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USE OF MELOXICAM FOR THE TREATMENT OF RESPIRATORY DISEASES IN PIGS

BACKGROUND OF THE INVENTION

1. TECHNICAL FIELD

The invention relates to the use of meloxicam or a pharmaceutically acceptable salt thereof for preparing a pharmaceutical composition for the treatment or prevention of respiratory diseases in pigs.

2. BACKGROUND INFORMATION

Respiratory disease in pigs belongs to the most important health problems in swine production. Porcine respiratory disease is primarily caused by infectious agents, but environmental factors have a strong influence. The relevant pathogens include mycoplasmas, bacteria and viruses (e.g. Christensen, G., Sorensen, V., & Mousing, J. (1999). Diseases of the respiratory system. In *Diseases of swine*, eds. Straw, B. E., D'Allaire, S., Mengeling, W. L., & Taylor, D. J., pp. 913-940. Iowa State University Press, Ames, Iowa).

The most important measures for the control of porcine respiratory disease are to improve herd management and housing conditions and introduce a vaccination programme. However, if pigs have developed respiratory disease, they have to be treated. Current therapy of porcine respiratory disease includes treatment with antibiotics. The successful use of various types of antibiotics is described, including β-lactams, quinolones and tetracyclines (e.g. Lang, I., Rose, M., Thomas, E., & Zschiesche, E. (2002). A field study of cefquinome for the treatment of pigs with respiratory disease. *Revue Med Vet* **8-9**, 575-580).

It is known that Cyclooxigenase-2 (COX-2) plays a relevant role in the pathophysiology of porcine pleuropneumonia caused by *Actinobacillus pleuropneumoniae*. Isolated porcine alveolar macrophages increase their COX-2 activity after exposure to *Actinobacillus*

pleuropneumoniae (Cho, W. S. & Chae, C. (2003b). In vitro effects of *Actinobacillus pleuropneumoniae* on inducible nitric oxide synthase and cyclooxygenase-2 in porcine alveolar macrophages. *Am.J Vet Res.* **64**, 1514-1518). Moreover, in situ hybridisation (Cho, W. S. & Chae, C. (2003a). Expression of cyclooxygenase-2 in swine naturally infected with Actinobacillus pleuropneumoniae. *Vet Pathol.* **40**, 25-31) and immunohistochemistry (Cho, W. S. & Chae, C. (2002). Immunohistochemical detection of cyclooxygenase-2 in lungs of pigs naturally infected with Actinobacillus pleuropneumoniae. *J Comp Pathol.* **127**, 274-279) showed increased COX-2 expression in lungs of pigs naturally infected with *Actinobacillus pleuropneumoniae*.

Moreover, it is well-known that acetylsalicylic acid (aspirin) can be used for the treatment of pigs with respiratory disease. However, only little information on controlled clinical studies is available. For a review, see Laval, A. (1992). Utilisation des anti-inflammatoires chez le porc. *Rec Méd Vét* **168** (8/9), 733-744. Ketoprofen, and, to a lesser extent, flunixin decrease fever induced by experimental infection with *Actinobacillus pleuropneumoniae* (Swinkels, J. M., Pijpers, A., Vernooy, J. C., Van Nes, A., & Verheijden, J. H. (1994). Effects of ketoprofen and flunixin in pigs experimentally infected with Actinobacillus pleuropneumoniae. *J Vet Pharmacol Ther* **17**, 299-303). However, no effects on lung lesions were observed. Ketoprofen was further tested in a controlled, blinded clinical field study (De Jong, M. F., Sampimon, O., Arnaud, J. P., Theunissen, G., Groenland, G., & Werf, P. J. A clinical study with a non steroid antiinflammatory drug. 14, 659. 1996. IPVS). In this study, ketoprofen had no effect on clinical score, relapse or cure rate.

Indomethacin alleviated experimental endotoxin-induced respiratory failure in pigs (Olson, N. C., Brown, T. T., Anderson, J. R., & Anderson, D. L. (1985). Dexamethasone and indomethacin modify endotoxin-induced respiratory failure in pigs. *J.Appl.Physiol.* **58**, 274-284).

Meloxicam is a non steroidal anti-inflammatory compound that belongs to the oxicam class and exerts potent anti-inflammatory, anti-exudative and anti-pyretic activity. The efficacy of meloxicam as an adjunctive therapy, in the treatment of respiratory infections in cattle

has been widely proven. Recently meloxicam was approved for the treatment of MMA (Hirsch, A. et al. (2003).J Vet Pharmacol Therap 26, 355-360) and locomotor disorders in pigs (Friton, G. et al. (2003) Berl Münch Tierärztl Wschr 116: 421-426).

A review article (Lees, P. (1991). The pharmacokinetics of drugs used in the treatment of respiratory diseases in cattle and pigs. 67-74. Hatfield, U.K. Proc.Royal Vet.Coll.) focuses on pharmacokinetics used in the treatment of respiratory disease in cattle and pigs. The publication reads that for non-steroidal anti-inflammatory drugs data for pigs were almost entirely lacking and only lists data for cattle including meloxicam.

The use of meloxicam in conjunction with antibiotics in bovine respiratory disease is well-established (Schmidt, H., Philipp, H., Salomon, E., & Okkinga, K. (2000). Effekte der zusätzlichen Gabe von Metacam (Meloxicam) auf den Krankheitsverlauf bei Rindern mit Atemwegserkrankungen. *Der praktische Tierarzt* **81**, 240-244) and registered in the EU. However, to date no information on the use of meloxicam in pigs with respiratory disease is publicly available.

Since the pharmacokinetics in pigs and cattle differ substantially for meloxicam (plasma half-time in cattle is 26 hours whereas it is 2.5 hours in pigs), there is no expectation that the successful use of meloxicam in cattle should also be beneficial for pigs.

Moreover, the causative agents for bovine and porcine respiratory disease differ substantially.

The problem underlying the present invention was to provide a medication for the prevention or treatment of respiratory diseases in pigs, one of the most important health problems in swine production.

BRIEF DESCRIPTION OF THE INVENTION

It has been found surprisingly that meloxicam can be used for the treatment or prevention of respiratory diseases in pigs.

Accordingly, the invention relates to the use of meloxicam or a pharmaceutically acceptable salt thereof for preparing a pharmaceutical composition for the treatment or prevention of respiratory diseases in pigs. In one embodiment, the respiratory disease is caused by virus which may be Swine Influenza Virus, *Aujetzky's* Virus, Porcine Reproductive and Respiratory Syndrome Virus, Porcine Circovirus, or Transmissible Gastroenteritis and Porcine Respiratory Coronavirus.

Moreover, the invention relates to a use of meloxicam for the treatment or prevention of a respiratory disease in pigs. In one embodiment, the respiratory disease is caused by virus which may be Swine Influenza Virus, *Aujetzky's* Virus, Porcine Reproductive and Respiratory Syndrome Virus, Porcine Circovirus, or Transmissible Gastroenteritis and Porcine Respiratory Coronavirus.

The invention also relates to a pharmaceutical composition comprising meloxicam or a pharmaceutically acceptable salt thereof and a pharmaceutically acceptable carrier or diluent for treatment or prevention of a respiratory disease in a pig. In one embodiment, the respiratory disease is caused by virus which may be Swine Influenza Virus, *Aujetzky's* Virus, Porcine Reproductive and Respiratory Syndrome Virus, Porcine Circovirus, or Transmissible Gastroenteritis and Porcine Respiratory Coronavirus.

Furthermore, the invention relates to veterinary preparation containing meloxicam as well as at least one antibiotic selected from the group consisting of β-lactams, quinolones, tetracyclines, sulfonamides, fenicoles and macrolides.

Another aspect of the invention is a ready-to-use two-component system for the treatment of respiratory diseases in pigs, wherein

(a) one component contains meloxicam and a pharmaceutically acceptable carrier; and

(b) the other component contains at least one antibiotic selected from the group consisting of β-lactams, quinolones, tetracyclines, sulfonamides, fenicoles and macrolides and a pharmaceutically acceptable carrier.

Still another aspect of the invention is an article of manufacture comprising packaging material contained within which is a composition consisting of meloxicam and a pharmaceutically acceptable carrier, and a label which indicates that said composition can be used to treat or prevent respiratory diseases in pigs. In one embodiment, the respiratory disease is caused by virus which may be Swine Influenza Virus, *Aujetzky's* Virus, Porcine Reproductive and Respiratory Syndrome Virus, Porcine Circovirus, or Transmissible Gastroenteritis and Porcine Respiratory Coronavirus.

BRIEF DESCRIPTION OF THE DRAWINGS

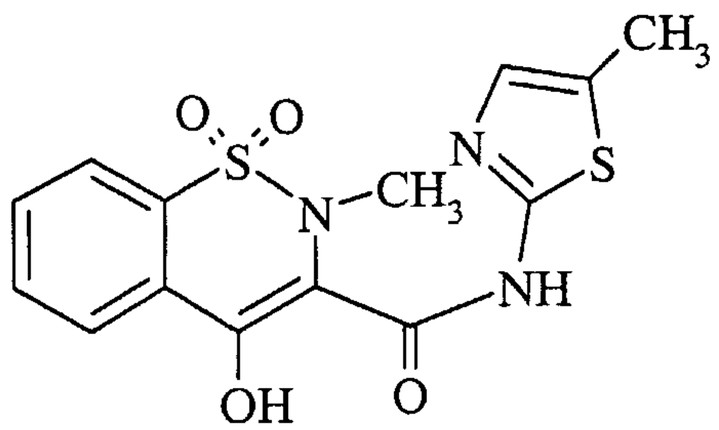
Fig. 1 shows the incidence of fever (rectal temperature ≥ 40.56°C) in percent following the first treatment in a group of pigs treated with oxytetracycline and meloxicam (♦), in a group of pigs treated with oxytetracycline alone (o), and in the untreated control (Δ).

Fig. 2 shows the efficacy of meloxicam in drinking water in reducing lung lesions caused by experimental Swine Influenza Virus (SIV) infection on study days 7 and 14.

DETAILLED DESCRIPTION OF THE INVENTION

Preferably the invention relates to the use of meloxicam or a pharmaceutically acceptable salt thereof for preparing a pharmaceutical composition in a form suitable for systemic or oral administration for the treatment or prevention of respiratory diseases in pigs.

Meloxicam (4-hydroxy-2-methyl-N-(5-methyl-2-thiazolyl)-2H-1,2-benzothiazine-3-carboxamide-1,1-dioxide) of formula



is an active substance which belongs to the group of NSAID's (non-steroidal-antiinflammatory drugs). Meloxicam and the sodium and meglumine salt thereof (N-methyl-D-glucamine salt) are described in EP-A-0 002 482.

Meloxicam may be used according to the invention in the form of a physiologically acceptable acid addition salt. By physiologically acceptable acid addition salts are meant, according to the invention, the meglumine, sodium, potassium or ammonium salt, preferably the meloxicam meglumine salt.

In a further preferred embodiment the pharmaceutical composition is administered corresponding to a daily dose of meloxicam ranging from 0.01 mg/kg to 5.0 mg/kg, preferably from 0.1 mg/kg to 3.5 mg/kg, in particular from 0.2 to 2.0 mg/kg.

The pharmaceutical composition is preferably administered in a form suitable for injection, in particular for intramuscular injection, or in form of water soluble granules for administration *via* drinking water or as top dressing on feed.

A suitable injection formulation is disclosed for example in Example 25 of EP-A-0 002 482.

Furthermore, such injection solutions may additionally contain excipients selected from among citric acid, lecithin, gluconic acid, tartaric acid, phosphoric acid and EDTA or the salts thereof as disclosed in the Examples 1 to 5 of the International Patent Application WO 01/97813.

Moreover, an injection solution of meloxicam for needleless injections is disclosed in the International Patent Application WO 03/049733.

Suitable water soluble granules for administration *via* drinking water or as top dressing on feed are for example disclosed in the International Patent Application PCT/EP03/11802.

In a preferred embodiment of the invention the meloxicam granules contain a binder which may be selected from among hydroxypropyl-methylcellulose, polyvinylpyrrolidone, gelatine, starch and polyethyleneglycolether, preferably hydroxypropyl-methylcellulose, polyvinylpyrrolidone and polyethyleneglycolether, most preferably hydroxypropyl-methylcellulose and polyvinylpyrrolidone.

In another preferred embodiment of the invention meloxicam granules contain a sweetener, which may be selected from among sodium saccharine, aspartame and Sunett®, preferably sodium saccharine or aspartame.

Particularly preferred according to the invention are meloxicam granules containing a flavouring agent which may be selected from among vanilla, honey flavouring, apple flavouring and contramarum, preferably honey flavouring and apple flavouring.

Also particularly preferred are meloxicam granules in which the carrier is selected from among lactose, glucose, mannitol, xylitol, sucrose and sorbitol, preferably glucose, lactose or sorbitol, more preferably glucose or lactose, most preferably glucose.

Most preferred are the following granules of meloxicam:

Example A

0.6% meloxicam granules

Recipe:

	g/100 g
Meloxicam	0.6
Meglumin	0.42
Hydroxypropylmethylcellulose	3.00
Povidone	2.00
Glucose monohydrate	93.98

Example B

1.2% meloxicam granules

Meloxicam	1.2
Meglumin	0.84
Hydroxypropylmethylcellulose	3.00
Collidone 25	2.0
Glucose Monohydrate	92.96

Example C

0.6% meloxicam granules

Meloxicam	0.6
Meglumin	0.42
Pharmacoat 606	4.0
Macrogol 6000	1.0
Acesulfame K	0.3
Lactose	93.68

Example D

0.6% meloxicam granules

Meloxicam	0.6
Meglumin	0.42
Pharmacoat 606	4.75
Macrogol 6000	0.25
Acesulfame K	0.3
Liquid vanilla flavouring	0.05
Lactose	93.63

Particularly preferred are meloxicam granules in which the content of meloxicam is between 0.05 % and 4 %, preferably between 0.1 and 2 %, preferably between 0.3 % and 1.8 %, more preferably between 0.4 % and 1,5 %, most preferably 1.2 %. Also particularly preferred are meloxicam granules which contain meglumin and meloxicam in a molar ratio of about 9:8 to 12:8, preferably 10:8.

Meloxicam can be used according to the invention to treat or prevent respiratory diseases in any breed of swines. Preferably pigs selected from the swine breeds American Landrace, American Yorkshire, Angeln Saddleback, Arapawa Island , Ba Xuyen , Bantu, Bazna, Beijing Black , Belarus Black Pied , Belgian Landrace, Bentheim Black Pied, Berkshire, Black Slavonian, British Landrace, British Lop , Bulgarian White , Cantonese , Chester White, Czech Improved White , Danish Landrace, Dermantsi Pied, Duroc, Dutch Landrace, Fengjing , Finnish Landrace, French Landrace, German Landrace,

Gloucestershire Old Spots, Guinea Hog, Hampshire , Hereford, Hezuo, Iberian, Italian Landrace, Jinhua, Kele, Krskopolje, Kunekune , Lacombe , Large Black, Large Black-white, Large White, Lithuanian Native, Mangalitsa, Meishan, Middle White, Minzhu , Mong Cai , Mukota, Mora Romagnola, Moura, Mulefoot, Neijiang, Ningxiang, Norwegian Landrace, Ossabaw Island, Oxford Sandy and Black, Philippine Native , Pietrain, Poland China, Red Wattle, Saddleback, Spots, Swabian-Hall, Swedish Landrace, Tamworth, Thuoc Nhieu , Tibetan , Turopolje, Vietnamese Potbelly, Welsh, and Wuzhishan, in particular American Landrace, Belgian Landrace, British Landrace, Danish Landrace, Dutch Landrace Finnish Landrace, French Landrace, German Landrace, Italian Landrace and Pietrain can be treated with meloxicam according to the present invention.

Furthermore preferred is the administration of meloxicam is in conjunction with an antibiotic, preferably selected from the group consisting of β-lactams, quinolones, tetracyclines, sulfonamides, fenicoles, and macrolides.

Most preferred are amoxicillin, ,oxytetracycline, florfenicol, tylosin, tilmicosin and sulfamethazine

The dose of antibiotic is not critical per se and depends strongly on the different efficacies of the antibiotics used. As a rule up to 150.0 mg/kg, preferably from 0.1 mg/kg to 120 mg/kg, in particular from 10 to 110 mg/kg of an antibiotic are co-administered together with meloxicam.

The following dose ranges are most preferred:

Amoxicillin:	5 to 30 mg/kg, in particular about 10 mg/kg,
Oxytetracycline:	20 to 70 mg/kg, in particular about 30 mg/kg;
Florfenicol:	10 to 20 mg/kg, in particular about 15 mg/kg,
Tylosin:	10 to 25 mg/kg, in particular about 16 mg/kg,

Tilmicosin:	5 to 30 mg/kg, in particular 10 to 20 mg/kg,
Sulfamethazine:	80 to 150 mg/kg, in particular about 100 mg/kg.

The phrase "co-administration" (or "administration in conjunction with"), in defining use of meloxicam and an antibiotic, is intended to embrace administration of each agent in a sequential manner in a regimen that will provide beneficial effects, in particular reduction of the symptoms of the respiratory disease in the affected pig of the drug combination. The phrase also is intended to embrace co-administration of these agents in a substantially simultaneous manner, such as in a single capsule or injection solution having a fixed ratio of these active agents or in multiple, separate capsules for each agent.

Accordingly, meloxicam and the antibiotic may be co-administered in a combined form, or separately or separately and sequentially wherein the sequential administration is preferably close in time.

Preferably the medicament according to this invention is used for the prevention or treatment of Porcine Respiratory Disease Complex in growing or fattening pigs; or

for the prevention or treatment of respiratory diseases in pigs caused by mycoplasmas, in particular *Mycoplasma hyopneumoniae*, *Mycoplasma hyorhinis*,

for the prevention or treatment of respiratory diseases in pigs caused by bacteria in particular *Actinobacillus* spp., in particular *Actinobacillus pleuropneumoniae*, *Bordetella bronchiseptica*, *Pasteurella multocida*, *Arcanobacterium pyogenes*, *Streptococcus* spp, and *Staphylococcus* spp., or

for the prevention or treatment of respiratory diseases in pigs caused by viruses, in particular Swine Influenza Virus, *Aujetzky's* Virus, Porcine Reproductive and Respiratory Syndrome Virus, Porcine Circovirus, and Transmissible Gastroenteritis and Porcine Respiratory Coronavirus.

Most preferably the medicament according to this invention is used for the prevention or treatment of respiratory diseases in pigs caused by *Mycoplasma hyopneumoniae*, *Actinobacillus pleuropneumoniae*, *Bordetella bronchiseptica*, *Pasteurella multocida*, *Streptococcus suis*, Swine Influenza Virus, Porcine Reproductive and Respiratory Syndrome Virus.

The Examples that follow serve to illustrate the use of meloxicam according to the invention. They are intended solely as possible procedures described by way of example, without restricting the invention to their content.

Example 1

Efficacy of meloxicam in pigs with experimental Actinobacillus pleuropneumoniae infection

The study was a controlled, randomised and blinded exploratory study under experimental conditions with a parallel group design.

Crossbred pigs of about 10 weeks of age were challenged with a single intranasal inoculation of *Actinobacillus pleuropneumoniae*. The next day, pigs were included in the study and treated if they fulfilled the following inclusion criteria: rectal temperature ≥40 °C and clinical symptoms of acute or subacute infectious respiratory disease.

Twenty-four (12 castrated male and 12 female) pigs were included and randomly allocated to three treatment groups with 8 pigs per group. The treatment groups were:

Group	**Treatment**
1	Untreated
2	Oxytetracycline
3	Oxytetracycline and meloxicam

Meloxicam was administered as 0.5 % solution, at 0.5 mg/Kg daily on three consecutive days, oxytetracycline as 20 % long-acting solution (Oxytet® 200) at 20 mg/Kg as single injection.

Relevant criteria for the evaluation of efficacy were incidence of fever, clinical parameters of respiratory disease, deaths, and lung lesions at necropsy 10 days after first treatment or after spontaneous death. The percentage of affected lung tissue was calculated by lobe and averaged for the total lung.

Challenge with *Actinobacillus pleuropneumoniae* lead to severe pleuropneumonia within 12 hours.

The incidence of fever (rectal temperature ≥ 40.56 °C) following the first treatment was lower in group 3 (♦) than in groups 1 (Δ), and 2 (o) (cp. Fig. 1).

The best treatment response in clinical parameters was observed in group 3.
The number of pigs which died during the three days following first treatment is displayed below.

Group (n=8 per group)	**Deaths**
1	7
2	1
3	0

The mean extent of lung lesions was less severe in group 3 than in the other groups (see below).

Group	Lung lesions (%)
1	60
2	35
3	14

Meloxicam in addition to antibiotic treatment effectively reduced fever, clinical symptoms of respiratory disease, deaths, and the extent of lung lesions in pigs with experimental *Actinobacillus pleuropneumoniae*-infection.

Example 2

Efficacy of meloxicam in drinking water in experimental Swine Influenza Virus infection

The aim of this study was to test the efficacy of meloxicam granules dissolved in drinking water in pigs experimentally infected with Swine Influenza Virus (SIV).

The study was an open, negative controlled randomised laboratory study carried out according to GCP at one site.

Meloxicam granules containing 6 mg meloxicam per gram were offered to the pigs in the treatment groups (A+B) via drinking water in a concentration of 1 g granules per litre drinking water *ad libitum* for 7 consecutive days. This resulted in an actual meloxicam uptake of 0.8 mg per kg body weight per day. The pigs in the control group (C) received municipal drinking water *ad libitum*.

30 pigs were infected with SIV on study day 0. 10 pigs were allocated to each of the three groups A, B, and C. Treatment (groups A and B) started after SIV challenge on the same day.

The study animals were clinically examined daily on study days 0–7 and 14. They were weighed on study days 7 and 14. All animals of group A and 5 animals of group C were

euthanised and necropsied on study day 7, the remaining study animals—group B and 5 study animals of group C—on study day 14.

It is the major finding of this study that meloxicam granules administered continuously in the drinking water at an approximate daily dose of 0.8 mg/kg body weight significantly alleviated the development of lung lesions caused by experimental infection with SIV during the first week after challenge. Fig. 2 shows the quantity of lung lesions by lung lobe on study days 7 and 14.

On study day 7 the percentage of lung tissue affected with SIV-related lesions (median value) was 8.9 % in meloxicam group A and 23.8 % in the control group (5 study animals of group C).

Moreover, meloxicam-treated pigs reached significantly higher weight gains during the two weeks following infection than untreated controls. Mean daily weight gain in the interval study day 0–7 was 557 g in meloxicam group A and 257 g in the control (5 study animals of group C). In the interval study day 0–14 mean daily weight gain was 629 g in meloxicam group B and 486 g in the control (5 study animals of group C).

The area under the curve of the clinical index score (CIS), a sum of the relevant clinical parameters, over study days 0–7 was significantly smaller in groups A and B than in group C.

Thus oral treatment with meloxicam granules at a dose of 0.8 mg meloxicam per kg body weight per day for 7 consecutive was an efficacious treatment for SIV infection.

Example 3

Field trial regarding the effect of meloxicam in the Porcine Respiratory Disease Complex (PRDC) in growing / fattening pigs

Materials and Methods

A medium scale farm (560 sows), with previous history of recurring PRDC episodes, was selected. A double-blinded randomized study was carried out with the selection of 162 growing animals with a mean age of 90 days at the onset of PRDC clinical signs. Animals were randomly allocated to 8 pens and divided into two treatment groups, with respect to equal sex ratio, same housing and feeding conditions and genetic background. **Group 1** (**PC**) received 800 ppm chlorotetracycline in the feed over 8 consecutive days plus a single IM injection of a placebo (isotonic saline) at d0 (start of the trial, n = 82). **Group 2** (**M**) received 800 ppm chlorotetracycline in the feed over 8 consecutive days plus a single IM injection of 0.4 mg/Kg bodyweight meloxicam (Metacam® 2%, Boehringer Ingelheim GmbH) at d0 (n = 80). Clinical parameters were assessed as the daily Respiratory Score (**RS**), using a 3 point score (0 = absence of signs to 3 = abdominal breathing and disordered general condition) over 8 consecutive days and the total number of additional required injectable medications (**AIM**). Growth performance data for each group included the Average Daily Gain (**ADG**) for the following trial periods: d90 to d117, d117 to d170 (slaughtering) and d90 to d170 of age. Mortality was also calculated for these time periods. Slaughterhouse records per group, included the percentage of each lung surface (**LS**) affected by chronic and acute respiratory lesions.

Student's t-Test and Pearson's Chi-Square Test were used for the consequent comparisons of means and frequencies between trial groups.

Results and Discussion

RS and AIM in the meloxicam group were significantly lower ($p < 0.05$) compared to the control group

Same applies for LS affected by acute lesions ($p < 0.01$), while no differences were observed for LS in chronic cases (Table 1).

The analysis of growth performance data revealed significant differences between groups at d90 to d117 ($p < 0.05$, Table 2).

Table 1 RS, LS: Mean (SD); AIM number (%)

	Treatment Group		
	PC	**M**	**Significance**
RS	0.70 (0.63)[a]	0.50 (0.51)[b]	$p = 0.0289$
AIM (%)	10/82(12.2%)[a]	2/80(2.5%)[b]	$x^2 = 4.226$
LS(chronic)	5.96 (2.28)[a]	5.91 (2.32)[a]	$p = 0.893$
LS (acute)	3.71 (1.81)[a]	2.64 (2.03)[b]	$p = 0.0007$

[a,b] Values in a row with different superscripts differ significantly

Table 2 ADG: Mean (SD)

	Trial Period		
Group	**d90 to d117**	**d117 to d170**	**d90 to d170**
PC	0.64 (0.09)[a]	0.89 (0.06)[a]	0.81 (0.03)[a]
M	0.67 (0.10)[b]	0.89 (0.06)[a]	0.82 (0.03)[a]

Table 3 Mortality: Number of animals/group (%)

	Trial Period		
Group	**d90 to d117**	**d117 to d170**	**d90 to d170**
PC	6/82 (7.32%)[a]	1/76 (1.22%)	7/82 (8.54%)
M	0/80 (0.00%)[b]	1/80 (1.25%)	1/80 (1.25%)

[a,b] Values in a column with different superscripts differ significantly ($p < 0.05$; Table 2 and 3)

Under the conditions of this study, the reduction of the prevalence of respiratory signs as well as the reduced overall number of required injectable antibiotic medications are indicative for the potent anti-inflammatory activity of meloxicam. The latter could become a valuable adjunctive measure, especially when respiratory distress is associated with remarkable reduction of the feed intake. The initial differences in growth performance and in mortality rate could be explained by the fact that meloxicam, when combined with proper antimicrobial medication, contributes to faster recovery from a respiratory inflammation and faster restoring of the distorted growth rate of affected animals. Further research on the evaluation of feed intake and the use of meloxicam in PRDC recurring episodes is required.

25771-1219

CLAIMS:

1. Use of meloxicam or a pharmaceutically acceptable salt thereof in preparing a pharmaceutical composition for treatment or prevention of a respiratory disease in a pig that is caused by virus.

2. Use accordingly to claim 1, wherein the virus is Swine Influenza Virus, *Aujetzky's* Virus, Porcine Reproductive and Respiratory Syndrome Virus, Porcine Circovirus, or Transmissible Gastroenteritis and Porcine Respiratory Coronavirus.

3. Use according to claim 1 or 2, wherein the pharmaceutical composition is in a format for systemic or oral administration.

4. Use according to claim 1 or 2, wherein the pharmaceutical composition is in a format for injection, or is a soluble granule for addition to drinking water or for use as a top dressing on feed.

5. Use according to any one of claims 1 to 4, wherein the respiratory disease is one or more viral components of Porcine Respiratory Disease Complex in growing or fattening pigs.

6. Use of meloxicam or a pharmaceutically acceptable salt thereof for treatment or prevention of a respiratory disease in a pig that is caused by virus.

7. Use according to claim 1, wherein the virus is Swine Influenza Virus, *Aujetzky's* Virus, Porcine Reproductive and Respiratory Syndrome Virus, Porcine Circovirus, or Transmissible Gastroenteritis and Porcine Respiratory Coronavirus.

8. Use according to claim 6 or 7, wherein the pharmaceutical composition is in a format for systemic or oral administration.

9. Use according to claim 6 or 7, wherein the pharmaceutical composition is in a format for injection, or is a soluble granule for addition to drinking water or for use as a top dressing on feed.

10. Use according to any one of claims 6 to 9, wherein the respiratory disease is Porcine Respiratory Disease Complex in growing or fattening pigs.

11. A pharmaceutical composition comprising meloxicam or a pharmaceutically acceptable salt thereof and a pharmaceutically acceptable carrier or diluent for treatment or prevention of a respiratory disease in a pig that is caused by virus.

12. A pharmaceutical composition according to claim 11, wherein the virus is Swine Influenza Virus, *Aujetzky's* Virus, Porcine Reproductive and Respiratory Syndrome Virus, Porcine Circovirus, or Transmissible Gastroenteritis and Porcine Respiratory Coronavirus.

13. A pharmaceutical composition according to claim 11 or 12, wherein the pharmaceutical composition is in a format for systemic or oral administration.

14. A pharmaceutical composition according to claim 11 or 12, wherein the pharmaceutical composition is in a format for injection, or is a soluble granule addition to drinking water or for use as a top dressing on feed.

15. A pharmaceutical composition according to any one of claims 11 to 14, wherein the respiratory disease is one or more viral components of Porcine Respiratory Disease Complex in growing or fattening pigs.

16. An article of manufacture comprising packaging material contained within which is a composition consisting of meloxicam and a pharmaceutically acceptable carrier, and a label which indicates that said composition can be used to treat or prevent a respiratory disease in a pig that is caused by virus.

17. An article according to claim 16, wherein the virus is Swine Influenza Virus, *Aujetzky's* Virus, Porcine Reproductive and Respiratory Syndrome Virus, Porcine Circovirus, or Transmissible Gastroenteritis and Porcine Respiratory Coronavirus.

DRAWINGS

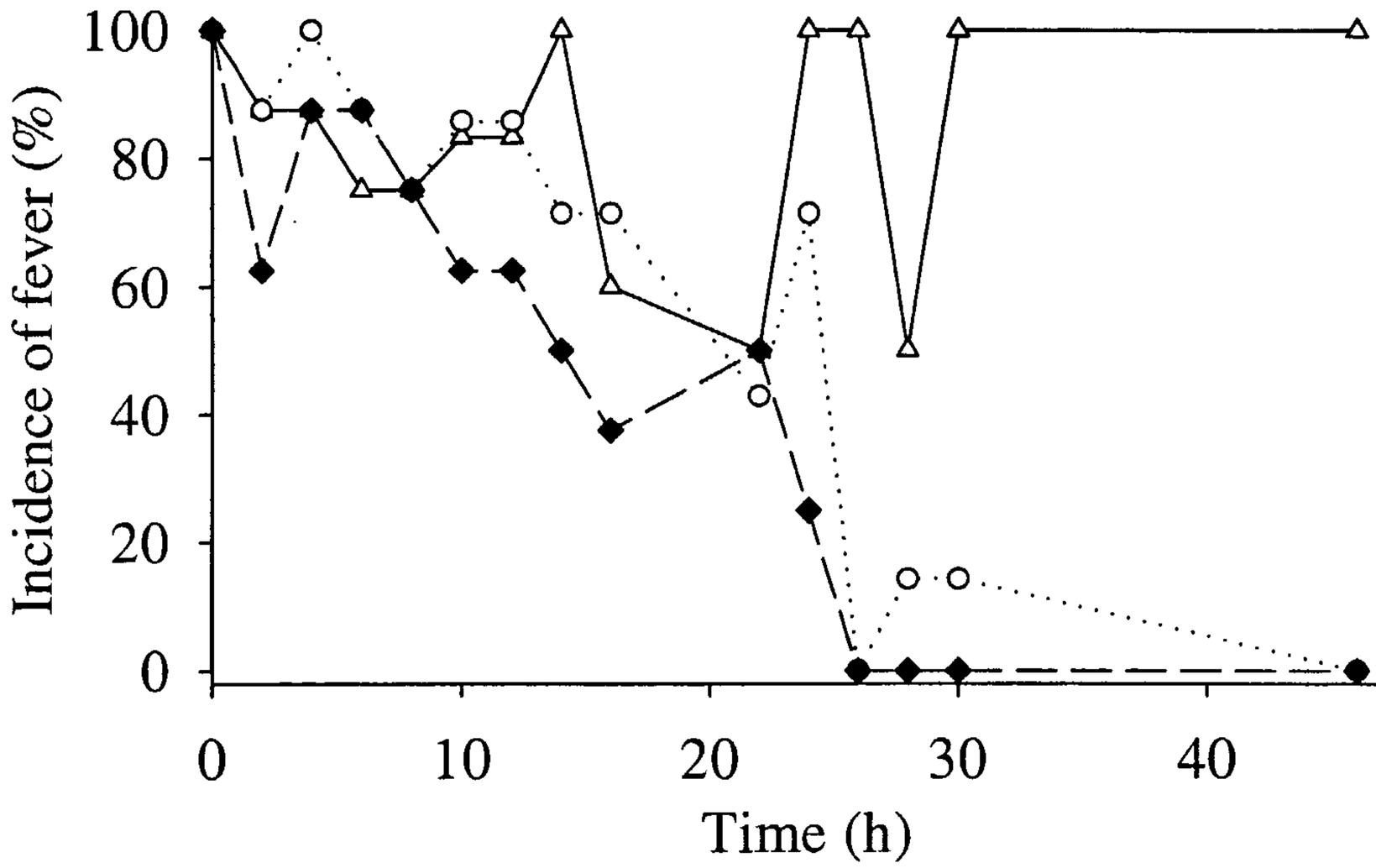


Fig. 1

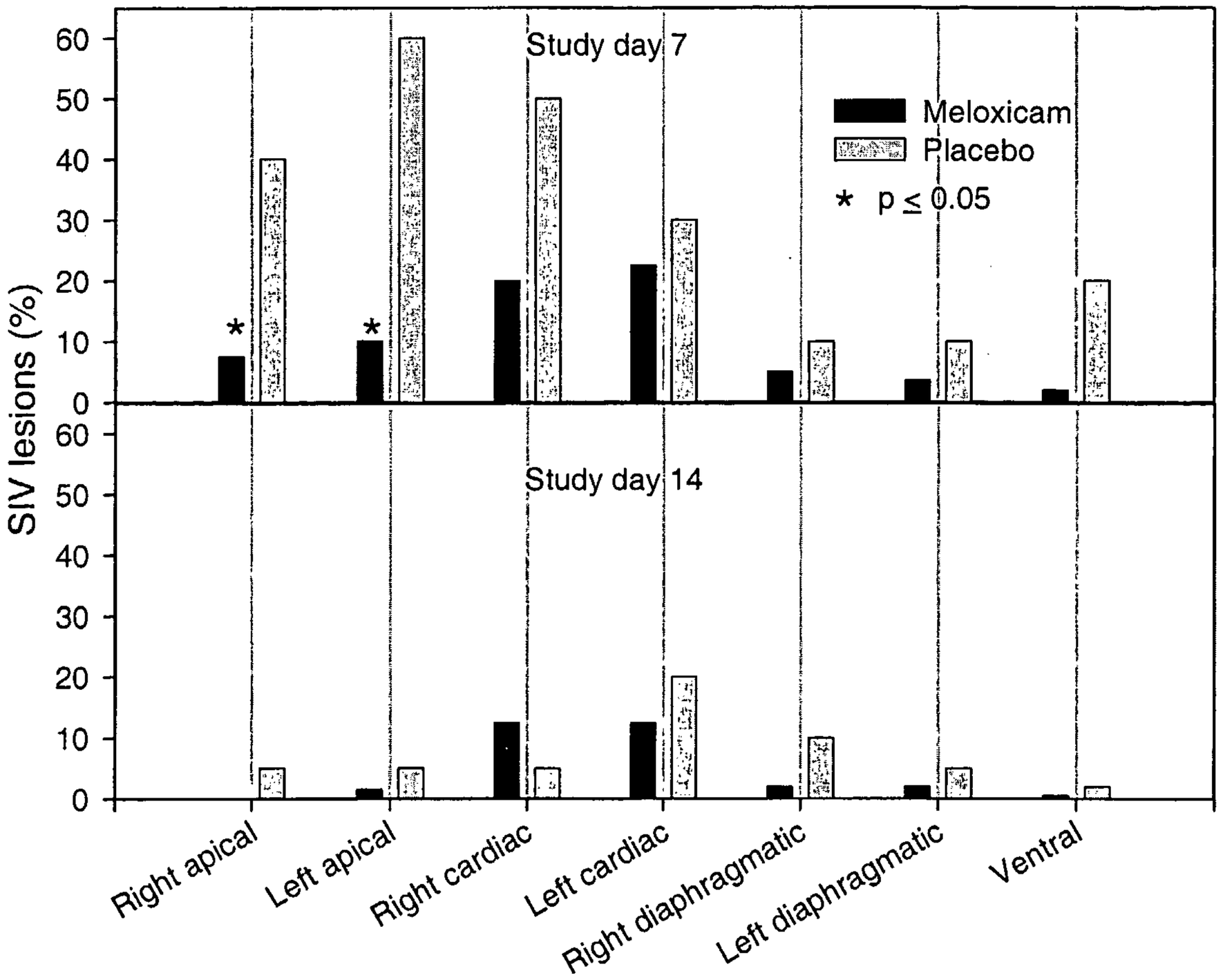

Study day 7
Meloxicam
Placebo
* p ≤ 0.05
Study day 14
SIV lesions (%)
0
10
20
30
40
50
60
*
*
Right apical
Left apical
Right cardiac
Left cardiac
Right diaphragmatic
Left diaphragmatic
Ventral

Fig. 2