Prevailing Bacterial Zoonoses in Sub-Saharan Nigeria: A 10 Years Retrospective Study in Veterinary Hospitals

Yakubu Yusuf, Usman Bashir and Sani Sulaiman
Department of Public Health and Preventive Medicine, Faculty of Veterinary Medicine, Usman Danfodiyo University Sokoto, Sokoto, Nigeria
Ministry of Animal Health and Fisheries Development, Sokoto, Nigeria

Abstract: Zoonoses are diseases transmissible from vertebrate animals to humans. They occur worldwide and present a significant threat to both human and animal health. A retrospective study was conducted to determine the bacterial zoonoses prevalent in the sub-Saharan Region of Nigeria. Two veterinary hospitals in Sokoto State were identified and data on diagnosed cases of microbial diseases between January 2006 and December 2015 were collected. A total of 14,832 cases were recorded of which 3,351 (22.6%) were considered to be of zoonotic importance while the remaining 11,481 (77.4%) were strictly animal diseases. All the microbial zoonoses recorded were bacterial infections comprising bovine brucellosis (21.10%), ovine brucellosis (37.45%), listeriosis (39.27%), leptospirosis (1.55%) and glanders (0.63%). Brucellosis and leptospirosis were observed to prevail throughout the year without any seasonal variation. While leptospirosis and glanders were seen to occur mostly in the rainy season. Ovine species had the highest proportion of zoonotic diseases recorded (27.53%) while equine species had the lowest (5.59%). The findings provided more information on the most commonly encountered bacterial zoonoses in animals in the sub-Saharan part of Nigeria. There is the need for public enlightenment on the potential health threats and the appropriate preventive measures against these diseases. Concerned authorities in the study area need to establish an all-encompassing monitoring programme for zoonotic diseases in both humans and animals.

Keywords: Bacterial zoonoses, sub-Saharan Nigeria, veterinary hospitals, leptospirosis, zoonotic diseases

INTRODUCTION

Zoonotic diseases are infectious diseases that are naturally transmitted from vertebrate animals to humans and vice versa (Wang and Cramer, 2014). The term “Zoonoses” was believed to be coined by Rudolf Virchow in 1885 as a synonym for “infections by contagious animal poisons”. Later in 1894, Galli-Valerio published a manual titled “Zoonoses: diseases communicable from animal to man”. These diseases have been recognized many centuries ago and are caused by all types of pathogenic microbes including bacteria, viruses, fungi, parasites and prions (Wang and Cramer, 2014). The organisms are responsible for a substantial number of diseases in man which have been associated with significant morbidity and mortality. It has been estimated that 61% of known human pathogens are zoonotic (Taylor et al., 2001) and make up 80% of the CDC list of bio-threat agents of concern (Anonymous, 2017). In the world over, the food safety concern and economic impact of zoonotic diseases cannot be overemphasized. The endemicity of some zoonotic diseases greatly affect the African economy due to trade barriers on animals and animal products imposed on some states (Anonymous, 2018). Needless to say that the cost of controlling the diseases as well as production losses experienced by farmers also have a significant impact on the livestock industry. Over 70% of livestock resources in Nigeria are located in the Northern Region where majority of the populace are rural subsistent farmers and livestock producers. Most of the livestock in the region are indigenous animals produced within the country. Although, a sizeable number of animals are imported from neighbouring countries via legal and illegal routes along the land borders. Unhealthy animals smuggled into the country could ultimately be taken to slaughter houses or introduced into new herds for breeding purpose. Hence, there is growing concern over the potential transmission and spread of important zoonotic diseases such as brucellosis and latent bovine tuberculosis amongst herds in the region. The low level of public awareness, neglect and misdiagnosis of zoonotic diseases contribute to the

Corresponding Author: Yakubu Yusuf, Department of Public Health and Preventive Medicine, Faculty of Veterinary Medicine, Usman Danfodiyo University Sokoto, Sokoto, Nigeria
under-reporting of these diseases in the region. Despite reports on some zoonotic infections endemic in Nigeria (Coker et al., 2000; Akinpelu et al., 2011), little is known about the prevailing zoonoses diagnosed in veterinary hospitals in the sub-Saharan Region of the country. Thus, this study was conducted to investigate the occurrence of microbial zoonoses diagnosed in animals presented to two veterinary hospitals in Sokoto State, Nigeria.

MATERIALS AND METHODS

Study area: The study was conducted in Sokoto Metropolis, the capital of Sokoto State, Nigeria. Two veterinary hospitals within the study area namely: Usman Danfodiyo University Sokoto Veterinary Teaching Hospital (UDUS-VTH) and the Sokoto State Veterinary Hospital (SSVH) were enrolled in the study. Sokoto State is located at latitude 130 N and between longitudes 40 8' and 60 54' E in the extreme North Western part of Nigeria, covering an area of approximately 56,000 km² (Blench, 1999). The state shares border with Niger Republic to the North, Kebbi State to the South and Zamfara State to the East. Based on the 2006 National population census, the state has a projected population of about 4,244,399 (Anonymous, 2006). The state is ranked second in the livestock population in Nigeria with an average of 3 million cattle, 4 million goats, 3.85 million sheep, 0.8 million camels and a million poultry (Anonymous, 2008).

Data collection: Following approval by the management of the two veterinary hospitals, relevant information on cases presented and diagnoses made were collected. Case files and diagnostic records from 2006-2015 were carefully examined to obtain vital information such as date of presentation, animal species (bovine, ovine, canine, equine), sex, age and diagnosis. The diagnostic processes in both hospitals involve taking history of the patient, clinical manifestation, laboratory investigation and postmortem examination. A total of 14,832 cases were recorded within the 10 years study period comprising 4,744 cattle, 9,339 sheep, 373 dogs and 376 horses.

Data analysis: The data obtained were entered into Microsoft Excel 2013 for descriptive statistics. The distribution pattern of the diseases diagnosed during the 10 years period was determined. Proportions of the zoonotic diseases were calculated based on species, year and disease type. The results obtained were presented in narratives and figures.

RESULTS AND DISCUSSION

A total of 14,832 cases of bacterial diseases comprising 10,084 cases in SSVH and 4,748 cases in VTH-UDUS were diagnosed between January 2006 and December 2015 (Table 1). Most of the cases (77.4%) were strictly animal diseases while 22.6% were potential zoonoses diagnosed in different animal species. Sokoto State Veterinary Hospital (SSVH) had the highest number of cases recorded (10084) with 19.63% (1979) being zoonotic infections while Usman Danfodiyo University Sokoto Veterinary Teaching Hospital (UDU-VTH) had a total of 4,748 cases with 28.9% (1372) diagnosed to be zoonotic (Fig. 1). Within the period under study, 2009 had the highest proportion of zoonotic diseases recorded (28.27%), followed by 2015 (25.52%), 2013 (23.45%), 2010 (23.30%), 2014 (22.71%), 2012 (22.05%), 2007 (21.84%), 2006 (20.15%), 2008 (20.06%) and 2011 (19.47%) (Fig. 2). Based on animal species presented within the study period, the proportions of zoonotic diseases diagnosed in ovine, bovine, canine and equine species were 27.53, 14.90, 13.94 and 5.59%, respectively (Fig. 3). Among the

Table 1: Number of bacterial diseases diagnosed between 2006 and 2015 in SSVH and UDUS-VTH

<table>
<thead>
<tr>
<th>Variables</th>
<th>Zoonotic Diseases (ZD)</th>
<th>Non-Zoonotic Diseases (NZD)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSVH</td>
<td>1979</td>
<td>8105</td>
<td>10084</td>
</tr>
<tr>
<td>UDUS-VTH</td>
<td>1372</td>
<td>3376</td>
<td>4748</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3351</strong></td>
<td><strong>11481</strong></td>
<td><strong>14832</strong></td>
</tr>
</tbody>
</table>

Fig. 1: Percentage distribution of zoonotic and non-zoonotic diseases diagnosed between 2006 and 2015

20
zoonotic diseases encountered, listeriosis had the highest proportion of 39.27%, followed by ovine brucellosis (37.45%), bovine brucellosis (21.10%), leptospirosis (1.55%) and glands (0.63%) (Fig. 4). Based on annual prevalence, brucellosis and leptospirosis were observed to prevail throughout the year without salient seasonal variation while leptospirosis and glands were mostly recorded during the rainy season (Fig. 5).

Brucellosis is one of the neglected endemic zoonoses reported in Nigeria over 40 years ago (Alausa and Awoseyi, 1976). Cross-sectional studies in different animal species across the country revealed presence of the disease, especially, in the Northern Region which has the highest population of livestock resources (Cadmus et al., 2006; Adamu et al., 2007; Junaidu et al., 2006; Cadmus et al., 2011; Junaidu et al., 2008; Adamu et al., 2014; Jajere et al., 2016). Risk of human brucellosis has been associated with consumption of unpasteurized milk and close contact with infected animals, especially, among occupationally exposed
individuals such as veterinarians, abattoir workers/animal handlers and livestock farmers (Alausa and Awoseyi 1976; Baba et al., 2001; Kozukeev et al., 2006; Ofukwu et al., 2007; Aworh et al., 2013a; Pandit and Pandit, 2013). During the period under study, there was no salient seasonal variation in the occurrence of the disease in animals. However, studies in Egypt and Greece have reported a significant increase in the disease prevalence in animals during spring (Avdikou et al., 2005; Haggag et al., 2016). Cases of bovine and ovine brucellosis in this study were believed to be caused by Brucella melitensis and Brucella abortus, respectively. The infections were diagnosed based on clinical presentations and Rose Bengal Plate agglutination Test (RBPT) as earlier described (Stryzak, 1986; Blasco et al., 1994; Ferreira et al., 2003). These Brucella species are highly infectious and have been incriminated in most human brucellosis (Acha and Szyfres, 2003; Corbel, 2006). Despite the tradition of consuming fresh unpasteurized milk in Sub-Saharan Nigeria (Yakuba et al., 2018) and reports on endemicity of human brucellosis in most developing African countries, there are no confirmed reports of human brucellosis diagnosed in hospitals in Nigeria. However, serological studies in some selected populations revealed occurrence of the infection in the country (Alausa, 1977; Aworh et al., 2013b; Ducrotay et al., 2014; Adesokan et al., 2016). Thus, the human perspective of the disease is believed to be under-reported due to neglect, misdiagnosis and lack of adequate laboratory facilities as earlier identified (Godfroid et al., 2005; Folagbade et al., 2017; Franc et al., 2018).

Listeria monocytogenes is a zoonotic bacterial pathogen responsible for listeriosis in ruminants (circling disease in sheep) and foodborne infection in humans (DiMaio, 2000). It is an environmental pathogen that frequently contaminates ready-to-eat food items such as vegetables and fruits (Allerberger and Wagner, 2010; Linke et al., 2014). Following infection, animals could shed the organism in milk which if consumed unpasteurized can result to life-threatening conditions, especially, in the young and old. Veterinary hospitals in the study area diagnose the disease based on cardinal signs such as still birth, abortion and circling gait in sheep (Vazquez-Boland et al., 2001; Dhama et al., 2015). Individuals, in close contact with animals such as livestock farmers, animal attendants and veterinarians are at high risk of infection, if hand hygiene is not regularly observed. The use of manure by irrigation farmers is a very common practice in Nigeria due to scarcity of fertilizer. This traditional farming method could expose the public to pathogens such as Listeria species when contaminated manure is used to produce vegetables. Although, there are no documented cases of human listeriosis in the study area, reports of the disease in pregnant women and neonates manifesting with meningitis and meningocoelephalitis in other parts of the country have been described (Nwanwu, 2015).

Leptospirosis is the most widespread zoonosis in the world reported in all continents except Antarctica (Adler and Mocetzuma, 2010). It is caused by over 250 serovars of Leptospira species found in a wide range of animal species (Levett, 2001; Cerqueira and Picardeau, 2009). Human leptospirosis is a neglected endemic disease in Africa, especially, amongst people in close contact with animals and (Allan et al., 2015). The disease is also transmissible via consumption of water contaminated with urine of infected dogs. Leptospirosis is mostly under-reported in economically poor countries in Africa due to lack of resources and human capacity (Mauldin et al., 2009). The cases of leptospirosis recorded in this study were all diagnosed in local breeds of dogs using clinical signs and microscopic agglutination test (Ananda et al., 2008). Higher reporting rates were recorded during rainy season when the weather is humid and warm which favours the survivability of the pathogen in the environment as earlier described (Adler and Mocetzuma, 2010; Harstskerel et al., 2011; De Vries et al., 2014). Dog handling has earlier been reported to be associated with leptospirosis in Nigeria following an outbreak in a dog kennel (Awosanya et al., 2013). Thus, individuals in close contact with infected dogs and other susceptible animals such as cattle and pigs are at risk of contracting the disease (Ngbede et al., 2013; Abiay et al., 2015; Ajayi et al., 2018). The public is also at risk of infection when infected dogs contaminate water bodies such as ponds and streams that serve as major sources of drinking water in the rural areas (Ishaku et al., 2011). Serological evidence of human leptospirosis have earlier been reported in Nigeria amongst kennel workers, abattoir workers and even healthy individuals (Ezeh et al., 1991; Onyenekwue, 1993; Agunloye et al., 2001; Awosanya et al., 2013).
Glanders is mainly a disease of solipeds such as horses, donkeys and mules caused by *Burkholderia mallei*. The disease has been eradicated in the United States, Western Europe, Australia and North America but still present in Africa, Eastern Europe, Asia, South America and Middle East (Wittig et al., 2006; Slater, 2013; Van Zandt et al., 2013). *Burkholderia mallei* is a zoonotic bacteria of great public health importance and have been reported in occupationally exposed persons such as veterinarians, horse attendants and laboratory workers (Howe and Miller, 1947; Georgiades and Fishman, 2001; Srinivasan et al., 2001). Glanders is seriously under-reported in Nigeria partly due to neglect by concerned authorities, preference for traditional medication by horse owners and inadequate veterinary hospitals. However, this study revealed presence of the disease in the Sub-Saharan Region of the country. The veterinary hospitals in the study area diagnosed the disease by some of its characteristic presentation such as pneumonia, nodules or purulent crater-like ulcers (farcy pipes) on the legs, especially, along the course of the lymphatic vessels, anaemia, neutrophilic leukocytosis and firm milary granulomatous nodules with caseous necrotic centre seen at postmortem (Al-Ani and Roberson, 2007). The higher number of the disease recorded during rainy season could be attributed to the need for a moist environment for the bacteria to survive and multiply as earlier described (Currie, 2014; Malik et al., 2015). To date, there is no documented case of human glanders in the study area. However, infection with the causative agent (*Burkholderia mallei*) was once diagnosed in a traveler who visited Nigeria and returned to the United Kingdom (Salam et al., 2011). Thus, characterizing the disease of utmost public health importance, especially, among immunocompromised individuals.

**CONCLUSION**

This study has provided information on some under-reported prevailing microbial zoonoses in Sub-Saharan Nigeria. It has also, revealed potential animal to human transmission of the diseases in the study area, especially, amongst individuals in close contact with animals. Occupationally exposed individuals such as veterinarians, animal handlers, abattoir workers and livestock farmers need to take precautionary measures when dealing with animals. The public particularly rural communities need to be enlightened on health threat posed by the prevailing zoonotic diseases and be educated on appropriate preventive measures. Concerned authorities in the study area need to establish an all-encompassing monitoring programme for zoonotic diseases in both animals and humans in the study area.

**ACKNOWLEDGEMENT**

The researchers wish to acknowledge the cooperation and understanding of the veterinarians, laboratory personnel and administrative staff of the Sokoto State Veterinary Hospital (SSVH) and Usman Danfodiyo University Sokoto Veterinary Teaching Hospital (UDU-VTH).

**REFERENCES**


Anonymous, 2008. Beef up your profits by investing in Sokoto State’s livestock sector. Space Station Integration & Promotion Center (SSIPC), Tsukuba, Japan.
Anonymous, 2017. Bioterrorism agents/diseases. Centers for Disease Control and Prevention (CDC), Atlanta, Georgia, USA.


