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Salmonellae in the African Great Cane Rat (*Thryonomys swinderianus*)

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ABSTRACT: Because of its large size, the African great cane rat (*Thryonomys swinderianus*) is valued for food and has become a popular meat in western Africa. A survey was conducted to determine the occurrence of salmonellae in cane rats. Ten strains of *Salmonella* sp. were isolated from eight of 25 (32%) cane rats. *Salmonella ajiobo* was isolated from the spleen and intestines of three cane rats; *S. agama* was obtained from the spleen, liver and intestines of three animals; and *S. poona* was isolated from the spleen and liver of two cane rats. The occurrence of salmonellae in *T. swinderianus* is a potential public health hazard. Humans may become exposed to infection by consumption of inadequately cooked infected cane rat meat, or by eating vegetables, sugar cane and fruits contaminated with excretions of carrier cane rats. Incidents of human salmonellosis attributable to cane rat meat have not yet been reported; however, all three serotypes isolated from the cane rats have also been isolated from stools of patients suffering from gastroenteritis in Nigeria.

Key words: *Thryonomys swinderianus*, African great cane rat, survey, *Salmonella* sp., epidemiology, field survey.

The African great cane rat (*Thryonomys swinderianus*) is a porcupine-like rodent with a coat of soft spines (Grizmek, 1979). Cane rats are the largest grass eating rodents found over much of sub-Saharan Africa. They shelter in dense grassland and vegetation, generally near water. The cane rat eats sugarcane, rice and other grasses.

Because of its large size, the cane rat is valued as food (Grizmek, 1979; Anonymous, 1986). In Nigeria, the cane rat has gained in popularity and the rate of consumption has increased. In the southern states of Nigeria, the meat of the cane rat has become an expensive delicacy. Research on breeding of the cane rat, with a view to its commercial production as an alternative source of animal protein, is being conducted in some universities and research institutes in Nigeria. With increasing demand for its meat, the cane rat has become a potential risk factor in meat-borne infections and intoxications. Nineteen humans died in Anambra State, Nigeria following their consumption of carcasses of cane rats from rice fields treated with pesticides (Anonymous, 1988). Methods of preparation of the meat and the display of smoked carcasses along highways portend health hazards.

Although some work has been done on the parasites of the great cane rat (Abana, 1985) there are no reports of surveys for salmonellae in *Thryonomys* spp. We examined the occurrence of salmonellae in the intestines and visceral organs of the cane rat.

Generally, cane rats were trapped or shot by hunters during the early hours of the day of sampling; only two or three were available at any one time. The animals had been purchased for preparation in two restaurants in the university town of Nsukka, Nigeria and in Obollo, Nigeria, approximately 08°00′N, 07°00′E. Twenty-five cane rats were screened during 8 wk. Portions of the spleen, liver including gall bladder, and sections of small intestines were aseptically collected.

Organs were separately homogenized in buffered peptone water which was incubated at 37 C for 24 hr. Subsequent enterobacteriological studies were in accordance to standard procedures (Edwards and Ewing, 1986) and as adopted in previous studies (Oboegbulem and Muogbo, 1981; Oboegbulem and Iseghohimhen, 1985). Enrichment was carried out in selenite F broth, with subsequent subcultures onto desoxycholate agar and MacConnkey agar (Oxoid Ltd., Basingstoke, Hampshire,

TABLE 1. Salmonella serotypes isolated from African cane rats (*Thryonomys swinderianus*) in Nsukka, Nigeria.

Serial number of cane rats	Antigenic structure* of Salmonella isolates	Salmonella serotypes	Source
C2	9,12:g,p	*S. agama*	Spleen
C8	9,12:g,p	*S. agama*	Liver & intestine
C10	12,22:Z:1,6	*S. poona*	Spleen
C11	13,23:Z_4,Z_{23}	*S. ajiobo*	Intestine
C12	13,23:Z_4,Z_{23}	*S. ajiobo*	Spleen
C13	13,23:Z_4,Z_{23}	*S. ajiobo*	Spleen
C16	13,22:Z:1,6	*S. poona*	Liver & spleen
C23	9,12:g,p	*S. agama*	Spleen

* The formulae for antigenic structures of salmonella serotypes are based on a combination of *number* and *alphabet* designations of the *somatic* and flagella antigen groups respectively. The first two numbers represent the *specific* somatic or "O" antigen group to which the strain belongs. The letters which follow the colon represent designations of the specific flagella or "H" antigen make-up of the strain. Thus, 9,12: g,p means that the salmonella organism with "O" antigens which belong to Groups 9 and 12 and with "H" antigens belonging to groups g (phase I) and p (phase II) is *S. agama*.

England). Colonies on the differential plates typical of salmonella were subjected to enzyme and biochemical testing (Carter, 1972; Edwards and Ewing, 1986). The possible occurrence of multiple serotypes in an organ specimen was studied by picking up to five colonies per plate. Serological identification was made with commercial polyvalent and specific "O" and "H" antisera (Oxoid Ltd.). Some of the cultures were sent to the Scottish Salmonella Reference Laboratory (Stobhill General Hospital, Glasgow G21, United Kingdom) for complete serotyping.

Salmonella isolates from cane rats are summarized in Table 1. Salmonella isolations were made from eight of 25 (32%) cane rats screened. Three strains of *S. ajiobo* were isolated from spleen or intestine of three cane rats. Four strains of *S. agama* were obtained from spleen, liver and intestines of three animals, while *S. poona* was isolated from spleen and liver of two animals.

This survey confirms the occurrence of the salmonellae in the intestine and other visceral organs of *T. swinderianus*. The 32% carrier rate suggests that the great cane rat is a natural reservoir of salmonellae and provides a potential source of infection for humans and other animals. *Salmonella agama* has been established as a common serotype in peri-domestic rats (*Rattus rattus*), agamid lizards (*Agama agama*) and wall geckos (Geckonidae) in western Africa (Collard and Montifiore, 1956; Collard and Sen, 1960; Falade, 1978; Oboegbulem and Iseghohimhen, 1985; Gugnani and Oguike, 1986). *Salmonella ajiobo* is an uncommon serotype in Nigeria, first isolated from rats (*R. rattus*) in Ajiobo district of Ibadan, Nigeria in 1955 (Collard et al., 1957). This appears to be the second time in 30 years that the serotype has been reported, and the first time *S. ajiobo* has been isolated from *T. swinderianus*. *Salmonella poona* is more commonly associated with domestic animals, particularly pigs and chickens.

The occurrence of salmonellae in *T. swinderianus* is a potential public health hazard. Humans may become exposed to infection by consumption of inadequately cooked infected cane rats, or by eating vegetables, sugarcane and fruits contaminated with the excretions of carrier cane rats. Under the prevailing socio-cultural conditions in Nigeria, the risk of such exposures is real and high. The usual methods of evisceration of the carcasses enhance cross-contamination of other tissues. The same kitchen table on which fresh carcasses of cane rats are eviscerated and prepared are also used for cutting other types of meat served to customers. The same kitchen knives are used to cut up cane rats and other fresh or pre-cooked meat. Studies on meat processing procedures have shown that knives constitute a means of cross-contamination (Lee and Mackerras, 1955).

In most of the restaurants serving cane rats, the meat is cut in measured sizes according to set prices. The measured portions are tied with string to hold them together during cooking. Cooking is

sometimes not thorough in an attempt to avoid fragmentation of the meat because cane rats have delicate skin and tender muscles (Grizmek, 1979). This method of preparation ensures survival of bacteria in the inadequately cooked meat. Often, the same kitchen assistants who eviscerate and prepare cane rat carcasses also serve the food to customers, and in the process handle plates, cups and cooked meat.

Eviscerated whole carcasses also may be held on spits and partially smoked. Such smoked carcasses are sold in markets or along highways, under environmental conditions that may promote the multiplication of any salmonellae in the undercooked tissues.

Cases of human salmonellosis attributable directly to consumption of cane rat meat have not yet been reported. But statutory notification of foodborne infections is not always in force, and epidemiological investigations of suspected foodborne gastroenteritis are often not conclusively conducted. However, all three serotypes we isolated from cane rats have also been isolated from stools of patients suffering from gastroenteritis in Nigeria (Collard and Montifiore, 1956; Collard et al., 1957; Falade, 1978; Oboegbulem and Iseghohimhen, 1985). In addition to the known *Salmonella* spp. serotypes prevalent in livestock, information on *Salmonella* spp. serotypes isolated from cane rats will contribute to knowledge of the epidemiology of human salmonellosis in the sub-region. Subsequent isolations of the same serotypes from sporadic cases or outbreaks of human salmonellosis may form the basis for establishing some epidemiological link with the cane rat. Routine surveillance of animal salmonellae and of foodborne infections is of particular value in Africa where meat from a variety of wildlife species constitute a major source of animal protein for human consumption.

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