International Journal of Animal and Veterinary Advance 2(2): 43-46, 2010
ISSN: 2041-2908

Submitted Date: January 09, 2010 Accepted Date: February 04, 2010 Published Date: April 15, 2010

Mycobacterium Avium and *Mycobacterium intracellulare* Infections in Slaughtered Pigs in Makurdi, North-Central Nigeria: An Emerging Zoonosis

[1]R.A. Ofukwu, [1]B.K. Iortyom and [2]C.A. Akwuobu
[1]Department of Veterinary Public Health and Preventive Medicine,
University of Agriculture, Makurdi, Nigeria
[2]Department of Veterinary Pathology and Microbiology, University of Agriculture,
Makurdi, Nigeria

Abstract: *Mycobacterium avium* and *Mycobacterium intracelluare* (*Mycobacterium avium* complex) infections in 462 randomly selected slaughtered pigs in Makurdi were determined over a period of 6 months to access the disease burden and potentials for human infection. Standard methods of acid-fast microscopy, culture and biochemical tests were used. Twelve (2.6%) of the 462 pigs slaughtered over a period of 6 months were infected with *Mycobacterium avium/intracellulare* (*Mycobacterium avium* complex). The infections were observed in all the months with an average monthly rate of 2.0%. Of the number infected, 7 (58.3%) were female and 5 (41.7%) were male with sex specific incidence rate of 3.3 and 2.0% respectively. Seventy-five percent of the infected were old while 25% were young ones with age group specific incidence rates of 5.5 and 1.0% respectively. Breed specific incidence rate of 5.9% for local breed was significantly ($p<0.05$) higher than 1.4% for exotic and cross breeds combined. One hundred and seventy three (37.4%) pigs from Makurdi and other parts of Benue State, were more affected than the 289 (62.6%) from other parts of Nigeria with respective source specific rate of 6.2 and 2.4%. Respondents indicated that most of the pigs were reared by extensive and semi-intensive systems with very few on intensive systems. The chance of human infection via consumption of infected carcass or contaminated food and water is high. The need for urgent diagnosis and control of the infection is highlighted.

Key words: Extensive system, incidence, intensive system, MAC, semi-intensive system, sex

INTRODUCTION

Infections of pigs by Mycobacterium avium and Mycobacterium intracellulare (Mycobacterium avium complex) have been reported in some parts of Nigeria (Idigbe *et al*., 1986; Cadmus, 2003). The pigs are mainly infected by ingestion of soil, litter, dust or danders contaminated by faeces of tuberculous chicken or consumption of improperly processed infected chicken offals (Ensminger and Parker, 1984; Theon and Karlson, 1990; Radostits *et al*., 2000). Infection in pigs is usually subclinical and is normally characterised by localised inflammation of cervical and mesenteric lymph nodes, occasionally generalised, resulting in carcass rejection at abattoirs (Lepper and Corner, 1983; Thoresen and Saxegaard, 1993).

Economic loss occur due to reduced performance, reduced weight gain and carcass condemnation at slaughter, it is also a zoonosis with high public health implication, and is being increasingly isolated from HIV/AIDS patients and other immuno-compromised persons (Wolinsky, 1979; Goldman, 1987). The increasing isolation of this pathogen from persons presents a serious danger to Benue state human population with very high HIV/AIDS prevalence rate (13.5%), high pig population (2.1 million) (Oche, 2000; FMH, 2003) and high rate of pork consumption. The pig and pork have very high trado-cultural value as animal of prestige and delicacies respectively among more than half of the Benue state population. It is usually the first choice animal for celebrations and burial ceremonies in the communities.

The scenario is compounded by the paucity of epidemiological information on non-tuberculous tuberculosis in Nigeria. No known epidemiological study of this emerging zoonosis has been done for Benue State. The study determined the incidence rate and distribution of *Mycobacterium avium* Complex (MAC) infection in the pig population in Makurdi with a view to assess the burden in Benue state. It also highlighted the implication of this emerging zoonosis in a highly immno-compromised, predominantly pig eating poor population.

MATERIALS AND METHODS

Study area: The study area was Makurdi capital city of Benue State, Nigeria. The city lies on the flood plain of River Benue, on latitude 7º44′N and longitude 8º54′E in

Corresponding Author: R.A. Ofukwu, Department of Veterinary Public Health and Preventive Medicine, University of Agriculture, Makurdi, Nigeria

the Guinea savannah belt of subsahara Africa. It forms one sixth of the total state land area of 33,706 km^2 and with a population of about 300,000 persons (NPC, 1991) and 132,000 pigs (Oche, 2000). The pigs were mostly reared by extensive system with roofs or nightshades in close contact with human houses. The exotic and crossbreeds were reared mostly by intensive system.

Sample collection: A joint participatory meat inspection was conducted with the veterinary officers at the major slaughter slab Wurukum-Makurdi for a period of six months, October 2007 to March 2008 as described by Wilson (1991). All the slaughtered pigs for each visit (Monday and Friday of the week) were identified and examined. They were identified by sex, age group and breed by visual observation of phenotypic characteristics (Dalton, 1985). Information on sources of supply was obtained from respondent traders and butchers. During inspection, granulomatous lymph nodes, firm caseous tissues, and tissues with nodular lesions were obtained from suspects. The specimens were mainly submandibular, cervical, and mesenteric lymph nodes, parts of lungs, spleen, and liver. The suspected lymph nodes and tissues were transported to the laboratory in sterile plastic bags within 4 hours. These were stored in the refrigerator at -4ºC until further processed.

Sample analysis: The standard methods of decontamination and concentration of specimen for acid-fast microscopy as described by Pratt (1985) was used. Each acid-fast positive sample was inoculated in triplicate into Lowenstein-Jensen media with isoniazid (INH). The three slants were separately incubated at 25, 37 and 40ºC in a CO_2 gassed chamber and observed for growth after three weeks. Smooth, dysgenic, opaque, colonial growth in all incubating temperatures, that changes to yellow colour when left for 2 to 3 more weeks were identified as MAC. Other pathogenic non-tubercular *Mycobacterium* species of pigs do not grow on media with INH at temperatures of 25 and 40ºC. Growths from positive samples were subjected to nitrate reduction, niacin production, and pigmentation tests as described by Kent and Kubica (1985). Positive growths which were negative for nitrate reduction and niacin production tests and without pigmentation were regarded as MAC. The data were analysed using descriptive statistics, chi square and student 't' test as described by Akindele (1996).

RESULTS

Twelve (2.6%) of the 462 pigs slaughtered and examined were infected with *M. avium/intracellulare* (MAC). Only 12 (21.1%) of the 57 suspected lesions were positive for MAC. The infection occurred in all the months with the highest (5.1%) in December and lowest (1.3%) in November (Table 1).

Table 1: Monthly distribution of MAC infection based on gross lesions and biochemical tests

Months of year	Total examined	Total with lesions (%)	Total confirmed positive (%)
October '07	103	13 (12.6)	3 (2.9)
November '07	77	4 (5.2)	1 (1.3)[b]
December '07	39	11 (28.2)	2 (5.1)[c]
January '08	68	1 (1.5)	1 (1.5)[b]
February '08	128	21 (16.4)	4 (3.1)[a]
March '08	47	7 (14.9)	1 (2.1)[a]
Total	462	57 (12.3)	12 (2.6)
Mean	77	9.5	2.0

Figures in parenthesis were calculated as percentages of the numbers examined
Figures with different superscripts are significantly different ($p<0.05$)

Table 2: Sex distribution of MAC infection among pigs slaughtered in Makurdi slaughter slabs (October 2007 – March 2008)

Sex	No. examined (%)	No. with lesions (%)	No. confirmed positive (%)
Male	247 (53.5)	19 (7.7)	5 (2.0)
Female	215 (46.5)	38 (17.7)	7 (3.3)
Total	462	57 (12.3)	12 (2.6)

Table 3: Age distribution of MAC infection among pigs slaughtered in Makurdi slaughter slabs (October 2007 – March 2008)

Age	No. examined (%)	No. with lesions (%)	No. confirmed positive (%)
0 - 2	299 (64.7)	15 (5.0)	3 (1.0)[a]
> 2	163 (35.3)	42 (25.8)	9 (5.5)[b]
Total	462	57 (12.3)	12 (2.6)

Figures with different superscripts are significantly different ($p<0.05$)

Table 4: Breed distribution of MAC infection among pigs slaughtered in Makurdi slaughter slabs (October 2007 – March 2008)

Breed	No. examined (%)	No. with lesions (%)	No. confirmed positive (%)
Exotic	146	15 (10.3)	2 (1.4)[a]
Cross breeds	215	20 (9.3)	4 (1.9)[a]
Local breeds	101	22 (21.8)	6 (5.9)[b]
Total	462	57 (12.3)	12 (2.6)

Figures with different superscripts are significantly different ($p<0.05$)

Table 5: Geographical distribution of MAC infection among pigs slaughtered in Makurdi slaughter slabs (October 2007 – March 2008)

Source	No. examined (%)	No. with lesions (%)	No. confirmed positive (%)
Benue	173	27 (15.6)	5 (2.9)
Other parts of Nigeria	289	30 (10.4)	7 (2.4)
Total	462	57 (12.3)	12 (2.6)

Of the 12 infected, 5 (41.7%) were male, while 7 (58.3%) were female. Sex specific incidence rate was higher in female (3.3%) than in male (2.0%) (Table 2).

Table 3 shows the age distribution of the infection. Three (1.0%) of the 299 young and 9 (5.5%) of the 163 old were MAC-positive. Seventy-five percent of the total pigs infected were old, while 25% were young ones.

Breed specific incidence rate was significantly ($p<0.05$) higher in local breeds (5.9%) than in the cross (1.9%) and exotic breeds (1.4%) (Table 4).

The sources of supply of the slaughtered pigs were Makurdi area, 117 (25.3%), other parts of Benue State 56 (12.1%) and other parts of Nigeria, 289 (62.6%). Source specific incidence rates were 2.6, 3.6 and 2.4% for Makurdi, other parts of Benue State, and other parts of Nigeria respectively (Table 5). The exotic breeds 146 (31.6%) came in mainly from southern part of Kaduna and Zaria. Pigs from other parts of Nigeria were less affected than those from Benue State.

Most interviewees indicated that the pigs were reared by extensive and semi-intensive system, hardly with any veterinary attention.

DISCUSSION

The detection of MAC in slaughtered pigs in Makurdi is a confirmation of its presence in North-central Nigeria and also of similar reports in Nigeria (Ayanwale *et al*., 1991; Cadmus, 2003). The incidence rate of 2.6% obtained in this study is however lower than the 6.5% reported for Ibadan, Southwest Nigeria by Cadmus (2003). This may be due to the fact that at least 31.6% of the pigs, some exotic breeds, in this study were reared by intensive system, with attendant good health management, compared to the population of local pigs on free range sampled by Cadmus (2003) in his study.

The highest infection rate (5.1%) in December may not be unconnected with the high volume of slaughter, particularly older ones, during Christmas festivities and cash for household use. We observed that infection rates were higher in older and female pigs. This collaborates the reports of Straw *et al*. (1999), Radostits *et al*. (2000) and Songer and Post (2005). We think this may be due to the insidious nature of the disease, which requires long time (aging) to establish, hence the higher rates in older pigs particularly female breeders.

It was also observed that the local and crossbreeds have higher incidence rates than the exotic breeds. This agrees with the work of Ensminger and Parker (1984) and Radostits *et al*. (2000). This condition might be due to poor management system with attendant high health burden used mainly for local and cross breeds compared to good intensive system used for exotic breeds.

Pigs brought to Benue State from other parts of Nigeria were slightly less affected than those sourced within. This may be due to the fact that good number (31.6%) of those brought in, including the exotic breeds, were reared by intensive system (with good health management) while the indigenous ones were reared on free range with high health hazards (Ensminger and Parker, 1984; Songer and Post, 2005)

The public health implication of the presence of an opportunistic, zoonotic MAC in slaughtered pigs in a predominantly pig eating poor Benue population with high incidence (13.1%) of HIV/AIDS is grievous. The zoonotic potentials of diseases caused by MAC in HIV/AIDS or immuno-compromised persons have been severally reported (Wolinsky, 1979; Berrera and deRanto, 1987; Blood and Radostits, 1989; Wayne *et al*., 1992; Chin *et al*., 1994; Radostits *et al*., 2000). The spread of the emerging disease in Benue State could also be enhanced with the prevailing poor environmental conditions, poor resources, holdings, urban population congestion and malnutrition, and hence the need for control. The control of this emerging zoonotic disease in human should be effected through public health education, proper meat inspection, hygiene; proper cooking of pork and poultry meat, disposal of animal beddings and good health management. Animal to animal transmission should be prevented by proper cooking of poultry offals, prevention of over crowding, swine and poultry contact, and proper disposal of wastes.

CONCLUSION

The incidence rate of MAC in pigs in Makurdi Nigeria was 2.6%. This occurred all the year round, affecting all ages and sex. The potential of human infection is very high in this predominantly pig eating poor population with high incidence of HIV/AIDS. Control strategies in both animals and humans are recommended.

ACKNOWLEDGMENT

We acknowledge the effort of Miss Naomi Oteh, a laboratory technologist at the Department of Veterinary Public Health and Preventive Medicine, University of Agriculture, Makurdi, Dr. I. Okewole of Bacteriology laboratory, National Veterinary Research Institute, Vom, Jos, and Mr. K. Terwase of National Leprosy and Tuberculosis Centre, Mkar – Gboko for the analysis of samples. We are also grateful to Professor A.E.J. Okoh of the Department of Veterinary Public Health and Preventive Medicine, University of Agriculture, Makurdi, Nigeria for his input during and after the study.

REFERENCES

Akindele, S.O., 1996. Basic Experimental Designs in Agricultural Research. 2nd Edn., Royal Bird Ventures, Mushin, Lagos, Nigeria, pp: 23-37.

Ayanwale, F.O., G.A.T. Ogundipe and I.G. Adeyemi, 1991. Characterisation of *Mycobacterium* species isolated from slaughtered food animals in southwest Nigeria (1988-1991). Trop. Vet., 9: 181-185.

Berrera, L. and I.N. deRanto, 1987. Non-tuberculosis mycobacteria and *M. bovis* as a cause of human disease in Argentina. Trop. Geo. Med., 39: 222-227.

Blood, D.C. and O.M. Radostits, 1989. Diseases caused by bacteria-IV. Veterinary Medicine. 7th Edn., Bailliere Tindall Ltd., London, pp: 710-719.

Cadmus, S.I.B., 2003. Tuberculosis in food animals. Nig. Vet. J., 24(3): 72-75.

Chin, D.P., P.C. Hopewell, D.M. Yajko, E. Vittingboff, C.R. Horsburgh, W.K. Hadley, E.N. Stone, P.S. Nasso, S.M. Ostroff, M.A. Jacobson, C.C. Matkin and A.L. Reingold, 1994. *Mycobacterium avium* complex in the respiratory or gastrointestinal tract and the risk of *Mycobacterium avium* complex bacterium in patients with human immunodeficiency virus infection. J. Infect. Dis., 169: 289-295.

Dalton, D.C., 1985. An Introduction to Practical Animal Breeding. 2nd Edn., Collons Professional and Technical Books, pp: 84-88.

Ensminger, M.E. and R.O. Parker, 1984. Tuberculosis: In: Swine Science. 5th Edn., Danrille, Illinois, pp: 326-327.

Federal Ministry of Health (FMH), 2003. Animal report of prevalence of HIV/AIDS, state by state of Nigeria, p: 5.

Goldman, P.K., 1987. AIDS and Tuberculosis. Br. Vet. J., 295: 511-512.

Idigbe, E.O., C.E. Anyim and D.I. Onwuejekwe, 1986. Human pulmonary infection with bovine and atypical mycobacterial infection in Lagos, Nigeria. J. Trop. Med. Hyg., 7: 384-387.

Kent, T.P. and G.P. Kubica, 1985. Public health mycobacteriology. A guide for level III laboratory. United States. Human Health Services. Centre for Disease Control, Atlanta. Georgia, 30: 333.

Lepper, A.W.D. and I.A. Corner, 1983. Naturally Occurring Mycobacteriosis of Animals. In: Ratledge, C. and J. Stanford, (Eds.), The Biology of Mycobacteria 2. Academic University Press, London, pp: 417-521.

National Population Commission (NPC), 1991. Nigeria and its people. Workshop series, 11: 5.

Oche, D.I., 2000. The Benue, livestock population. Proceeding of the 25th annual conference of the Nigerian Society for Animal Production. Michael Okpara University of Agriculture, Umudike, Nigeria, March, pp: 19-23.

Pratt, P.W., 1985. Diagnostic Veterinary Microbiology. In: Laboratory Procedures for Animal Health Technicians. 1st Edn., American Veterinary Publications, Inc., pp: 162-164.

Radostits, O.M., C.C. Gay, D.C. Blood and K.W. Hinccliff, 2000. Diseases Caused by Bacteria-IV. In: Veterinary Medicine. 9th Edn., W.B. Saunders Ltd. Edinburgh, London, New York, Oxford, Philadelphia, St. Louis, Sydney, Toronto, pp: 909-933.

Songer, J.G. and K.W. Post, 2005. The Genus Mycobacterium. In: Veterinary Microbiology: Bacterial and Fungal Agents of Animal Disease. Elsevier Saunders, pp: 95-104.

Straw, B.E., S. Allaire, W.L. Mengeling and D.J. Taylor, 1999. Tuberculosis. In: Diseases of Swine. 8th Edn., Iowa State University Press, pp: 601-608.

Theon, C.O. and A.G. Karlson, 1990. Tuberculosis. In: Leman, A.D., B. Straw, R.D. Glock, W.L. Mengeling, R.H.C. Penny and E. School, (Eds.), Diseases of Swine. pp: 484-493.

Thoresen, O.F. and F. Saxegaard, 1993. Comparative use of DNA probes for *Mycobacterium avium* and *Mycobacterium intracellulare* for serotyping, for identification and characterisation of animal isolates of *Mycobacterium avium* complex. Infect. Dis., 161: 217-222.

Wayne, I.G. and H.A. Sramek, 1992. Agents of newly recognised or infrequently encountered mycobacterial diseases. Clin. Microbiol. Rev., 5: 1-25.

Wilson, A., 1991. Practical Meat Inspection. 3rd Edn., Public Blackwell Scientific Publications, London.

Wolinsky, E., 1979. Non-tuberculous mycobaceria and associated diseases. Am. Rev. Resp. Dis., 119: 107-159.