

ANALYTIC EPIDEMIOLOGY OF PMWS IN FRANCE: A CASE / CONTROL STUDY

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Abstract

A case / control study was carried out in France in 2001 and 2002 aiming at the identification of risk factors for PMWS occurrence in farrow-to-finish farms. This survey involved 149 farms located in the main pig-producing areas of the country. Three groups of farms were selected according to their current- or past-PMWS status. The latter was defined using a combination of inclusion criteria. The cases (n=59) were defined as farms where typical PMWS was currently running and if possible since less than two years. The control farms were of two types: type 1 (n=55) had no history of PMWS whereas type 2 (n=35) had been typically concerned and had been able to properly recover with a mortality rate being now close to the one before PMWS outbreak. A questionnaire was filled in with the farmer during the visit to the farm and blood samples were taken from different categories of pigs including sows of different parities and growing pigs. The dynamic of PCV-2 infection was clearly modified in cases farms with a higher within-herd seroprevalence for 13 week-old pigs. Risk factors were mainly related to co-infectious agents (PRRSv and Parvovirus), rearing and hygiene conditions and the vaccination scheme against the Parvovirus.

Keywords: PMWS, Pig, Epidemiology, Risk factors

I. INTRODUCTION

The economic impact of the post-weaning multisystemic syndrome (PMWS) is of great importance because of the considerable losses due to mortality or production of non-marketable pigs. In 1998, in a French group of severely affected farms more than 20% of mortality from weaning to fattening was reported (Madec et al., 2000). Today the situation is getting better in France whereas the disease is acute in other European countries particularly in Great Britain (Gresham et al., 2000). Porcine Circovirus type 2 (PCV-2) was quickly found to be pivotal in this syndrome (Allan et al., 1998; Ellis et al., 1998). However, when serological tests became available they showed a very wide spread of the virus in the pig population and this situation seemed to have been the case for many years, before PMWS occurrence (Magar et al., 2000). Prospective studies carried out in France from 1998 (Madec et al., 2000) clearly showed management deviations in severely affected farms. Several environmental conditions might therefore be necessary in association with PCV-2 infection to lead to the clinical expression of the disease. The implementation of Madec's 20-point plan proposed in 1997 to lower the impact of the disease significantly decreased the percentage of mortality in severely affected farms (Madec et al., 2001). Those measures were not real risk factors 'per se' because they were not obtained from an

epidemiological survey and their individual impact could not be estimated. The aim of this study was therefore to identify the risk factors for PMWS expression in farrow-to-finish farms.

2. MATERIALS AND METHODS

A case / control survey was carried out in France in 2000 and 2001 in 149 farms. The latter were selected in close relation with the farm organisations (n=22) according to inclusion criteria related to PMWS Sorden's definition (Sorden, 2000). Three groups of farms were defined. The cases were currently affected farms where typical PMWS has been running for less than two years before the visit. The percentage of mortality (from weaning to market age) had to have increased by at least 5 units in comparison to the situation before PMWS context. The diagnosis for each « CASE » was confirmed through the necropsy of two pigs typically expressing symptoms of the disease and carrying out histology on affected organs (lungs, lymph nodes, tonsils, kidneys) and staining of the lesions with *in situ* hybridisation of viral inclusions. Control farms were of two types : type 1 farms had no history of PMWS expression and type 2 farms had been concerned with the disease but had recovered from it with a mortality rate now close to the situation before PMWS context. The proportion of « CASES » and « CONTROLS » was well balanced at the regional level. Only one visit was performed in each farm to fill-in a questionnaire with the farmer (housing, hygiene, rearing conditions, prophylactic scheme) and take blood samples from different categories of pigs to evaluate the microbial load (antibodies against PCV-2, Porcine parvovirus (PPV), PRRS virus, *Lawsonia intracellularis*, influenza viruses). The statistical analysis aimed at comparing the profiles of affected and non-affected farms using multiple correspondence analysis.

3. RESULTS

3.1. PCV-2 serological profile of affected and non-affected farms (Figure 1)

The percentage of positive results for PCV-2 steadily decreased with the age of the sows ($p < 0.001$). However for every parity group, no significant difference could be found according to the PMWS status of the farm. For 8 week-old piglets the percentage of positive results according to the PMWS status of the farm was not different. Conversely, the within-herd sero-prevalence of 13 week-old pigs was significantly higher for those coming from « CASES » farms than for those coming from « CONTROLS#1 » ($p < 0.001$). Only a slight similar tendency could be seen for « CONTROLS#2 » farms.

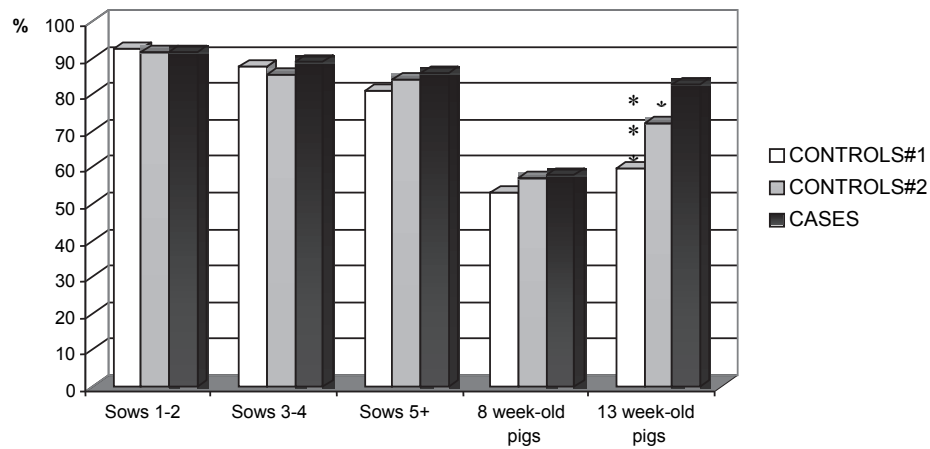


Figure 1. Percentage of PCV-2 positive results according to the PMWS status of the farms and for different categories of pigs (sows of different parities, growing pigs)

3.2. Risk factors for PMWS expression

The multiple correspondence analysis showed a clear opposition between “CASES” and “CONTROLS” following the first dimension of the analysis (Figure 2). “CONTROLS#1” and “CONTROLS#2” were separated according to the second dimension of the analysis, showing an intermediate situation for “CONTROLS#2” regarding several variables.

Fattening pigs in “CASES” farms were more likely to be positive for PRRSv and PPv ([PRRS] and [PARVO] variables). The average pen area in weaning facilities was larger in “CASES” than in “CONTROLS#1” (>7.8 m² instead of <5.9 m² [WAREA]) as well as the average pen area in fattening facilities (>14.4 m² instead of <8.4 m² in “CONTROLS#1” farms, [FAREA]). The access to feeders in weaning facilities was more appropriate in “CONTROLS#1” than in “CASES” (>6.43 cm/pig instead of <5.15 cm/pig, [LFEED]) as well as the number of drinkers per piglet (<1/12 piglets in “CASES” instead of >1/12 in “CONTROLS#1”, [Ndrinker]). The duration of empty periods in farrowing and weaning facilities was longer in “CONTROLS” than in “CASES” (>5 days and >4 days respectively, [DEFARR] and [DEWEA] variables). Rearing conditions were also different between affected and non-affected farms especially the percentage of cross-fostering (>15% in “CASES” farms, [CRFOST]) and the presence of a supplementary stage for the weaned piglets which was more related to the “CASES” [NURPRES=2]. The vaccination scheme against the parvovirus was different according to the farm category as “CASES” were more likely to use a “light” protocol for the gilts without the booster for the first vaccination instead of the 2 typical injections [parvovac]. With regard to the kind of vaccines, “CASES” were more likely to use separated vaccines for parvovirus and *erysipela* whereas “CONTROLS” used grouped vaccines for both agents [parvery].

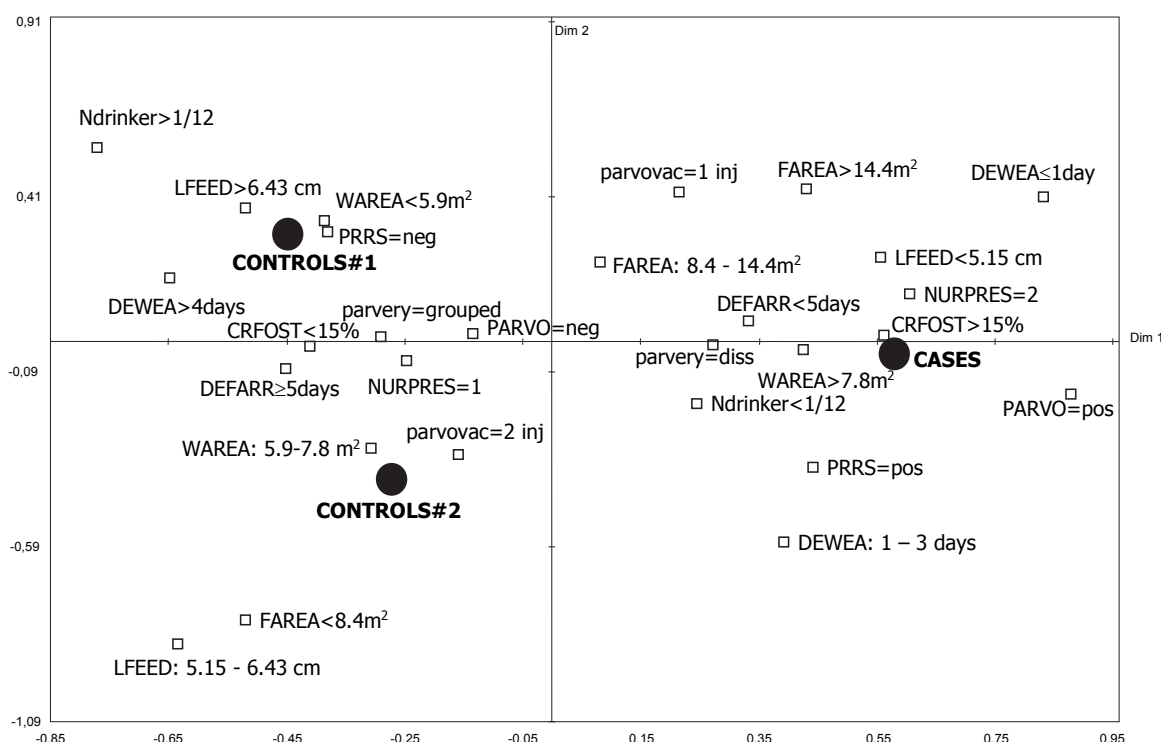


Figure 2. Two first dimensions of the multiple correspondence analysis for risk factors of PMWS, percentage of inertia: 19%, 17 variables, 149 farrow-to-finish farms, France – 2000-2001.

4. DISCUSSION

The puzzling problem of PMWS motivated the implementation of such a survey carried out in more than 140 French farrow-to-finish farms in the most pig-populated areas in France. The pivotal role of PCV-2 in PMWS (Kennedy et al., 2000) was confirmed through our results even if no farm under study could be considered PCV-2 negative. The PCV-2 dynamic within the herd is still clearly different between « CASES » and « CONTROLS » with for the latter a delayed seroconversion as previously found in a preliminary analysis on a sub-sample (Rose et al., 2001). Conversely the serological profile of the breeding herd seemed only slightly modified but the difference between “CASES” and “CONTROLS” could be related to a very tiny part of the herd which could not be shown with the limited sample of sows taken from each farm in this study.

From our results, the co-infections and the vaccination scheme with regard to the Parvovirus were found to influence PMWS expression. The synergy between other viruses and the PCV-2 is clearly established for PRRSv (Harms et al., 2001) but particularly for the Parvovirus (Allan et al., 1999; Ellis et al., 2000; Krakowka et al., 2000). From our results many findings are consistent with a probable active participation of this virus in the syndrome (seroconversion of fattening pigs, quality of the immune status of the breeding herd). The differences observed between “CASES” and “CONTROLS#2” showed that improving the quality of the immune status of the gilts regarding PPV was protective for PMWS. The breeding herd might have an heterogeneous immune status

with regard to the Parvovirus which could be responsible for an active infection of the fattening pigs but without the specific reproductive failure related to this virus. It would be interesting to test this assumption on a larger sample of sows in affected herds. The co-infectious agents (PRRSv, PPv) found from our data might be representative of a more global pathogenesis related to the enhancement of specific white blood-cell lines which enable PCV-2 to multiply (Krakowka et al., 2001). Other viruses or even bacteria might therefore have the same ability and might explain PMWS expression in PRRSv-free farms or farms where PPv is managed. From our results and even if it didn't remain in the final analysis, the prevalence for Influenza H1N1 antibodies was more important in "CASES" farms than in "CONTROLS#1".

Other risk factors were more related to rearing and hygiene conditions and consistent with Madec's 20 point-plan (Madec et al., 2001). Rearing pigs in small pens to decrease contact and mixing, sufficient access to the feeders and drinkers, lowering the percentage of cross-fostering were, in addition with a good hygiene in farrowing and weaning facilities, the pivotal key parameters to manage the disease.

From a general point of view all the measures that could help to lower all stressful conditions such as, successive mixing (showed in this study by the supplementary nursery stage) or bad rearing and hygiene conditions might be of interest to lower PMWS expression. Because of its immunosuppressive action (Shibahara et al., 2000) PCV-2 is able to favour other contaminants which can take advantage of the environmental conditions. However PMWS is a clearly defined entity with an ubiquitous virus as associated cause. Further research about the genetic variability of the virus and the viral load in affected and non-affected farms would be of great interest to better understand the pathogenesis of this multifactorial disease.

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