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Full Length Research Paper

Retrospective study of bovine and human tuberculosis in abattoirs and hospitals in Enugu State, Southeast Nigeria

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A study to generate epidemiological data on tuberculosis in cattle and humans in Enugu State, through a retrospective survey of abattoir and hospital records for a five-year period (2004 to 2008) was undertaken. A total of 748 and 2452 cases of tuberculosis were recorded in cattle and humans respectively. Statistical analysis showed that a variation in seasonal prevalence in both studied population, but the variation was not statistically significant. Sex-associated prevalence differed in both studied populations. Cows and male persons were both significantly ($p<0.05$) affected in cattle and humans, respectively. Patients within the age-group of 21 to 40 years had statistically significant ($p<0.05$) higher proportion of tuberculosis in humans. Overall mean prevalence of 1.4% and 12.9% was recorded for cattle and humans, respectively. This prompts intensification of control programmes against tuberculosis in both cattle and humans in the state.

Key words: Cattle, humans, tuberculosis, Enugu State, prevalence.

INTRODUCTION

Human and bovine tuberculosis (TB) are two forms of TB that cause significant disease in mammals (Beals, 2008). Bovine TB, which is commonly known to be caused by *Mycobacterium bovis*, is zoonotic (Ameni et al., 2003) and nearly all warm-blooded animals are susceptible to the infection. Human TB is mainly caused by *Mycobacterium tuberculosis* but in regions where bovine TB is prevalent in animals, human TB cases due to *M. bovis* may occur (Thoen et al., 2009). TB remains a major public health problem worldwide. The disease is widespread and affecting livestock and human health in Africa (Corbett et al., 2006). It is amongst the fastest killer disease in Nigeria today (Anosike, 2011) and in developing countries as a whole (Seyed et al., 2008).

There is an estimated population of 14 million cattle in Nigeria (Wosu, 2002) and 140,431,790 persons (National population commission, 2006), with significant continuously changing demographic factors such as population growth and structure. As a result, there is a considerable increase in the demand for animal products, in terms of both quantity and quality. Moreso, there is increasing contact between humans and animals due to increasing population density and growth, and traditional livestock husbandry practices, where man and livestock co-habit (Anon., 2005; Ofukwu et al., 2008), as seen in nomadic Fulani settlements in the country. To this effect, control of diseases such as TB and other zoonoses is a prerequisite. As TB remains a dreaded infection in Enugu state, prominent among rural farmers and their families (ACERDEN, 2010), a study to find out the association between bovine and human TB is very much relevant considering the high prevalence of TB in the country. It is against this background that this study is carried out to determine the prevalence of bovine and human TB in Enugu State, Nigeria, establish whether there is link between bovine and human TB, and ascertain the

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correlation between TB and epidemiological variables such as season, sex and age in the studied populations.

MATERIALS AND METHOD

The study area

The study area is Enugu State (5°N, 7°E), an inland state in southeast Nigeria (Figure 1). It lies on an estimated land area of 8,727.1 square kilometers. The state has a typical climate characterized by two distinct seasons – the wet and dry seasons. The wet season occurs between April and October with a break in August while the dry season lasts from November to April with a cold harmattan between December and January. The state has semi–tropical rain forest vegetation which changes gradually northwards from rain forest to savannah. The state has an estimated population of about 3,267,837 persons (National Population Commission, 2006), comprising 1,596,042 males and 1,671,795 females. Majority of the people are rural dwellers, with about 85% of them involved in subsistence agriculture. In urban areas, trading and civil service are the major occupation of the people. Abattoir slaughtered cattle is the main source of meat for the Enugu populace. Though most of these cattle come from neighboring northern states, small scale livestock farming of indigenous breeds (mainly Muturu) do exist but this accounts for less than 10% of the state's cattle population.

Study design

A retrospective study was carried out using abattoir and hospital records for cases of TB in cattle and humans, respectively, over a period of five years from 1st January 2004 to 31st December, 2008.

Study population

The study population comprises cattle slaughtered at Enugu State abattoirs and humans screened for TB at different TB diagnostic centres and hospitals in Enugu State within the five year period (2004 to 2008).

Sample and sampling method

The seventeen (17) Local government areas (LGA) of the state were grouped into three based on the senatorial zones - East, West and North. The sampling sites include three slaughter houses and nine TB diagnostic centres/hospitals selected from nine LGAs across the three zones. Purposive sampling technique was used to select one abattoir per zone based on slaughter capacity. Simple random sampling technique was used to select three hospitals per zone.

DATA COLLECTION

The sampled abattoirs include Ogige market slaughter house in Nsukka LGA (Northern Zone), 9th mile Ngwo slaughter house in Udi LGA (Western Zone), Ogbete market slaughter house in Enugu-North LGA (Eastern Zone). Routinely, cattle brought in for slaughter were subjected to procedures such as ante-mortem inspection, bleeding, flaying, evisceration and post-mortem examination before the carcass was conveyed to the market. State-employed veterinarians carried out the meat inspection in some of the abattoirs and state animal-health officers in some others.

Diagnosis of tuberculosis was based on gross detection of typical granulomatous caseated lesions in the lungs, lymph nodes, liver and/or other visceral organs. These slaughter houses make monthly and annual reports to the State ministry of agriculture detailing all slaughter statistics and diseases encountered. Data on enumerated bovine TB cases and slaughter statistics were obtained from the State ministry of agriculture and zonal veterinary clinics. Data collected include: total number of cattle slaughtered per month per year, number reported to have tuberculous lesions and sex of the animal. However, the records did not have information on the age of the animals, breed and organs affected.

Hospitals sampled in the Northern zone were Nsukka health centre in Nsukka LGA, Our Lady health of the sick in Uzo-Uwani LGA and Chest and skin clinic in Udenu LGA. In the Western zone, Udi district hospital in Udi LGA, Aguobu-Owa cottage hospital in Ezeagu LGA and Oji-River General hospital in Oji-River LGA were sampled. In the Eastern zone, Agbani district hospital in Nkanu-West LGA, Chest unit of the University of Nigeria teaching hospital in Enugu-North LGA and Ntasi obi ndi no n'afufu specialist hospital in Enugu-East LGA were sampled. These hospitals have laboratories for diagnosis of TB using acid-fast staining of sputum smears and X-ray in some cases in accordance with the national TB control programme. Cases with at least two sputum smears positive for acid fast bacillus or a chest radiograph suggestive of TB plus one sputum smear positive for acid fast bacillus were classified as being smear positive for TB. Cases with clinical finding suggestive of TB plus three sputum smears negative for acid fast bacillus at 2 to 3 weeks intervals were classified as smear negative TB. Data on all clinical cases and specifically for TB were made available to the State ministry of health on monthly and annual basis.

Data on human TB cases for the five year period (2004 to 2008) were obtained from the State ministry of health and laboratory registers in reference laboratories for TB in each of the nine hospitals sampled. These data contained information on the total number of suspected TB patients screened per month per year, number of confirmed cases, age and sex of affected individuals. However, the records had no information on the occupation of the patients.

Data analysis

Descriptive statistics such as mean, tables, graphs and charts were used to analyze the data. The prevalence of the disease was calculated for the different zones and the state as a whole. The sex, age and seasonal distribution were also determined. Chi-square analysis using Statistical package for social sciences (SPSS) version 17 for Windows 4th edition was used to determine the association between the disease and epidemiological variables such as sex, age and season.

RESULTS

Meat inspection records on cattle TB

Prevalence of TB in cattle slaughtered at Enugu State abattoirs

Ogbete market slaughter house, Enugu-North LGA accounted for 71.7% (38281) of the total slaughter and 38.9% (291) of enumerated TB cases. 9th Mile slaughter house, Udi LGA and Ogige market slaughter house, Nsukka LGA accounted for 4843 (9.1%) and 10242

Table 1. Prevalence of TB in abattoir slaughtered cattle in Enugu State, 2004 to 2008.

Year	No. of cattle slaughtered	No. with TB lesions	Prevalence (%)
2004	9286	131	1.4
2005	10307	113	1.1
2006	10278	217	2.1
2007	11789	176	1.5
2008	11726	111	0.9
Total	53365	748	1.4
Average	10677.2	149.6	1.4

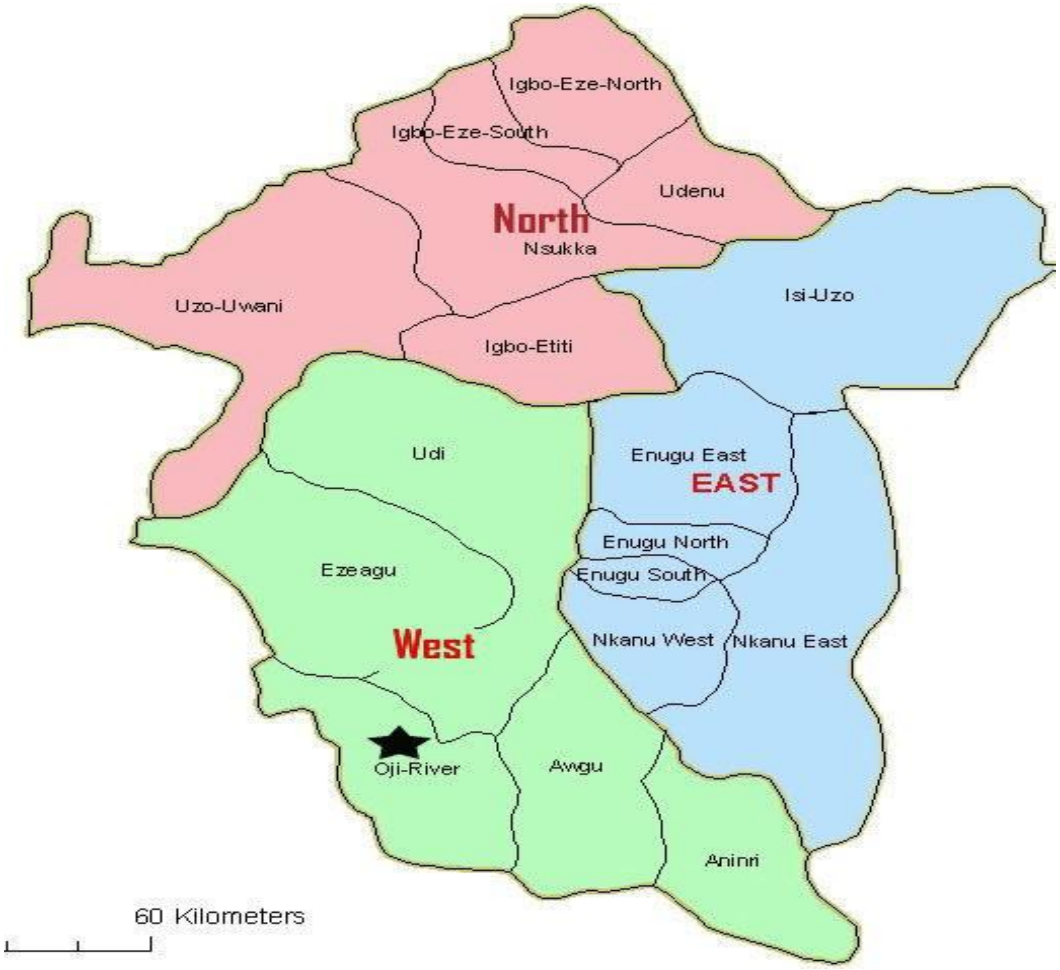

Figure 1. Administrative map of Enugu State showing the sampling sites.

(19.2%) of the total slaughter, respectively, while 179 (24%) and 278 (37.2%) TB cases were also recorded, respectively. The Western zone (9th mile slaughter house, Udi LGA) had the highest prevalence of 3.7%. The Eastern zone (Ogbete market slaughter house, Enugu-North LGA) and Northern zone (Ogige market slaughter house, Nsukka LGA) had prevalence of 0.7 and 2.7%, respectively. The overall prevalence and mean prevalence for the state was 1.4% (Table 1 and Figure 3).

Seasonal distribution of bovine TB in Enugu State abattoirs

Out of 27687 cattle slaughtered in the rainy season, 378 (50.5%) had tuberculous lesions. A total of 25678 cattle were slaughtered during the dry season, of which 370 (49.5%) showed TB lesions. Prevalence of 1.3 and 1.4% were recorded for rainy and dry seasons, respectively. The variation in seasonal prevalence is not significant

(P>0.05), as such there was no association between the occurrence of bovine TB and season in the state.

Sex distribution of TB in abattoir slaughtered cattle

Bulls accounted for 273 (36.5%) of the 748 suspected TB cases recorded, with a prevalence of 0.6%. Cows had a prevalence of 6.9%, accounting for 475 (63.5%) of TB cases. Cows were significantly (P<0.05) affected than bulls.

Hospital records on human TB (2004 to 2008)

Prevalence of human TB in Enugu State Hospitals

The Eastern zone had the highest number of people screened for TB, 10625 (57%), followed by the Northern zone, 6309 (32.3%) and the Western zone, 2078 (11.7%). The prevalence of the disease was highest in Western zone (14.4%); followed by the Eastern zone (13.4%) and the Northern zone (11.5%). The overall prevalence and mean prevalence for the state recorded was 12.9% (Figure 3).

Seasonal distribution of Human TB in hospitals in Enugu State

A total of 9583 patients were tested for TB in the rainy season, of which 1270 (1.3%) were positive. In the dry season, 1182 positive cases were recorded, out of 9436 persons tested. A prevalence of 13.2% was recorded in the rainy season while 12.5% was recorded in the dry season. Statistical analysis showed that the variation in seasonal prevalence was not significant (P>0.05).

Sex distribution of human TB in hospitals in Enugu State

Males accounted for 1383 (56.4%) of TB cases while 1069 (43.6%) were observed in females. Sex- specific prevalence was 13.9 and 11.8% for males and females, respectively (Figure 4). The male to female ratio was 1.3:1. Sex-specific prevalence was significantly (P<0.05) higher in males than females.

Age distribution of TB in humans in Enugu State

Age-specific prevalence (15.8%) was significantly (P<0.05) higher among patients of 21 to 40 years, accounting for 56.7% of TB patients.

DISCUSSION

For the five-year period (2004 to 2008), the average prevalence of TB in humans (12.9%) is approximately ten times that observed in cattle (1.4%), as shown in this study. The overall prevalence of 12.9 and 1.4% for humans and cattle, respectively, recorded in this study compares with that for similar studies conducted in other parts of the country. Aliyu et al. (1993), Garba (2001), Bikom et al. (2007) and Ameen et al. (2008) reported prevalence values of 2.1, 0.8, 1.1 and 0.55% for Maiduguri, Sokoto, Cross River and Ogbomosho areas, respectively. In humans, varying prevalence values of 15.9% (Nwachukwu et al., 2009), 21.7% (Okodua et al., 2004), 31% (Nwankwo et al., 2005), 32.5% (Chigbu et al., 2005) were reported for Abia state, Edo state, Kano and Aba metropolis, respectively. The prevalence recorded in the cattle agrees generally with Ofukwu ((2006)) who stated that the prevalence of bovine TB was higher in the southern part of the country than in the north. Since most of the cattle slaughtered in the south come from the north, the higher prevalence of cattle TB in the south could probably be due to the movement of higher number of sick animals from the north to the south for sales and slaughter. The high prevalence (12.9%) recorded in humans may be connected to the increasing prevalence of HIV/AIDS put at 6.5% for Enugu State (Edike, 2008). Though the graphical trend analysis of the annual prevalences of the disease in both studied populations show similarity (Figure 2), the reason for the fluctuation of annual prevalence rates for the entire study period was not clear. However, the findings give evidence of the declining prevalence of the disease since 2006. This gives some rays of hope that intervention strategies by government and other agencies are working.

TB prevalence values differ in each zone of the study area probably due to the socio-economic status of its inhabitants. The western zone had the highest prevalence in both cattle and human populations for the five-year period under study. Inadequacies in capacity coupled with lack of thoroughness of the veterinary staff carrying out meat inspection could have played major roles to influence the prevalence of the disease in cattle. This agrees with Corner et al. (1990) and Shitaye et al. (2006) who reported that post-mortem surveillances for detection of bovine TB lesions in particular depend on the work load, time, and diligence of the inspector conducting the examination. The high prevalence in the western zone can also be related to the fact that cachexic cows were mainly slaughtered in abattoirs in this zone, perhaps, due to the low income of the rural populace (Okoro, 2010). This is in contrast to Enugu-East, which harbors the state capital and with a high population of civil servants and elites, thus, more healthy and castrate bulls were slaughtered (Okoro, 2010). Secondly, relatively more thorough and strict routine inspection of meat and meat products is carried out by qualified

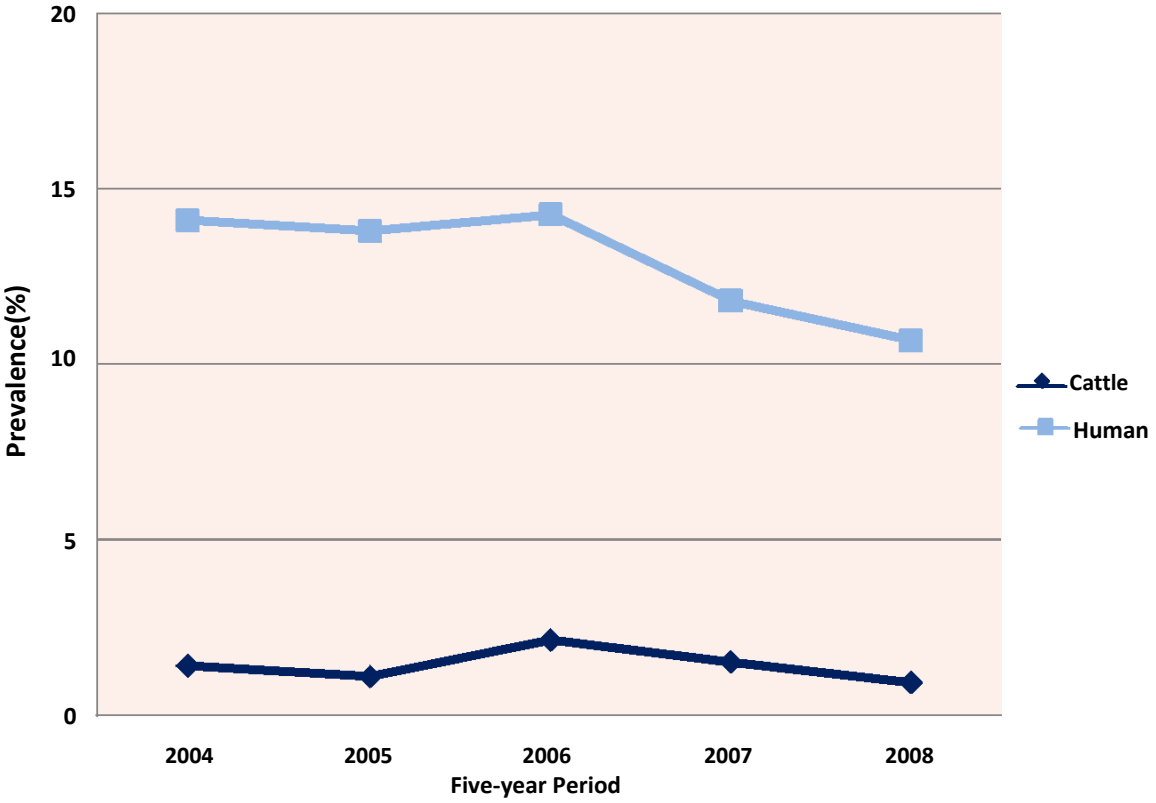

Figure 2. Graph showing the trend of TB in cattle and humans in Enugu State, 2004 to 2008.

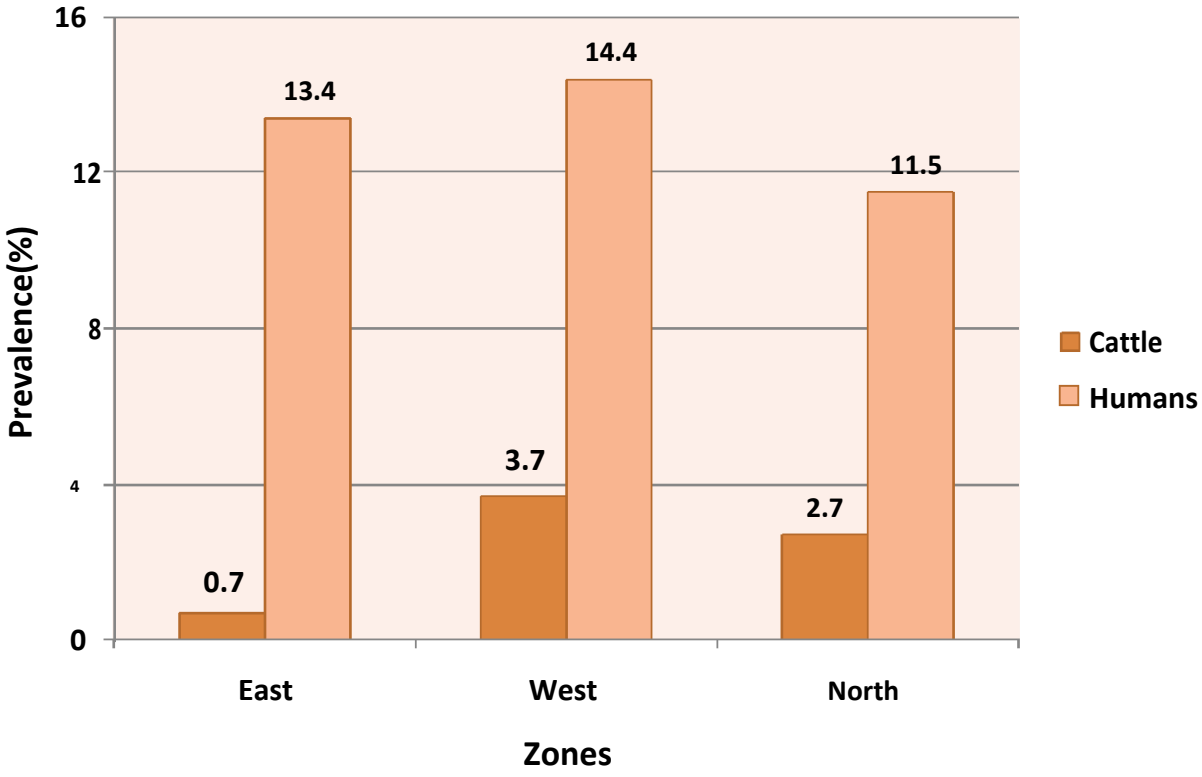

Figure 3. Average prevalence of TB in cattle and humans in Enugu State by zones, 2004 to 2008.

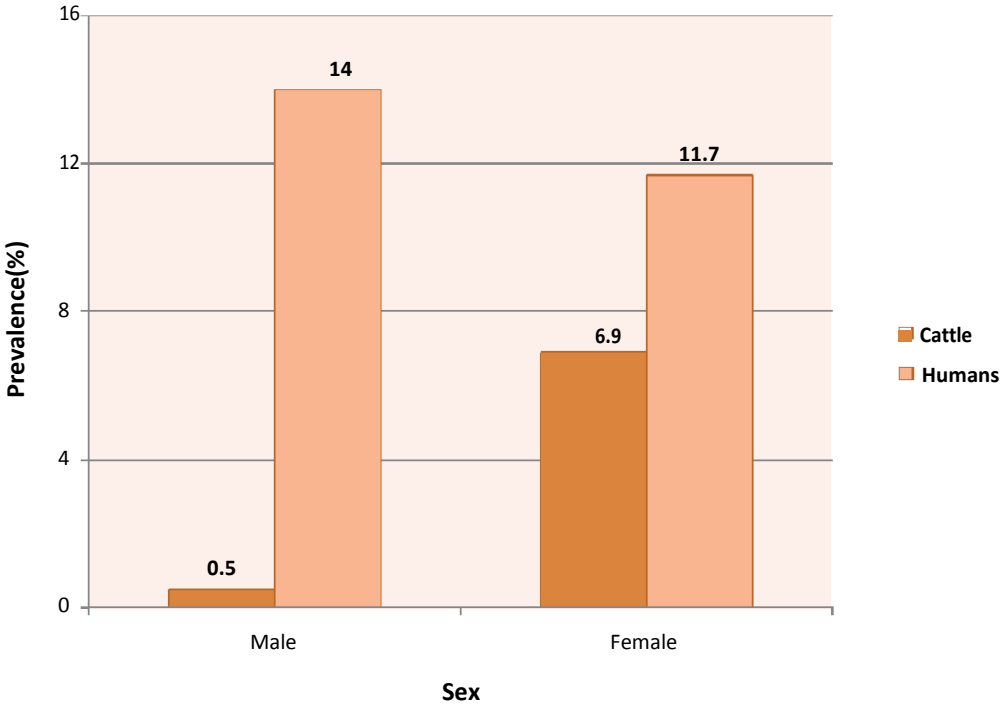

Figure 4. Sex-specific prevalence of TB in cattle and humans in Enugu State, 2004 to 2008.

Table 2. Prevalence of human TB in hospitals in Enugu State, 2004 to 2008.

Year	No. of persons tested	No. of positive cases	Prevalence (%)
2004	2996	445	14.1
2005	3235	447	13.8
2006	3961	567	14.3
2007	4065	480	11.8
2008	4755	513	10.7
Total	19012	2452	12.9
Average	3802.4	490.4	12.9

veterinary personnel in the state capital than in any other Local Government Area studied. Consequently, butchers and owners of slaughtered cattle are afraid of carrying sick cattle to the state capital for fear of being condemned (Okoro, 2010). The relatively high mean prevalence of human TB in Enugu-East could be as a result of the fact that most patients, who visited the sampled TB centres, are mainly residents of rural areas (based on available medical records), as they believe they can get better health care in the state capital, which has two tertiary health institutions (Table 2). This had resultant increase in the number of participants in Enugu-East,when compared with other zones. The high population density in this zone may have also contributed to the high prevalence in humans in this region.

Statistical analysis showed there was no statistically significant difference in the prevalence of TB in cattle and humans and season. However, the prevalence of TB lesions in cattle was higher during stressful periods such as the dry season, when there is scarcity of forage and water, and farmers tend to sell unhealthy and aged animals to invest in the cropping season and avoid the stress of the dry season. This is similar to the findings of Ofukwu (2006) and Ndukum et al. (2010) for Benue state abattoirs and neighbouring Cameroun, respectively. The reason for the higher prevalence of the disease in the rainy season in humans was not clear. However, it may be attributed to the increased activity of flies, which are known to be mechanical transmitters of *Mycobacterium* spp (Greenberg, 1973; Khan et al., 2007; Kazda et al., 2009) and could have contaminated human food during this period of the year.

Sex-associated prevalence differed in both studied populations. Cows and males were both significantly

Table 3. Age distribution of human TB in hospitals in Enugu State, 2004 to 2008.

Age (years)	Total No. of persons examined	Total No. with TB	Prevalence (%)
0-20	1743	255	14.6
21-40	8825	1390	15.8
41-60	5749	639	11.1
>60	2702	197	7.3
Total	19012	2452	

(P<0.05) affected in cattle and humans respectively. The findings of Milan et al. (2000), Garba (2001), Chamala et al. (2004), Itah et al. (2005), Bikom et al. (2007) and Nwachukwu et al. (2009) confirmed this trend. This result was no surprise as both sexes had higher exposures to the risk of the disease in the different populations. Cows usually stayed longer in the herd for breeding purposes and may encounter more exposure than bulls, while occupation and lifestyle put men at higher risk than female persons.

Age distribution of TB cases in humans showed that individuals between the age-group of 21 to 40 years were significantly (P<0.05) affected (Table 3). This is similar to the findings of Chamala et al. (2004) in China. This is probably due to the fact that individuals in this age-group are able-bodied men and women with higher exposure to the risk factors. It may also be connected to the high incidence of HIV/AIDS among young adults in Nigeria (WHO, 2007), as infection with HIV/AIDS facilitates the process towards active TB when exposed. Okodua et al. (2004) and Acholonu et al. (2010) corroborated this fact, when they reported significantly higher HIV/AIDS and TB co-infection in individuals belonging to the age-group, 21 to 50 years, in Benin-City and Imo state, respectively. This finding is of great concern because of its socio-economic impact on the state and nation at large, as this group of persons constitutes the manpower of the economy.

The prevalence rates reported in this study could actually be underestimations of the real situation. Most importantly, the detection rate of TB lesions in abattoirs can be affected by the differential diagnosis of *M. bovis* infection in cattle such as parasites, non-specific reactions (Corner, 1994; Shitaye et al., 2006), irregularities of abattoir meat inspections (Edwards et al., 1997) and poor clinical meat inspection records (Ndukum et al., 2010), which could not be relied upon.

Conclusion

Though the prevalence of TB in both studied population is on the decline, the disease is still prevalent in the study area. Also, no link was established between human and bovine TB in this study because the specie level of *Mycobacterium* was not determined. However, the findings though inconclusive, suggest many opportunities abound for the emergence of zoonotic TB. It cannot be ignored that a proportion of TB in humans may have been caused by exposure to *M. bovis*. As this is a preliminary work, this necessitates further coordinated intensive and extensive studies into the modes of transmission and link between bovine and human TB.

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