

## ORIGINAL PAPER

# Homeopathy as replacement to antibiotics in the case of *Escherichia coli* diarrhoea in neonatal piglets

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**Background:** The use of antibiotics in the livestock sector is increasing to such an extent that it threatens negative consequences for human health, animal health and the environment. Homeopathy might be an alternative to antibiotics. It has therefore been tested in a randomised placebo-controlled trial to prevent *Escherichia coli* diarrhoea in neonatal piglets.

**Method:** On a commercial pig farm 52 sows of different parities, in their last month of gestation, were treated twice a week with either the homeopathic agent *Coli* 30K or placebo. The 525 piglets born from these sows were scored for occurrence and duration of diarrhoea.

**Results:** Piglets of the homeopathic treated group had significantly less *E. coli* diarrhoea than piglets in the placebo group ( $P < .0001$ ). Especially piglets from first parity sows gave a good response to treatment with *Coli* 30K. The diarrhoea seemed to be less severe in the homeopathically treated litters, there was less transmission and duration appeared shorter. *Homeopathy* (2010) 99, 57–62.

**Keywords:** Homeopathy; Piglets; Neonatal diarrhoea; *Escherichia coli*

## Introduction

The use of antibiotics in the agricultural sector is increasing worldwide. In the Netherlands, total antibiotic usage in the livestock sector increased from 322,000 to 590,000 kg active substance between 1999 and 2007.<sup>1</sup> High use of antibiotics can have negative aspects for animal health, human health and the environment.<sup>2</sup> This rapid rise in usage of veterinary antibiotics necessitates the development of sustainable alternatives.

In the organic livestock sector the amount of antibiotics is restricted. Here, antibiotics are partly replaced by complementary or alternative medicines (CAM), of which homeopathy is the most frequently applied.<sup>3</sup> Homeopathy has

demonstrated in many medical areas its effectiveness in practice, but scientific evidence is lacking.<sup>4,5</sup> The veterinary homeopathy research literature comprises less than 20 published, peer-reviewed randomised controlled trials (RCTs).<sup>6</sup> Previous research concerned mastitis in cattle, infertility in cattle, infectious diseases in pigs, growth rate in pigs and salmonella in chickens.<sup>7</sup> Homeopathic remedies have significant benefits since there are no residues in animal products, nor does homeopathy generate resistant microorganisms. According to the European Committee for Homeopathy<sup>4</sup>: “If homeopathy is introduced into the livestock farming sector, the European citizen could be better protected from pharmacological residues in animal products.” Homeopathy aims to activate self-healing mechanisms of the body. Therefore the healing process might have a longer duration and more attention need to be paid to determine the correct remedy. Lack of knowledge and understanding might be reasons for the limited use of homeopathy in the present livestock sector.<sup>8</sup>

In swine, neonatal diarrhoea is one of the most common illnesses. In the first days after birth *Escherichia coli*

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bacteria may cause diarrhoea, leading to weight loss and increased piglet mortality.<sup>9</sup> Conventional treatments of *E. coli* diarrhoea is administration of antibiotics to affected piglets, or preventive vaccination of the sows. Homeopathic treatment of *E. coli* has been studied by Velkers and others<sup>10</sup> in commercial broilers. In that study, broilers were infected with *E. coli* and treated afterwards with an antibiotic or with different combinations of homeopathic remedies, including a nosode of *Coli* 30C. None of the homeopathically treated groups differed significantly from the controls. In another experiment *E. coli* nosodes were administered to calves suffering from scours.<sup>11</sup> Here, the nosode treated group did not differ significantly from the control group, but the study was underpowered, due to small numbers of diseased animals in the treatment and control group. Many experiments in the homeopathic field have failed to prove an effect of the treatment. Reasons for that could lie in the methodology of medicine testing as applied in regular medical science, which partly contradicts with the homeopathic philosophy.<sup>12</sup>

This research aimed at investigating prevention of *E. coli* diarrhoea in neonatal piglets by using a homeopathic *Coli* 30K nosode. The choice of *E. coli* was based on economic importance for the livestock sector and its relevance to antibiotic usage. For the present experiment it was hypothesized that administration of the homeopathic agent *Coli* 30K to sows one month pre-partum can prevent neonatal diarrhoea in piglets caused by *E. coli* bacteria.

## Materials and methods

### Animals and housing

The experiment was performed on a commercial pig farm, where approximately 300 sows (Large White × Dutch Landrace) were present. Piglet mortality on the farm was 12.1% in 2008, partly caused by neonatal *E. coli* diarrhoea. Fifty-two healthy sows in their last month of gestation, which had never been vaccinated against *E. coli* before, were selected. Twenty-six sows were randomly assigned to receive homeopathic treatment and another 26 sows received placebo. In total 525 piglets, born from these sows, were included in the experiment. The placebo group comprised 265 piglets, the *verum* group consisted of 260 piglets. Piglets could suckle colostrum from the sow. Piglets did not receive additional milk replacer or feed. Both groups were housed in the same compartment. Animal care was in accordance to institutional guidelines.

### Experimental design

The experimental design was a randomised, observer blind, placebo-controlled clinical trial. Sows were assigned to gestation groups, i.e. batches, depending on expected week of farrowing. There were four gestation groups with farrowing dates between August 27 and September 20, 2008. Each group included on average 14 sows. According to former research parity has an influence on the occurrence of neonatal diarrhoea.<sup>13</sup> First parity sows may have fewer antibodies than older sows and therefore might transfer

less immunity to the piglets. Therefore strata were made for i) sows in 1st parity, and ii) sows >1st parity. The four gestation groups were first divided in strata and thereafter randomly allocated to group A or group B, in which A received placebo and B the homeopathic treatment (*Coli* 30K). Randomisation was computer generated per batch, i.e. gestation groups 1–4. Administration of treatments, observations and statistical analyses were all performed blind. The research was conducted in normal farm conditions, according to homeopathic principles of disease and recovery. Therefore animals were not deliberately infected, nor was the treatment performed at a random farm but in a situation where *E. coli* occurred naturally.

### Treatments

The homeopathic agent *Coli* 30K is a nosode prepared from various strains of *E. coli* bacteria. It seeks to prevent and cure diseases such as colibacillosis and mastitis caused by *E. coli*.<sup>14</sup> The homeopathic dosage *Coli* 30K consisted of 99.85% demineralised water, 0.1% pure alcohol and 0.05% milk sugar sprinkled with a homeopathic potentization of *E. coli*. The homeopathic milk sugar tablet was manufactured by Unda-Dolisos (LOT:C00A03 341UH6761 F33). The placebo had exactly the same content, except for the homeopathic preparation of *E. coli*. Homeopathic substances are absorbed by the blood through soft tissue of the body e.g. mouth, nose, vulva. For practical reasons the treatment was administered by spraying the agent in the vulva of the sow. Treatments were administered to each sow twice a week during the last four weeks pre-partum.<sup>15</sup>

### Clinical examination

Observations were performed, observer-blind, on both sows and piglets. During application of the treatment the body condition score of the sows, ranging from values of 1–5, was recorded. Piglets were observed daily regarding faecal consistency. Normal faecal consistency was scored as –, diarrhoea defined as watery faeces was noted with +, and severe diarrhoea with dehydration was scored as ++. Faeces samples were taken from three different litters and sent as a mixed sample to the lab of the Animal Health Service, Deventer for identification. Faeces were cultured to identify enteropathogenic *E. coli*, *E. coli* K99 and Salmonella. None of these were identified as present in the faeces sample. This does not per se demonstrate that enteropathogenic *E. coli* were not present at the farm at that moment. It was a relatively small sample size of three litters, which would not necessarily include the infective agent. Because treatment with *Coli* 30C had worked before, and *E. coli* diarrhoea generally can be distinguished based on day of appearance and colour, this was not further investigated. Piglets having diarrhoea were noted by individual registration number and duration of morbidity was recorded. Scours from *E. coli* bacteria were distinguished on the basis of colour and day of appearance. Neonatal *E. coli* diarrhoea is generally observed between 12 h and 5 days after birth<sup>16</sup>, therefore individual observations were continued one week post-partum.

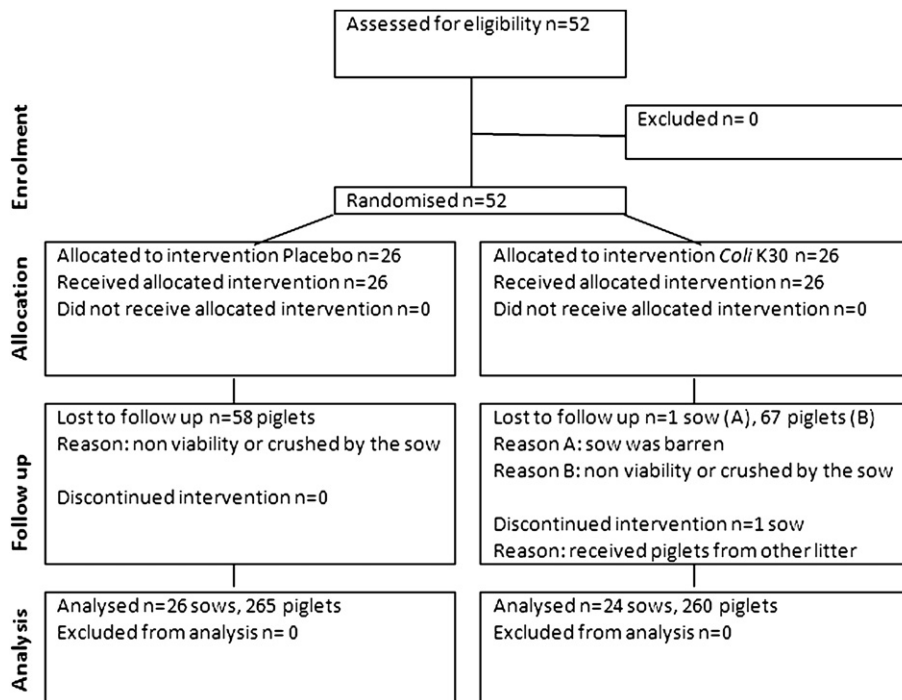


Figure 1 CONSORT flow chart for treatment with *Coli* 30K versus placebo.

## Statistics

The data were analysed with SAS Institute Inc., Cary, NC, USA 2002–2003 (version 9.1.3). Data per piglet were used to generate frequency distributions, further statistical analyses were based on data per sow. To test if the treatment had an effect on the occurrence of diarrhoea, data were analysed using the module Generalized Linear Models. The type of distribution was Binomial, as Link function the Log has been used. To correct for possible effects of season, parity, and group, these factors were included in the model. Values of  $P < 0.05$  were considered significant.

## Results

In total 52 sows were treated with either *Coli* 30K or placebo. Both treatment groups included 26 sows, see Figure 1.

Baseline variables of the four batches, i.e. gestation groups, are presented in Table 1. There were no significant differences between the four groups.

Birth parity number of the sows varied between 1 and 8, with a mean of 3.9 (SD 2.16). Mean condition score was 3.0

Table 1 Baseline variables for the four gestation groups (batches 1–4). Numbers, except for number of sows, are presented as means per batch (parity and condition score of the sows) or means per litter

Batch	1	2	3	4
No. of sows	17	10	13	12
Parity	4.1	5.5	2.7	3.6
Condition score	3.2	2.8	3.0	3.0
Piglets life born	13.9	14.4	11.7	12.0
Piglets dead born	1.4	1.7	1.8	1.3
Final litter size	11.4	11.4	9.6	9.2
Piglets with diarrhoea	1.6	0.8	1.3	2.0

(SD 0.35), which is common. Two sows from the placebo group were excluded from the data, one of them was barren, the other was excluded because other piglets were placed with the sow. In total 650 piglets were born. Sows in their first parity had on average smaller litters than sows in later parities, 11.0 vs 13.2 live born piglets, respectively. Mortality in first parity litters was lower, which resulted at the end of the observation period in 9.6 piglets on average for first parity litters and an average litter size of 10.6 piglets in later parities. Piglets that died from non-viability or that were crushed by the sow were excluded from the experiment. In total, 58 piglets from the placebo group and 67 piglets from the *Coli* 30K group were lost to follow-up. From the 525 remaining piglets 265 were born from sows that received placebo and 260 piglets were from homeopathic treated sows (Figure 1).

During the total observation period 88 piglets suffered from scours. Only two piglets suffered from severe scours, denoted with ++. Therefore the differentiation between diarrhoea (+) and severe diarrhoea (++) was not taken into account during statistical analyses. Fifteen piglets were excluded because they did not fit the definition of *E. coli* diarrhoea, based on day of appearance and colour. After correction there were 73 piglets with *E. coli* diarrhoea as defined, and 452 piglets without. Piglets in the placebo group had slightly over six times more diarrhoea than piglets treated with *Coli* 30K (Table 2). Administering the

Table 2 Incidence of diarrhoea in piglets due to *E. coli*

Group	No. of sows	No. of piglets	No. of piglets with diarrhoea (%)
Placebo	26	265	63 (23.8)
<i>Coli</i> 30K	24	260	10 (3.8)

homeopathic agent *Coli* 30K instead of a placebo significantly diminished the occurrence of neonatal *E. coli* diarrhoea in piglets ( $P < .0001$ ).

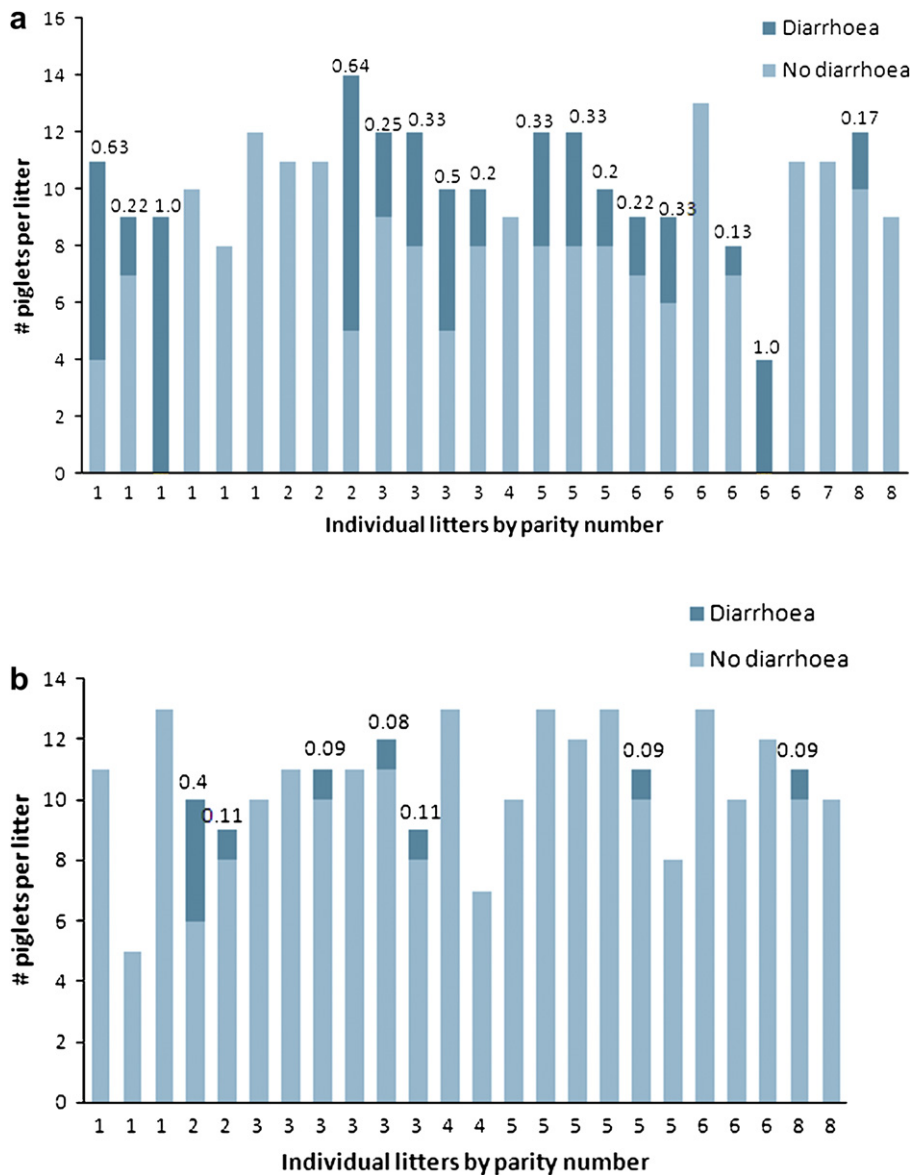
In the placebo group diarrhoea occurred throughout the observation period, with peaks on day 0 (within 24 h after birth) and day 1 (Table 3). In the *Coli* 30K group 60% of the piglets got diarrhoea between 24 and 48 h after birth (day 1). In 70% of all affected litters, piglets within a litter started to show signs of diarrhoea on the same day. Duration was counted from day of appearance of diarrhoea until faeces returned to normal consistency or until death. Only two piglets were lost to follow-up while suffering from diarrhoea. Average duration of diarrhoea tended to be longer in the placebo group than in the *Coli* 30K group, 1.86 vs 1.3 days respectively ( $P = 0.1552$ ).

Data were stratified for first parity sows and >1st parity sows (2nd to 8th parity). There was no significant influence ( $P = 0.3735$ ) of parity on the occurrence of diarrhoea,

**Table 3** Day of occurrence and duration of diarrhoea for newly affected piglets

Day	Occurrence (%)		Duration (%)		
	Placebo N = 63	Coli 30K N = 10	Days	Placebo N = 63	Coli 30K N = 10
0 ≤ 24 h	17 (27.0)	0	0 ≤ 24 h	–	–
1	23 (36.5)	6 (60.0)	1–2	39 (61.9)	7 (70.0)
2	9 (14.3)	0	2–3	8 (12.7)	3 (30.0)
3	9 (14.3)	1 (10.0)	3–4	3 (4.8)	0
4	4 (6.3)	2 (20.0)	4–5	12 (19.0)	0
5	1 (1.6)	1 (10.0)	>5	1 (1.6)	0

though it can be seen that in first parity litters there was a larger difference between the placebo and *Coli* 30K group. While none of the piglets in the *Coli* 30K group showed signs of diarrhoea, piglets from first litters sows in the placebo group showed higher morbidity rates (Figure 2a). This



**Figure 2** (a): Numbers of piglets with and without diarrhoea within placebo-treated litters, fractions denote morbidity rate. Litters are presented by parity number of the sow. (b): Numbers of piglets with and without diarrhoea within *Coli* 30K-treated litters, fractions denote morbidity rate. Litters are presented by parity number of the sow.

reveals that treatment with *Coli* 30K offered good protection against diarrhoea, especially in first parity litters.

In the placebo group 16 out of 26 litters showed diarrhoea, compared to 7 out of 24 litters in the *Coli* 30K group. Within litters transmission of infection can easily take place. This was indeed observed in the placebo group (Figure 2a) where the piglets rapidly infected each other. However, in litters where piglets were treated with the homeopathic agent the disease did not spread further (Figure 2b). While in *Coli* 30K-treated litters mostly only one piglet was affected, 54% of the placebo-treated litters had a morbidity rate of 0.20 or higher.

Day of birth ( $P = 0.3999$ ), gestation group ( $P = 0.5461$ ) and condition score ( $P = 0.1373$ ) had no significant influence on the occurrence of diarrhoea. Since all births took place within two consecutive months, effects of season could be excluded.

## Discussion

Research in the field of homeopathy is often subject to criticism. One of the reasons is that at molecular level no actual substance in highly diluted homeopathic medicines can be detected.<sup>17</sup> To ensure that possible differences between placebo and the medicine could not have been caused by placebo effect or by the farmer taking care of the animals differently after treatment, a randomised, observer blind and placebo-controlled set up was followed.

Results showed that the placebo group faced over six times more diarrhoea than the homeopathic treated group ( $P < 0.0001$ ). Although mean duration of diarrhoea was not significantly different for both groups, 1.86 days on average in the placebo group compared to 1.3 days in the *Coli* 30K group, the difference of half a day can make large differences in the overall performance of piglets. In a study of Johansen and others<sup>18</sup> diarrhoea caused a loss of 8 g in average daily weight gain over the period from birth to weaning, even though sows were vaccinated against *E. coli* and piglets received preventive treatment against coccidiosis.

Within litters, piglets from the homeopathic treated group seemed to be better protected. When diarrhoea occurred within a homeopathic treated litter the disease did not spread further, while piglets from the placebo group rapidly infected each other (Figure 2a). It is common that there is at least one weak piglet in a litter. This piglet usually also has a lack of colostrum intake and therefore is more susceptible to disease.<sup>19</sup>

Piglets from first parity sows are more susceptible to get neonatal diarrhoea because of fewer antibodies in the colostrum.<sup>20</sup> The observation that first parity sows showed an especially good response to the administration of *Coli* 30K, might have been due to lack of former exposure to *E. coli* or lack of habituation to antibiotics.

Homeopathic prescriptions are generally based on the symptoms of disease and individual characteristics of the patient, in this case the animal. In principle the homeopathic preparation of *E. coli* can be used for all types of coliform bacteria infection.<sup>15</sup> However, the effectiveness of an agent

may also depend on farm characteristics, such as breed. Hence, one treatment for a particular disease cannot be a guarantee for each situation. Independent repetition on different farms with standard preventive treatment against *E. coli*, is required.

The owner of the farm where the experiment was carried out was at first quite sceptical about homeopathy. After the experiment he decided to apply *Coli* 30K to all sows. Since then *E. coli* diarrhoea has hardly occurred. In the experimental set up the homeopathic treatment was administered twice a week, over a period of four weeks.<sup>15</sup> In practice it might be possible to administer the treatment once a week during weeks 13, 14 and 15 of gestation and twice a week in the last week before partus, i.e. week 16. Time spent on administration of the homeopathic agent (approximately 5 s per sow) can vary per housing system, since animals have to be approached closely. Advantages at farm level are application of the treatment by the farmer and cost reduction. These advantages and the positive results from this study make the homeopathic agent *Coli* 30K an attractive potential alternative in the prevention of *E. coli* diarrhoea.

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