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# Serological prevalence of leptospiral antibodies in pigs in South Africa

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**ABSTRACT**

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A serological survey for leptospiral antibodies was carried out on 5 041 abattoir pigs from different regions in South Africa. Antibodies to at least one serovar were detected in 22,2% of the animals. The serovars showing the highest prevalence were: *icterohaemorrhagiae* (12,6%), *hardjo* (12,1%) and *bratislava* (7,5%). The serum dilution level at which 90% of the sera reacted was 1/80 or 1/160.

**Keywords**: Antibodies, leptospiral, pigs

## INTRODUCTION

Pigs of all ages are susceptible to leptospirosis. Death or retarded development may occur in young pigs. Abortion and stillbirth are also consequences of infection (Faine 1994). These effects on reproductive potential are of economic importance, while the disease is also a health hazard for animal workers. Diagnosis is difficult as most infections are sub-clinical.

Serological surveys can be helpful in determining the prevalence of anti-leptospiral antibodies in a population, and the background levels of infection for interpreting individual serological tests. Serological surveys of leptospiral antibodies in swine have been carried out in various parts of the world: the USA (Jenkins, Harrington, Gbadamosi & Braye 1979; Miller, Wilson, Owen & Beran 1990;), Canada (Higgins, Désilets & René-Roberge 1980; Van Til & Dohoo 1991), England (Hathaway & Little 1981; Hathaway, Little & Stevens 1981), Australia (Elder & Ward 1978; Chappel, Ellis, Adler, Amon, Millar, Zhu & Prime 1992), the Netherlands (Bercovich, Spek & Comvalius-Adriaan 1983), and West Malaysia (Bahaman, Ibrahim & Adam 1987). The only previous survey of porcine populations in South Africa was carried out 30 years ago with no indication of the serovars involved (Botes & Garifallou 1967). The present study was undertaken to determine the current prevalence of antibodies to *L. interrogans* serovars in pigs in South Africa, and is based on abattoir samples. It should be noted that the provincial boundaries used were those in place at the time of the survey.

## MATERIALS AND METHODS

### Source of sera

Between July 1992 and January 1993, 5 041 blood samples of slaughter pigs (ranging in age from approximately 16 weeks to approximately 24 weeks) from 341 premises were collected randomly at abattoirs. Between ten and 20 samples were collected from each of the premises.

### Antigens

Eight serovars of *Leptospira interrogans* were used in testing: *canicola, icterohaemorrhagiae, grippotyphosa,*

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*hardjo*, *pomona*, *australis*, *tarassovi*, *szwajizak*. At a later stage, *bratislava* and *muenchen* were added, replacing *australis* and *szwajizak*.

### Test procedure

The microscopic agglutination test (MAT) was carried out in microtitre plates with the use of eight live antigens (Cole, Sulzer & Pursell 1973). Initially, all sera were tested at a dilution of 1/11. Those sera showing 50% agglutination or disappearance of leptospires compared to a negative control, were titrated further. Doubling dilutions from 1/40 to 1/2 560 were made and the serum dilution showing 50% agglutination or disappearance of leptospires was recorded as the titre. A titre of 1/80 or more was recorded as contributing to the prevalence of leptospiral antibodies. Conventionally, MAT titres are considered significant at levels of 1/100 or higher. When two or more serovars reacted, they were both recorded, if within one dilution of each other. These serovars were also recorded as contributing to cross-reactions.

The results were organized into three categories, low, medium and high, according to titre level. These categories are somewhat arbitrary and were used as a convenient means of condensing the data.

## RESULTS

Overall, 22,2% of sera showed a reaction to at least one serovar (Table 1). Natal had a significantly higher level of reactors than the other regions. The serovars showing the highest prevalence were *icterohaemorrhagiae*, *hardjo* and *bratislava* (Tables 2 and 3). *Icterohaemorrhagiae* and *hardjo* showed a higher prevalence in Natal, while *bratislava* was not prevalent in the Cape Province. Most of the titres (90%) were in the low-titre category (1/80–1/160). Reactions to *pomona*, though not very frequent, were mostly in the high-titre category (1/1 280–1/2 560) (70%).

The highest number of cross-reactions was found between *icterohaemorrhagiae* and *hardjo* (Table 4). These reactions were more frequent in Natal. In Natal, 35% (148/419) of *icterohaemorrhagiae* reactions cross-reacted with *hardjo* and 14% (24/168) of *bratislava* reactions cross-reacted with *hardjo*.

Reactions to three serovars, *szwajizak*, *muenchen* and *tarassovi*, were not recorded during the survey. Only two serovars, *icterohaemorrhagiae* and *hardjo*, had reactors in all four provinces, while *pomona* and *bratislava* were recorded in Transvaal, the Cape Province and Natal, but not in the Orange Free State. Reactions to *grippotyphosa* were recorded only in the Cape Province and Natal, *australis* only in Transvaal, and *canicola* only in Natal.

TABLE 1 Number of porcine sera from different regions of South Africa reacting to at least one leptospiral serovar

| Region | Reactors | | Total tested |
|---|---|---|---|
| | No. | % | |
| Transvaal | 203 | 12,0 | 1 690 |
| Natal | 697 | 37,2 | 1 876 |
| Cape | 193 | 16,0 | 1 206 |
| OFS | 25 | 9,3 | 269 |
| Total | 1118 | 22,2 | 5 041 |

## DISCUSSION

In this abattoir survey, the serovars with notable reaction rates were *icterohaemorrhagiae*, *hardjo* and *bratislava*. Serovar *icterohaemorrhagiae* is thought to be infectious, but not pathogenic, in swine (Jenkins *et al.* 1979). The injection of virulent *icterohaemorrhagiae* into pregnant sows produced no adverse effects (Fennestad & Borg-Peterson 1966). However, *icterohaemorrhagiae* is associated with jaundice in piglets (Little & Hathaway 1983) and does cause a severe type of illness in humans (Faine 1994). Rodents are carriers of *icterohaemorrhagiae* and can act as sources of infection for both animals and humans.

Other porcine surveys revealed low prevalences of *hardjo*: 0,4% (Hathaway & Little 1981), 0,8% (Jenkins *et al.* 1979), 2,6% (Miller *et al.* 1990), and 1% (Elder & Ward 1978). *Hardjo* has been associated with reproductive disease, but pigs are regarded as accidental hosts (Hathaway, Ellis, Little, Stevens & Ferguson 1983; Ellis, McParland, Bryson & Cassells 1986). Serovars *bratislava* and *hardjo* were isolated from swine at slaughter in Iowa (Bolin & Cassells 1992). In 20 herds tested against *bratislava*, no significant differences were observed between herds with higher seropositive rates (43,3–63,3%) and herds with low seropositive rates (14,3–40,0%) in farrowing averages or in the occurrence of stillbirths, abortions and mummified foetuses (Miller *et al.* 1990). Experimental infections with *bratislava* in sows did not cause abortion (Hathaway, Little & Wrathall 1983b). However, *bratislava* was isolated from aborted piglets in Northern Ireland (Ellis, McParland, Bryson & Cassells 1986). *Bratislava* has also been isolated from the genital tracts and kidneys of sows that aborted (Ellis, McParland, Bryson, Thiermann & Montgomery 1986). A poor correlation was found between antibody level and isolation of leptospires.

Serovar *pomona* is the strain most commonly affecting pigs in South Africa (Hunter 1986). *Pomona* has been isolated from kidneys and renal lymph nodes of pigs in South Africa (De Lange, Gummow, Turner & Redman 1987; Hunter, Van der Vyver, Selmer-Olsen, Henton, Herr & De Lange 1987).

TABLE 2 Prevalence of antibodies to leptospiral antigens in porcine sera collected at abattoirs from different regions of South Africa

| Region | Serovar | No. tested | Prevalence (%) | Titre[a] | | |
|---|---|---|---|---|---|---|
| | | | | Low | Medium | High |
| Transvaal | *icterohaemorrhagiae* | 1 690 | 8,00 | 115 | 19 | 1 |
| | *hardjo* | 1 690 | 5,70 | 83 | 14 | – |
| | *pomona* | 1 690 | 0,30 | 2 | – | 3 |
| | *australis* | 1 633 | 0,06 | 1 | – | – |
| | *bratislava* | 57 | 10,50 | 6 | – | – |
| Natal | *icterohaemorrhagiae* | 1 876 | 22,30 | 377 | 36 | 6 |
| | *hardjo* | 1 876 | 21,00 | 363 | 28 | 3 |
| | *pomona* | 1 876 | 0,05 | – | – | 1 |
| | *canicola* | 1 876 | 0,30 | 5 | – | 1 |
| | *bratislava* | 1 564 | 10,70 | 160 | 8 | – |
| | *grippotyphosa* | 1 564 | 0,10 | 1 | 1 | – |
| Cape | *icterohaemorrhagiae* | 1 206 | 6,00 | 62 | 8 | 2 |
| | *hardjo* | 1 206 | 8,70 | 96 | 9 | – |
| | *bratislava* | 1 206 | 3,10 | 32 | 4 | 1 |
| | *pomona* | 1 206 | 0,30 | – | 1 | 3 |
| | *grippotyphosa* | 1 206 | 0,08 | – | 1 | – |
| Orange Free State | *icterohaemorrhagiae* | 269 | 3,00 | 6 | 2 | – |
| | *hardjo* | 269 | 5,90 | 16 | – | – |

[a] Low = 1/80–1/160; medium = 1/320–1/640; high = 1/1280–1/2560

TABLE 3 Prevalence of antibodies to leptospiral antigens in porcine sera collected at abattoirs in South Africa

| Serovar | No. tested | Prevalence (%) | Titre[a] | | |
|---|---|---|---|---|---|
| | | | Low | Med. | High |
| *icterohaemorrhagiae* | 5 041 | 12,60 | 560 | 65 | 9 |
| *hardjo* | 5 041 | 12,10 | 558 | 51 | 3 |
| *bratislava* | 2 827 | 7,50 | 198 | 12 | 1 |
| *pomona* | 5 041 | 0,20 | 2 | 1 | 7 |
| *canicola* | 5 041 | 0,10 | 5 | – | 1 |
| *grippotyphosa* | 5 041 | 0,06 | 1 | 2 | – |

[a] Low = 1/80–1/160; medium = 1/320–1/640; high = 1/1280–1/2560

TABLE 4 Number of cross-reactions between different serovars found in porcine abattoir blood samples from the different regions of South Africa

| Serovars | Tvl | Natal | Cape | Total |
|---|---|---|---|---|
| *icterohaemorrhagiae; hardjo* | 10 | 148 | 26 | 184 |
| *icterohaemorrhagiae; bratislava* | – | 22 | 12 | 34 |
| *hardjo; bratislava* | 1 | 24 | 7 | 32 |
| *icterohaemorrhagiae; hardjo; bratislava* | 4 | 22 | 2 | 28 |
| *icterohaemorrhagiae; hardjo; pomona* | 1 | 1 | 1 | 3 |
| *hardjo; pomona* | 1 | – | 1 | 2 |
| Total | 18 | 217 | 50 | 285 |

The overall reaction rate of 22,2% found in this survey is similar to the rate of 16,2% found in the previous survey, though it is not clear what level of positivity was used or what serovars were involved (Botes & Garifallou 1967).

The results of the current survey bear out the fact that *australis* is not a good representative of the Australis serogroup for serological testing (Hathaway, Little & Wrathall 1983a). In the Transvaal, when *australis* was used, the incidence was only 0,06%, while with *bratislava* it was 10,5% (Table 2).

The greater level of cross-reactions in Natal, especially between *icterohaemorrhagiae* and *hardjo*, could possibly be due to vaccination practice. On the other hand, it might be due to a non-serovar-specific antibody response. Hathaway *et al.* (1983b) found that in gilts, experimental infection with *copenhageni* (Icterohaemorrhagiae serogroup) gave rise to cross-reactions with *bratislava*, though why this phenomenon should occur mainly in Natal, is not clear.

The following conclusions based on this survey are to be regarded as merely tentative, owing to the limitations of serological tests. The low prevalence of *pomona* (the main serovar affecting pigs in South Africa) and the generally low titres to *icterohaemorrhagiae*, *hardjo* and *bratislava,* indicate that leptospirosis is not a major problem in pigs in South Africa. It is possible that the low *icterohaemorrhagiae* titres are due to exposure to rodents acting as maintenance hosts. Improved rodent control may lead to a decline in antibody prevalence. Caution needs to be exercised in the case of *bratislava*, as it has been

shown there is no correlation between antibody level and infection (Ellis, McParland, Bryson, Thiermann & Montgomery 1986).

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