of previous studies by Awoyomi *et al.* (2007) that local breed stand a higher risk of being unvaccinated compared to exotic breeds. Dogs within the age range of 3-12 months had the highest vaccination coverage than older dogs of the age range >12-36 months and >36 months. The high vaccination rate in these young dogs may not be unconnected with the frequent advice to dog owners to vaccinate their dogs from 3 months old and above. Theoretical and empirical studies have shown that inclusion of puppies in rabies vaccination campaigns is likely to result in substantial epidemiological and economic benefits (Cleaveland, 1996; Coleman, 1999). Dogs less than 6 months are significantly important in rabies transmission to humans (Mitmonnpitak *et al.,* 1998) and more likely to be accessible for parenteral vaccination than older dogs. The sex of dogs may affect the vaccination coverage in the study area, as more males (57.6%) were vaccinated than females (42.4%). The increased number of male dogs being vaccinated could be as a result of male: female ratio dominance due to the desire of dog owners to acquire male dogs mainly for security and hunting expeditions. Most residents in the study area prefer male dog ownership as it is believed to be more vicious in security and hunting purposes. The significant increase in the

number of dogs vaccinated in 2008 was due to the intensive mass campaign on vaccination of dogs against rabies which resulted in incresaed response from the people. This awareness created had a spillover effect in 2009 thus resulting in a significant response.

The respondents showed awareness about the legal implications of non-vaccination/ registration of dogs and age of vaccination. This could be due to availability of information from previous campaigns either by veterinarians, animal health workers who visit dog owners for anti-rabies vaccination or from multiple sources including government campaigns and mass media. Respondents > 40 years and civil servants had significantly acceptable knowledge scores. This may not be unconnected with the fact that knowledge increases with age and civil servants tend to have better understanding and awareness about the disease because they are more enlightened than other occupational category. The attitude of respondents not allowing stray dogs to roam freely into their compound, seeking medical treatment if bitten by a dog, not playing with unknown dogs or keeping unvaccinated dogs against rabies are good indicators of community involvement in the control of rabies since people were constantly being motivated and reminded about the dangers of rabies in the society through awareness campaigns and personal contacts with dog handlers. The practice of seeking traditional therapy if bitten by a dog could however, be due to the traditional beliefs that dog bite wounds are better managed with herbs than the use of orthodox treatment. This poor practice of seeking traditional treatment negates WHO recommendation of instituting medical consultation of victims of dog bite. WHO recommends immediate and vigorous washing with soap and water after a dog bite, followed by application of 70% ethanol or tincture of iodine (Matibag *et al.*, 2009). Respondents above fourty years, civil servants and those with secondary or tertiary education showed acceptable practices against

rabies, possibly due to their maturity and experience in handling dogs and/or awareness about the danger of the disease. This could explain why a significant number (71.5%) of the respondents do not allow stray dogs to roam freely into their premises. Allowing stray dogs to roam about is one of the risk factors contributing to the spread of rabies in the animal population and could continue to make rabies a zoonotic threat to humans. Majority of the respondents answered affirmatively that it is good to wash dog bite wounds with soap and water which is in line with WHO recommendation as first aid treatment against dog bite. Personal observation and communication with the respondents revealed that they were not wearing protective clothing during the processing and handling of dogs, neither do they have knowledge of pre or post exposure prophylaxis against rabies. These negative attitudes and practices concerning rabies management and control may be due to lack or inadequate knowledge about the consequences of the disease. This may reflect the inaccessibility of the people to participate in rabies control programs at the personal, household and community levels (Matibag *et al.*, 2007). Individuals involved in the handling and processing of dog meat are constantly being exposed to rabies virus through bites from dogs, cuts or wounds not adequately protected from the saliva or brain tissues of these dogs could constitute great risk to rabies infection.

The presence of rabies antigen in brain tissues of apparently healthy dogs slaughtered for human consumption is a significant factor in the epidemiology of the disease. The public health implication of this finding is that individuals involved in handling and processing of dog meat are at risk of exposure to rabies either from bites by these dogs before slaughter or from infected nervous tissues or saliva that may accidentally contaminate open wounds or bruises during processing of slaughtered dogs. This finding is in agreement with previous studies from several

locations in Northern Nigeria (Sabo, 2008; Akombo, 2009; Garba *et al.,* 2008; Aliyu *et al.,* 2010). In this study, it was shown that there were more female dogs positive for rabies antigen than male dogs. This could possibly be due to some population dynamic factors like breeding and sex. Adult dogs were mostly affected with rabies antigen than young dogs probably because more adult dogs were presented for slaughtering during the period of study. This result also agrees with the findings of Baba (2006) and Aliyu *et al* (2010) which showed that more adult dogs tested positive for rabies antigen compared to puppies. Majority of the positive dogs 4(2.26%) were sourced from Benue State which is a neighbouring State to the study area. The implication of this finding is that rabies could possibly be imported to Ogoja through dog trade from the neighbouring states. In an earlier study carried out by Akombo (2009) in Makurdi, Benue State, a prevalence of 15.8% was recorded in brain tissues of dogs slaughtered for human consumption.

The public health education was useful mainly in informing the participants on how to handle animals suspected of rabies, the earliest age for pets to receive anti-rabies vaccination (ARV) and repeat inoculation, clinical signs of rabies, prevention and control. This was demonstrated in the participants' willingness to change their attitudes and practices positively towards rabies. They were also used in creating awareness about adequate wound washing which should be the first line of action after animal bites before seeking medical attention.

CHAPTER 6

SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1 SUMMARY

This descriptive and cross sectional study was conducted to examine factors associated with dog bites on humans and vaccination of dogs by analysing records of dog bite and anti-rabies vaccination in the State Veterinary Hospital, Ogoja. Also, to assess knowledge, attitude and practice of processors and consumers of dog meat through structured questionnaires, check for the presence of rabies antigen in the brain tissues of dogs slaughtered for human consumption using the fluorescent antibody technique and educate processors and consumers of dog meat on the dangers of rabies. The study revealed that out of 183 human dog bite cases reported to the State Veterinary Hospital, Ogoja, 68(37.2%) were in persons between 10-19 years of age and the highest frequency (65%) of dog bites occurred on lower extremities. Dogs within the age of 3-12 months received the highest vaccination 464 (67.5%) against rabies. Association of demographic variables with categorized knowledge, attitude and practice scores of respondents revealed statistically significant differences ($P < 0.05$). Respondents > 40 years had highest acceptable (77.5%) scores and practice scores of (75%). Also, civil servants and respondents with secondary and tertiary education had higher acceptable knowledge, attitude and practices towards rabies than other occupational categories. Rabies antigen was detected in 6 samples (3.4%) out of 177 brain tissue samples examined by fluorescent antibody technique. Some risk factors such as not wearing protective coverings and receiving pre- and post-exposure prophylaxis were identified among dog meat processors and consumers in the study area. There is high public health risk of rabies to processors and consumers of dog meat and requires strategic intervention.

6.2 CONCLUSION

In this study, it was observed that dog bite is a common problem and the distribution is higher among males than females. Individuals between 10-19 years were mostly affected. Bite wounds occurred on the lower extremities (legs) than other parts of the body. Local breed of dogs are mostly incriminated in the bites and there was seasonal variation in the occurrence of dog bites in the study area with the highest frequency in the dry season between the months of October and March. Vaccination profile of dogs showed high vaccination coverage (94%) in local breed of dogs, (57.6%) male and (67.5%) young dogs. However, there were no statistically significant differences among ages of dogs vaccinated.

In this study, respondents showed inadequate knowledge about rabies and its public health consequences. The general attitude and practice of respondents towards rabies management, control and prevention is not encouraging as majority of the respondents still prefer traditional therapy if bitten by a dog. They do not wear protective clothing during processing and handling of dogs; neither do they receive pre or post exposure prophylaxis against rabies. This negative practice not only negates WHO guidelines for the control and prevention of rabies but could easily exposed them to the disease. The practice towards rabies was significantly affected by educational status, age and occupational characteristics of respondents.

The detection of rabies antigen in the brain tissues of dogs slaughtered for human consumption (3.38%) indicates the occurrence of rabies virus and is a significant factor in the transmission and spread of rabies in the area. Risk factors such as not wearing protective coverings, lack of awareness of pre and post exposure prophylaxis of human anti- rabies vaccine, dog bites and

exposure of cuts or wounds to brain tissues and saliva during processing of dog meat were observed among dog handlers during the study. All these factors could contribute to the epidemiology of rabies in the study area.

The institution of public health education for processors and consumers of dog meat about the dangers of rabies had proved useful in the prevention and control of the disease and should be sustained.

6.3 RECOMMENDATIONS

In this study, the following recommendations are made:

1. Educational awareness of people about the risk of dog bites and rabies should be intensified. Dog bite victims and dog handlers should be encouraged to receive post exposure treatment from qualified medical facilities instead of using traditional medicine to treat dog bite injuries.

2. Intensive mass vaccination campaign against rabies through public enlightenment campaign is imperative as a means of controlling the disease.

3. Intervention measures should include public health educational programs on dog behaviour, pre- and post-exposure prophylaxis, dog- child interaction, importance of responsible dog ownership and the danger of rabies.

4. Enforcement of leash laws and regulations for licensing of dogs, rabies vaccination and stray dogs population management are important for reducing bite incidents and post bite treatment cost.

5. The knowledge, attitude and practice on rabies could be further enhanced through the use of information and educational materials.

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APPENDICES

Appendix i

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

KNOWLEDGE, ATTITUDE AND PRACTICE OF PROCESSORS AND CONSUMERS OF DOG MEAT TOWARDS RABIES

INSRUCTION: Please kindly read and answer the following questions. The information obtained will be used strictly for academic purpose only and absolute confidentiality will be ensured. Thank you for your time spared. Tick (√) the box provided accordingly.

SECTION A: BIODEMOGRAPHIC INFORMATION OF RESPONDENT.

1. Name: _____
2. Location: _____
3. Age (years): a. <19[ ] b. 20-30[ ] c. 31-40[ ] d. >40[ ]
4. Sex: a. Male[ ] b. Female[ ]
5. Marital status: a. single[ ] b. married[ ] c. divorced[ ] d. widowed[ ]
6. What is your occupation? a. businessman/woman[ ] b. civil servant[ ] c. unemployed[ ] d. farmer[ ]
7. Duration in business/ service/ practice/ farming a.0-3[ ] b.4-6[ ] c.7-9[ ] d. > 10[ ]years
8. Level of education: a. no formal education[ ] b. primary[ ] c. secondary[ ] d. tertiary[ ]
9. Number of children: a. none[ ] b. 1[ ]c. 2[ ]d. 3[ ]e. >3[ ]
10. What is your religion: a. Christian[ ] b. Islam[ ] c. others[ ]
11. Number of dogs owned: a. none[ ] b. 1[ ]c. 2[ ]d. 3[ ]e. >3[ ]
12. Have you been bitten by a dog before? a. yes[ ] b. no[ ]
13. Are you involved in a. processing and consumption [ ] b. consumption only [ ] of dog meat.
14. Reasons for consumption of dog meat:

SECTION B: KNOWLEDGE

15. Rabies cannot kill a. yes[ ] b. no[ ] c.I don't know[ ]
16. The organism that causes rabies affects the nerves a. yes[ ] b. no[ ] c. I don't know[ ]
17. Rabies does not exist in Nigeria a. yes[ ] b. no[ ] c. I don't know[ ]

18. All animals can be infected with and can transmit rabies virus a. yes[ ] b. no[ ] c. I don't know[ ]
19. Dogs are possible common source of rabies virus in Nigeria a. yes[ ] b. no[ ] c .I don't know[ ]
20. All humans can be infected with rabies a. yes[ ] b. no[ ] c. I don't know[ ]
21. Bites from an infected animal cannot spread rabies organism to another animal a. yes s[ ] b. no[ ] c. I don't know[ ]
22. Rabies is spread through saliva of a rabid animal a. yes [ ] b. no[ ] c. I don't know[ ]

24. Do you know the age of first vaccination of dogs against rabies? a. yes[ ] b. no[ ] c. I don't know [ ]
25. Those slaughtering and processing dogs for human consumption are likely to be infected by rabies virus a. yes [ ] b. no[ ] c. I don't know [ ]
26. An infected human can transmit rabies to another human through contact a. yes [ ] b. no[ ] c. I don't know [ ]
27. Dog bites increases your chances of getting rabies a. yes [ ] b. no[ ] c. I don't know [ ]
28. A rabid animal can be slaughtered for consumption a. yes[ ] b. no[ ] c. I don't know[ ]
29. A friendly dog that suddenly turns aggressive may have rabies a. yes[ ] b. no[ ] c. I don 't know[ ]
30. Excessive foamy salivation and tendency to bite anything are not signs of rabies in dogs. a. yes[ ] b. no[ ] c. I don't know[ ]
31. I know that it is against the law not to vaccinate my dog(s) against rabies a. yes[ ] b. no[ ] c. I don't know[ ]
32. Will you present your rabies vaccination certificate on request? a. yes[ ] b. no[ ] c. I don't know[ ]
33. Dog registration and licensing cannot help in the control of rabies a. yes[ ] b. no[ ] c. I don't know[ ]
34. Vaccination of dogs against rabies should be repeated yearly a. yes[ ] b. no[ ] c. I don't know[ ]

SECTION C: ATTITUDE

35. I do not allow stray dogs roam freely into my compound a. yes[ ] b. no[ ] c. undecided[ ]
36. A dog that bites someone should be caught and killed a. yes[ ] b. no[ ] c. undecided[ ]
37. It is not good to nurse an unknown sick dog a. yes[ ] b. no[ ] c. undecided[ ]
38. If I am bitten by a dog, I will go to the hospital a. yes[ ] b. no[ ] c. undecided[ ]

39. It is good to let dogs roam to get food because it makes them grow stronger a. yes[ ] b. no[ ] c. undecided[ ]
40. It is inhumane/bad to confine your dog(s) a. yes[ ] b. no[ ] c. undecided[ ]
41. I do not play with unknown dogs a. yes[ ] b. no[ ] c. undecided[ ]
42. Keeping dogs that are not vaccinated against rabies is dangerous and should be avoided a. yes[ ] b. no[ ] c. undecided[ ]
43. Children should be allowed to play with dogs? a. yes[ ] b. no[ ] c. undecided[ ]

SECTION D: PRACTICE

44. Do you like keeping dog(s)? a. yes[ ] b. no[ ] c. undecided[ ]
45. Is it good to vaccinate your dog(s)? a. yes[ ] b. no[ ] c. undecided[ ]
46. Dog handlers should always wear protective clothing a. yes[ ] b.no[ ] c. undecided[ ]
47. It is good to wash dog bite wounds with soap a. yes[ ] b. no[ ] c. undecided[ ]
48. Dog handlers should take human anti-rabies vaccine? a. yes[ ] b. no[ ] c. undecided[ ]
49. It is good to have a cage for your dog(s)? a. yes[ ] b. no[ ] c. undecided[
50. It is not a good practice to castrate/spay dogs? a. yes[ ] b. no[ ] c. undecided[ ]

How would you handle a victim bitten by a dog?

51. Do nothing a. yes[ ] b. no[ ]
52. Take the victim to a chemist for treatment a. yes[ ] b. no[ ]
53. Treat using traditional medicine (herbs etc) a. yes[ ] b. no[ ]
54. Take the victim to a Veterinary clinic a. yes[ ] b. no[ ]
55. Take the victim to a hospital a. yes[ ] b. no[ ]

Appendix ii: Public health education pamphlet

BASIC FACTS ABOUT RABIES

What is Rabies?
Rabies is a disease caused by virus which can be transferred from dogs to humans. The disease has no cure which means that once a person gets the disease, you will be sick and may die because it affects the brain. You can only prevent rabies by vaccination of dogs. Dogs are the common source of rabies and the disease is endemic in Nigeria.

Who can be affected by rabies?
All warm blooded animals including dogs, cats, sheep, goats, cattle, horses and man

What signs can you suspect in a dog that has rabies?
Two forms of rabies exist (a) furious rabies (b) dump rabies
Signs of furious rabies

- A dog that has saliva coming out of its mouth profusely
- A dog that attacks other dogs and people without being provoked
- A dog that attacks any moving object
- A dog that bites itself in several parts of the body
- A friendly dog that suddenly turns aggressive

Signs of dump rabies

- A dog with saliva coming out of its mouth
- A dog that stay away or hide from its owner
- A dog that looks confused
- A dog that hides in dark places

How can you get rabies?

- From dog bites if the dog has rabies
- If a dog with rabies licks a fresh cut or wound on your body
- If the dog brain or saliva splashes into your eyes or open during processing of dog meat

How to avoid or prevent rabies?

- Avoid playing with strange dogs
- Wear protective coverings during dog meat processing
- Cover open wounds in your body during processing of dog meat
- Always take your dogs to the Veterinary clinic for vaccination
- Don't hide dog bite wounds.
- Endeavour to take pre and post- exposure prophylaxis
- Register and license your dogs
- Repeat anti-rabies vaccination of your dogs annually

What to do when you are bitten by a dog

- Immediately wash the wound with plenty of water and soap
- Apply iodine solution
- Do not close or tie the wound

- Go to the hospital immediately
- Do not go to the native doctor or treat with traditional herbs