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ARTICLE

House Rats, *Rattus Rattus*, as Reservoirs of Salmonellae in Gboko, North Central Nigeria: Implications for Human Health

OFUKWU, R. A.[*1], OCHE, D.[2] and AKWUOBU, C. A.[3]

[1]Department of Veterinary Public Health and Preventive Medicine, University of Agriculture, Makurdi, Nigeria; [2]Department of Livestock Production, College of Agriculture, Yandev, Gboko, Nigeria; [3]Department of Veterinary Pathology and Microbiology, University of Agriculture, Makurdi, Nigeria. *Corresponding Author: E-mail: ofu_kwu@yahoo.com. Tel.: 08065799831

SUMMARY

The occurrence and carrier rate of *Samonella* in house rats at various sites in Gboko, North Central Nigeria was determined from October 2008 to June 2009. Cultural, biochemical and serological tests as modified were used for isolation and identification. A carrier rate of 8.7% was observed as 9 of the 104 sampled were salmonellae positive. Those caught from around waste dumps had significantly higher ($p<0.05$) carrier rate than rats from other locations. The distribution of the isolates in the 9 positive rats were mixed infection of *S. enterica* ser. Typhumurium and *S. enterica* ser. Enteritidis in 3 (33.3%), *S. enterica* ser.Newport and *S. enterica* ser.Weltevreden2 (22.9%), *S. enterica* ser.Typhimurium and *S. enterica* ser.Newport 1(11.1%), and *S. enterica* ser.Typhimurium only in 2 (22.2%) and *S. enterica* ser. *Enteritidis* only in 1(11.1%). Species specific carrier rates were however, *S. enterica* ser.Typhimurium (5.8%), *S. enterica* ser.Enteritides (3.8%), *S. enterica* ser. Newport (2.9%) and *S. enterica* ser.Weltevreden (1.9%) when the total sampled is considered. The potentials of human infection by these salmonellae via food borne intoxication are discussed.

KEY WORDS: House Rats, Salmonellae, Human Health, livestock, epidemiology.

INTRODUCTION

One of the most significant bacterial zoonoses in Nigeria is salmonellosis. It accounts for more than 20% of febrile illness in poor rural communities of Nigeria (Idris *et al.*, 1995). Researches conducted in the country for identification of the reservoir, epidemiology and control are most often restricted to humans, companion animals and livestock, leaving out wild but "neighbourhood" animals like rats (***Rattus rattus***). Rats, with its high population and its use as delicacies in some communities, has unfortunately been reported to harbour various species of *Salmonella* (Sharma *et al.*, 1980; Toms, 2000; Songer and Post, 2005) as reservoirs. Suresh *et al.* (1980) reported on the importance of these pests in the transmission, epidemiology and control of salmonellosis in animals and man.

Humans can get infected by oral contact with faecal droppings of infected pests contaminating indoor environments, including stored grains, foods, water and household utensils (Suresh *et al.*, 1980; Songer and Porker, 2005). Prevalence rate of up to 7.1% in rats (Oche, 2002) has been reported in Nigeria. The isolation of these zoonotic pathogens is of public health importance as these are known for their association with diarrhoea, septicaemia, food poisoning and other diseases. This

presents great danger to humans in Nigeria, particularly the North Central area where no known information of the reservoir status of these wild animals exists. This is despite the high population of rats and general unsanitary condition of the town. This study therefore was to determine the occurrence and public health potential of salmonellae in the intestinal contents and visceral organs of household rats

MATERIALS AND METHODS

Animals

One hundred and four house rats were randomly captured by bait traps from around households, waste dumps, grain stores and hospitals in Gboko from October 2008 to June 2009. The bait traps were laid every fortnight and there after inspected every day after setting. Captured rats were immediately disinfected in 70% alcohol and transported in sterile polythene bags to the laboratory and stored at -4°C until used for analysis.

Processing of Samples

In the laboratory at the National Tuberculosis and Leprosy Centre, Yandev, Nigeria, each captured rat was properly identified according to Hsu (1979) as modified by Idris *et al*. (1995). It was then mounted dorsally on a dissecting board and the ventral surface was cut open by midline incision from the anal region to the neck. The gastrointestinal tract with its contents and other visceral organs were collected and processed for isolation of salmonellae using a modification of the method described by Oboegbulem (1993).

Culture and Biochemical Tests

The guts with its contents and the visceral organs were blended together in some quantity of Selenite-F-broth to homogenize the content. Two swabs per each homogenized sample were separately inoculated into 10 ml of Selenite-F-broth and incubated at 37°C for 24 hours.

A loopful of the Selenite-F-broth cultures was streaked into MacConkey agar and Brilliant Green agar and again incubated at 37°C for 24 hours.

A non-lactose fermenting colony from each agar was picked and sub-cultured on MacConkey agar and incubated at 37°C overnight to obtain pure cultures. These pure cultures were subsequently subjected to biochemical tests at the Federal Medical Centre, Makurdi diagnostic laboratory using the method described by Barrow and Felthan (1993) to show typical *Salmonella* characteristics.

Serology to show antigenic characterization of the *Salmonella* isolates was done at the National Veterinary Research Institute, Jos, Nigeria. This was done using the rapid serum agglutination technique with polyvalent and monovalent somatic and flagella antisera (poly Al-V) as described by Le-Minor and Popoff (1987). The data were analyzed using rates and proportions and then subjected to chi square and student "t" tests as described by Swinscow (1985).

RESULTS

Nine (8.7%) of the 104 house rats screened harboured salmonellae. Those caught from around refuse dumps had significantly ($P<0.05$) higher carrier rates (11.8%) than those from around houses (8.6%), market (7.9%) and hospital (7.1%) (Table I).

Presence of the organism in the rats generally increases as the period of raining season increases with the highest carrier rate (15.4%) in the month of September (Table II).

Specific *Salmonella* species carrier rates were *S. enterica ser. Typhimurium* (5.8%), *S. enterica ser.Enteritidis* (3.8%), *S. enterica ser.Newport* (2.9%) and *S. enterica ser.Weltevreden* (1.9%). Mixed infection of *S. enterica ser.Typhimurium* and *S. enterica ser.Enteritidis* occurred in 3 (33.3%), *S. enterica ser.Typhimurium* and *S. enterica ser.Newport* in 1(11.1%), and *S. enterica ser.Newport* and *S. enterica ser.Weltevreden* in 2(22.2%) of the 9 positive rats. (Table III).

Distribution patterns of *Salmonella* serotypes in house rats in Gboko are presented in Table IV. A total of 5 patterns of distribution were recorded for the 9 house rats harbouring *Salmonella* serotypes with *S. enterica ser.Typhimurium + S. enterica ser.Enteritidis* being the predominant pattern.

DISCUSSION

The isolation of *S. typhimunium*, *S. enteritidis*, *S. newport* and *S. weltevreden* from house rats confirmed earlier reports that rats are a reservoir of salmonellae (Suresh., 1980; Songer and Porker, 2005). The carrier rate of 8.7% in the study was however higher than that (6.3%) reported by Suresh *et al*. (1980) in India. This may be due to the poor hygienic environment compared to the relatively better University environment where they did their work. This was further corroborated by the fact that rats caught from around waste dumps had higher carrier rates than those from around living house.

The detection of these serovars in rats is of high public health importance due to ability for cross infection, and potentials for human disease (Fierer and Swancutt, 2000). In human, *S. enterica ser.Typhimurium*, *S. enterica ser.Weltevreden*, *S. enterica ser.Enteritidis* and *S. enterica ser.Newport* are known for their association with diarrhoea, septicaemia, and food intoxication (Songer and Porker, 2005). Ogbegbulem and Muogbo (1981) reported that *S. enterica ser.Typhimunium* and *S. enterica ser.Newport* accounted for 50 – 80% of human *Salmonella* intoxication in Nigeria with *S. enterica ser.Newport* being consistently ranked among the 10 salmonellae most commonly isolated from human food borne infections. The importance of these *Salmonella* species as environmental health problems has been stressed (Lu *et al*., 1999)

House rats in Gboko, Nigeria harboured salmonellae all the year round. These rats are at least potentially capable of transmitting the disease to humans through food and water contamination. There is need for proper control of rats around human houses in Gboko. Proper environmental sanitation and prompt disposal of refuse is recommended. Personal hygiene and food protection by proper covering should be instituted to reduce the risk of human infection.

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TABLE I: Source distribution of salmonellae positive house rats in Gboko, Nigeria.

	Number of house rats	
Sample site	**Examined**	**Positive (%)**
Households	35	3 (8.6)[a]
Waste dumps	17	2 (11.8)[b]
Grain market	38	3 (7.9)[a]
Hospital	14	1 (7.1)[a]
Total	**104**	**9 (8.7)**

*The figure in parenthesis with different superscripts are significantly different (p<0.05)

TABLE II: Monthly distribution of salmonellae in house rats in Gboko, Nigeria.

	Number of house rats	
Months of year	**Examined**	**Positive (%)**
January	6	0 (0.0)
February	11	1 (9.1)[a]
March	5	0 (0.0)
April	9	1 (11.1)[a]
May	15	1 (6.7)[a]
June	12	1 (8.3)[a]
July	16	2 (12.5)[a]
August	11	1 (9.1)[a]
September	13	2 (15.4)[b]
October	6	0 (0.0)
Total	104	9 (8.7)
Mean	10.4	0.9 (8.7)

*The figure in parenthesis with different superscripts are significantly different (p<0.05)

TABLE III: Specific carrier rates of *Salmonella* species in house rats in Gboko, Nigeria.

***Salmonella* species identified**	**No. rats positive (%)**
S. enterica ser.Typhimurium	6 (5.8)
S. enterica ser.Enteritidis	4 (3.8)
S. enterica ser.Newport	3 (2.9)
S. enterica ser.Weltevreden	2 (1.9)

*The figures in parenthesis were calculated as a percentage of 104 rats sampled.

TABLE IV: Pattern of distribution of zoonotic *Salmonella* species isolates in house rats in Gboko, Nigeria.

No. examined	**No. positive for species (%)**	**Species identified**
	2 (22.2)	*S. enterica* ser.Newport+ *S. enterica* ser.Weltevreden
104	1 (11.1)	*S. enterica* ser.Newport+ *S. enterica* ser.Typh imurium
	3 (33.3)	*S. enterica* ser.Typhimurium + *S. enterica* ser.Enteritidis
	1 (11.1)	*S. enterica* ser.Enteritidis
	2 (22.2)	*S. enterica* ser.Typhimurium

*The figures in parenthesis were calculated as a percentage of the 9 positive rats

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