MRSA in livestock: news for the pig production sector

Introduction

Similar to humans, pigs can be asymptomatic carriers of MRSA on the skin and mucosal surfaces. Although it is usually a commensal bacteria with few cases of infections reported so far,[1] it cannot be excluded that the clone could become virulent[2,3] resulting in more severe infections in animals with consequential economical losses.

A specific clone associated with farm animals, livestock associated MRSA (LA-MRSA), has been discovered since 2004 in European livestock and in humans in close contact with them.[4] The ability of MRSA to spread from animals to animals and from animals to humans (zoonose), have raised the attention of science and society. Some even consider LA-MRSA as an emerging zoonotic threat for public health. LA-MRSA is responsible for more than 30% of all human MRSA-cases in the Netherlands[5] and has been involved in human severe infections.[6,7] It seems clear that pigs are the main reservoir of this clone. In order to control MRSA in humans, more insight in the transmission dynamics of LA-MRSA within pig herds is needed.

PILGRIM partners have addressed this question and have assessed quantitatively the horizontal spread of LA-MRSA within pig herds and factors affecting the transmission between pigs.

Objectives of the study

A longitudinal study was carried out on 8 LA-MRSA positive farrow-to-finish farms (4 Dutch / 2 Belgian / 2 Danish). A cohort of approximately 10 sows per farm were monitored during 3 to 4 weeks comprising the period before and after pigs‘ birth.

Description of the sampling moments

Moment	Section	Approximate time in life	Type of swab in sows	Type of swab in pigs	Environmental samples
1	Farrowing	1 wk before birth	Nasal/ Vaginal		4 per section
2	Farrowing	3 d after birth	Nasal/ Vaginal	Nasal/ Rectal	4 per section
3	Farrowing	3 wk after birth	Nasal/ Vaginal	Nasal	4 per section
4	Weaning	6 wk after birth		Nasal	4 per section
5	Weaning	10 wk after birth		Nasal	4 per section
6	Finishing	25 wk after birth		Nasal	4 per section

Subsequently, newborn piglets were monitored for approximately 25 weeks, from birth to slaughter, to identify the moment (s) at risk for MRSA acquisition and to determine the dynamic of colonisation. In addition, environmental samples were also taken at the time of all sampling moments.

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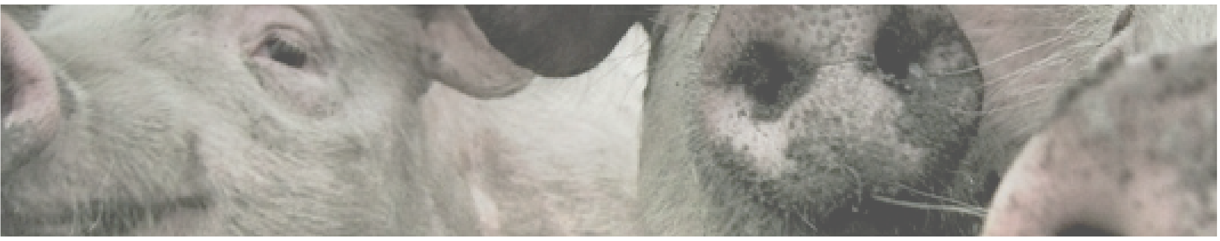

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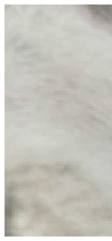

Epidemiology and transmission of LA-MRSA

Prevalence in sows

Prevalence of MRSA among sows at the beginning of the study, before birth, varied greatly per herd and per country, from 0% (exact 95% CI: 0.0-16.5%) in 2 Dutch herds to 100% (exact 95% CI: 86.8-100.0) in both Belgian and 1 Danish herd (Figure 1). The high MRSA prevalence in sows remained stable after birth in Belgian and Danish farms, while in The Netherlands, prevalence increased up to 72.9% (exact 95% CI: 58.2-84.7). This high MRSA colonisation rate found before birth in Belgium and Denmark, can have important implications for the newborn piglets, since they are considered MRSA negative at birth and therefore susceptible to colonisation. They can become easily infected by horizontal transfer via direct contact with the sows or by indirect contact via the contaminated environment.

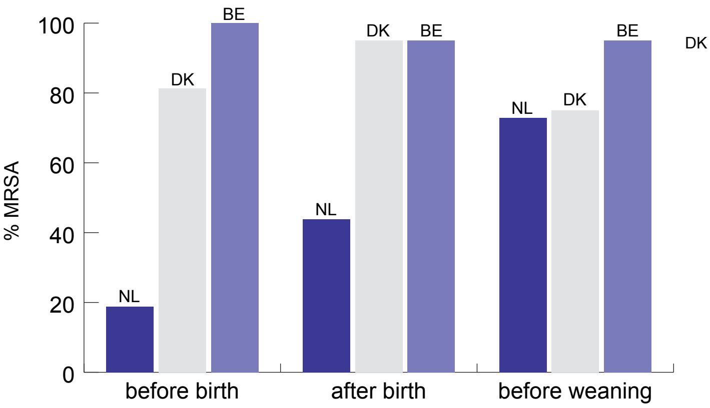

Figure 1. Average of MRSA-prevalence in sows (black column The Netherlands, light grey column Denmark, dark grey column Belgium)

Prevalence in piglets

MRSA prevalence in piglets seems to increase with age. This finding was only clearly observed in The Netherlands. In Denmark, this increase was less clear since 77.4% (exact 95% CI: 70.9-83.0) of the piglets tested MRSA positive at the starting point of the study, 3 days after birth, leaving fewer susceptible to MRSA. In Belgium, the situation in piglets equalled the situation in sows, as prevalence was almost 100% from start till the end of the study.

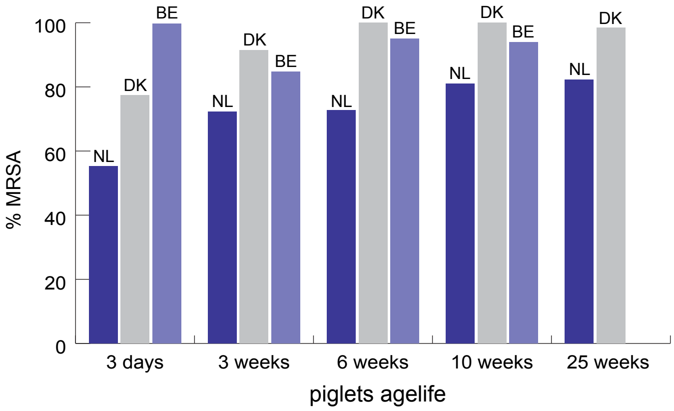

Figure 2. Average of MRSA-prevalence in piglets

Transmission between pigs

Transmission between pigs within herds was assessed in The Netherlands. The estimate of R0, the basic reproduction ratio, was therefore based on data from 4 Dutch farms and varied from 0.24 to 8.35 depending on use of antimicrobials, the location of the piglets and the infection pressure within the pen relative to other sources of infection. If R0 < 1 an introduction of MRSA will most probably not result in an outbreak. If R0 > 1, an introduction of MRSA will most probably lead to an outbreak and eventually an endemic situation on a farm. The reproduction ratio is higher when risk antimicrobials are used and when piglets are housed in the farrowing section. The increase of the reproduction ratio with the infection pressure within the pen, assumes that direct contact between pigs is an important route of transmission.

Prevalence of MRSA in the environment

MRSA was found in environmental samples of all farms in all countries but not at all sampling moments in The Netherlands. The environmental samples and the nasal colonisation rates seem to correlate and follow similar trends. Environmental samples could therefore be used as an indicator of the MRSA herd status.

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Conclusions

To summarise, introduction of LA-MRSA in a fully susceptible population most probably leads to a major outbreak with direct contact between animals as an important route of transmission, even without use of risk antimicrobials. However, as the results in the field study indicate, transmission rates might differ depending on the type of antimicrobial use, location of the pigs and proportion of within-pen infection pressure relative to other infection sources. Control programs should therefore focus on:

1) prevention of introduction into a herd, e. g. isolation of new animals brought into the farm and

2) prevention of transmission within a herd, e.g. isolation of sick animals, regulation of the movement of animals and by restrictive antimicrobial use.

However, prudence is called for in drawing strong conclusions on these data; studies involving larger numbers of herds are required to confirm our findings.

Perspectives

Additional data analysis on the complete dataset, including data from Danish and Belgian farms is ongoing. The association between sow and piglet colonisation will be explored further, just as the association between age and probability of colonisation and the colonisation patterns in time. All this information will be incorporated in an upcoming factsheet.

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SEVENTH FRAMEWORK PROGRAMME

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