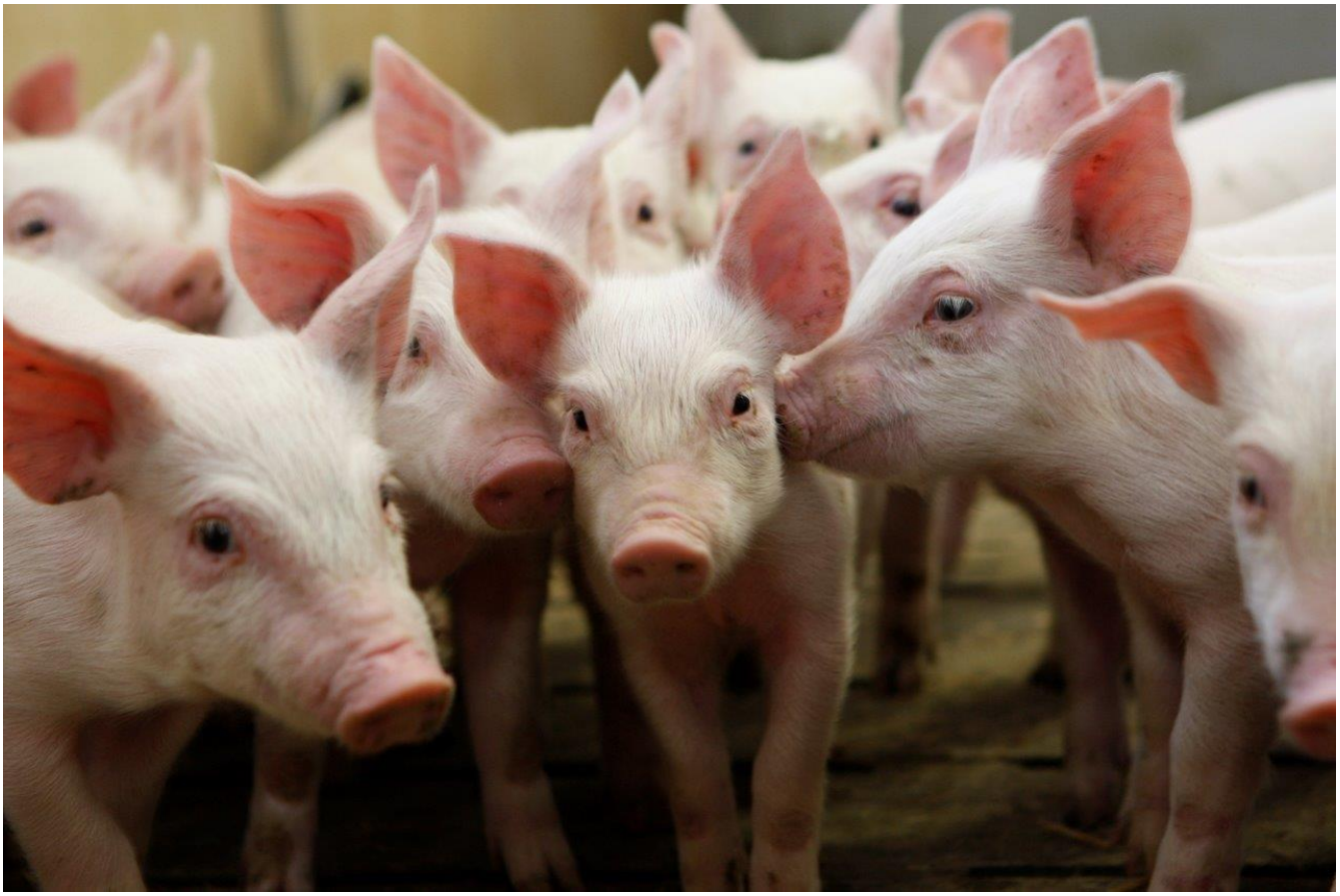
Skjoldborg test station

TestGris***

SvineRådgivningen

Birk Centerpark 24, 7400 Herning
www.svineraadgivningen.dk
CVR: 25399781



SR Elite-weaner diet as an alternative to high doses of ZnO for small piglets after weaning.

Presentation of results from the project “SR Elite-Weaner-Diet”.

Authors:
Dorthe Carlson, Niels Ove Nielsen, Jes Callesen, Bjarne Knudsen, Jonas From Katholm and Jens Korneliussen,

October 2021

Indhold

Sammendrag

Denne rapport præsenterer resultaterne fra projektet "SR Elite Smågriseblanding I". Projektet var et samarbejdsprojekt mellem SvineRågivningens (SR) foderrådgivere og blev finansieret af sponsorater fra de leverandører af foderstoffer og fodertilsætningsstoffer, der blev valgt til at indgå foderblandingen.

Formålet med forsøget var at sammenligne en standard fravænningsblanding med medicinsk zink fra ZnO (Control) med en blanding formuleret af foderrådgiverne ved SR (SR-Elite). De to blandinger bliver kaldt hhv. **Control** og **SR-Elite** i rapporten.

Forsøget blev udført på de mindste af de fravænnede grise (25 ± 3 dage gamle). På grund af deres lave vægt blev disse smågrise placeret i baby-stalde i de første to uger efter fravænning. Effekten af foder i babystalden blev undersøgt og herefter blev de flyttet til klimastalden, hvor de blev fulgt i yderligere fire uger.

Forsøget var designet til at teste foderets effekt på diarré efter fravænning under praktiske produktionsbetingelser. Derudover blev den gennemsnitlige daglige tilvækst (ADG), foderindtag (FI) og foderudnyttelse (FCR; kg foder pr. kg tilvækst og FEs/kg tilvækst) målt.

Forsøget var opdelt i 5 blokke af 2 stald-sektioner, og de to foderblandinger blev tilfældigt fordelt på en af de to sektioner i hver blok. I alt omfattede forsøget 40 stier (20 stier pr. behandling), og det samlede antal grise var henholdsvis 538 og 534 i Control- og SR-Elite-gruppen. Smågrisenes gennemsnitlige startvægt var henholdsvis 4,2 og 4,1 kg for kontrol- og SR-Elite holdet.

Der var ikke behov for medicinsk behandling for diarré i hverken kontrol-holdet eller SR-Elite holdet. Antal dage, hvor 1/3-del af grisene i hver sti havde diarré, var 0,9 dage for kontrolholdet og 1,7 dage for SR-Elite holdet. Antal dage, hvor 2/3-dele af grisene i hver sti havde diarré, var 0,1 og 0,4 dage for hhv. kontrol- og SR-Elite holdet. Der var tendens til at SR-Elite holdet havde højere daglig tilvækst i de første to uger (198 vs. 173 g/d) efter fravænning. Foderudnyttelsen i de første 2 uger var signifikant bedre i SR-Elite holdet sammenlignet med kontrolholdet (1,78 vs. 1,96 FEs/kg tilvækst). De mindste af grisene udnyttede SR-Elite blandingen meget effektivt, hvilket indikerer, at SR-Elite blandingen var særligt gavnlig for de ekstra små grise efter fravænning.

Ud over dette kontrollerede forsøg blev SR-Elite blandingen afprøvet i tre andre besætninger. I disse besætninger blev der i forvejen brugt foder med medicinsk zink som standard i de første 2 uger efter fravænning. Resultatet, en kvalitativ evaluering af SR-Elite blandingen fra de tre besætninger, er præsenteret i Appendix H, og erfaringerne fra de tre besætninger er inkluderet i diskussionen af hovedresultaterne i denne rapport. Erfaringerne fra de 3 besætninger bekræftede resultaterne fra hovedforsøget.

Summary

This report presents a study conducted as a part of the project “SR Elite Weaner Diet I”. The project was a collaborative project between the nutritionists at The Danish Pig Advisory Service (SR) and it was financed by sponsorships from the suppliers of the feed stuffs and feed additives that were chosen to be included in the diets.

The objective of this study was to compare a standard weaning diet containing medical doses of zinc from ZnO (Control) with a diet formulated by the Nutritionist at SR (SR-Elite). The two diets are designated **Control** and **SR-Elite**.

The trial was performed on the smallest of the weaned piglets (25 ± 3 days of age) and due to their low body weight, these piglets were kept in BabyPig rooms for the first two weeks after weaning (BabyPig period) before being transferred to the standard weaning rooms. The effect of diets in the BabyPig rooms was investigated. Hereafter they were moved to standard weaning rooms where they were followed for another four weeks (Weaning period).

The test was designed to test the effect of diet on post weaning diarrhoea in small, weaned piglets under practical pig production conditions. In addition, the average daily gain (ADG), feed intake (FI) and Feed Conversion Ratio (FCR; kg feed per kg gain and FUp per kg gain) was measured.

The trial was divided in 5 blocks of 2 rooms and the two diets were allocated randomly to one of the two rooms in each block. In total, the study included 40 pens (20 pens per dietary treatment) and the total number of pigs was 538 and 534 in the Control and the SR-Elite group, respectively.The average initial body weight of the piglets was 4.2 and 4.1 kg for the Control and the SR-Elite diets, respectively.

There was no need for medical treatment for diarrhea in either the Control or the SR-Elite group. The number of days in which 1/3 of the pigs in each pen had diarrhea was 0.9 days for the control group and 1.7 days for the SR-Elite group. The number of days of which 2/3 of the pigs in each pen had diarrhea was 0.1 and 0.4 days for the Control and SR-Elite group, respectively. The SR-Elite group tended to have higher ADG the first two weeks (198 vs. 173 g/d) after weaning. Feed utilization in the first 2 weeks was significantly improved in the SR-Elite group compared with the Control group (1.78 vs. 1.96 FUp/kg gain). The smallest of the pigs utilized the SR-Elite diet very efficiently, indicating that the SR-Elite diet was particularly beneficial for the extra small piglets after weaning.

In addition to this controlled trial the SR-Elite diet was also tested in three commercial herds. In these herds the standard weaning diets contained medical doses of zinc. The outcome, a qualitative evaluation of the SR-Elite diet from three different herds, is presented in Appendix H and the experiences from the three herds are included in the discussion of the main results in this report. The experiences from the 3 herds confirms the results from the main trial.

Introduction

This report presents a study conducted as a part of the project “SR Elite weaner diet”. The project was a collaborative project between the nutritionists at The Danish Pig Advisory Service (SR) and it was financed by sponsorships from the suppliers of the feed stuffs and feed additives that were chosen to be included in the diets. The project was one of SRs approaches in finding good alternatives to the use of medical zinc for weaning piglets. The use of medical zinc for weaning piglets will be banned in EU from June 2022.

The objective of this study was to compare a standard weaning diet containing medical doses of zinc from ZnO (Control) with a diet formulated by the Nutritionist at SR (SR-Elite). The two diets are designated **Control** and **SR-Elite** in this report.

This trial was conducted in the period April 26 to August 10 (2021) at Skjoldborg test station (TestPig).

The test was designed to test the effect of diet on post weaning diarrhoea in small, weaned piglets under practical pig production conditions. In addition, the average daily gain (ADG), feed intake (FI) and Feed Conversion Ratio (FCR; kg feed per kg gain) was measured.

The trial was performed on small, weaned piglets and due to their low body weight, these piglets were kept in “extra care” weaning rooms for the first two weeks after weaning before being transferred to the standard weaning rooms. The “extra care” weaning rooms and the period where piglets were housed in these rooms are in the following called “BabyPig rooms” and “BabyPig period”, respectively. The effect of diets on production and health in the BabyPig rooms were investigated. Hereafter they were moved to standard weaning rooms where they were followed for another four weeks, which are called the weaning period in this report.

In addition to the main trial the SR-Elite diet was tested in three commercial herds. In these herds the standard weaning diets contained medical doses of zinc. The herd owners agreed to replace their standard diet with SR-Elite diet in one or more week-batches of pigs. The outcome, a qualitative evaluation of the SR-Elite diet from three different herds, is presented in Appendix H. The experiences from the three herds are included in the discussion of the main results from the trial performed by TestPig at Skjoldborg test station.

Materials and methods

Animals, diets and protocol

The test station is a conventional (Health status: Blue Spf + myc + AP6 +AP12+Vac.) integrated production, which runs weekly operation in the sow unit. This means, that every week, sows farrow and piglets are weaned.

The study included a total of 1072 pigs. The pigs were Danbred crossbred (Landrace/Yorkshire x Duroc) female and castrated male piglets with approximately the same number of both genders.

The piglets were weaned at 25 ± 3 days of age. Housing conditions for piglets complied fully with EU and Danish legislation.

The test period was initiated at the day of weaning and finalised at day 43 after weaning.
All rooms used in test were cleaned and disinfected before insertion of piglets.

BabyPig period

Four similar rooms of 4 pens where used. The piglets were group housed in pens and allocated randomly according to gender. Around 27 piglets were inserted in every pen after weaning. Pens are designed as 2-climate pens with an insulated piglet nest and a slatted activity area.

At the day of weaning, all piglets were distributed in the pens according to size (Small or Large). The average body weight of piglets in the pens was in the range of 3.1 to 5.0 kg.

The main objective of this trial was to study the effect of diet on post weaning diarrhoea. Consequently, in order, to avoid contamination of faeces between pens fed the Control and the SR-Elite diet, respectively, it was decided to compromise on the experimental design of the trial. Hence, all 4 pens in one room were fed the same diet. The trial was divided in 5 blocks of 2 rooms and the two diets were allocated randomly to one of the two rooms in each block.

The average initial body weight of the piglets was 4.2 (± 0.5) and 4.1 (±0.5) kg for the Control and the SR-Elite diets, respectively.

The study included 40 pens (20 pens per dietary treatment) and the total number of pigs was 538 and 534 in the Control and the SR-Elite group, respectively.

The SR-Elite diet fed in the baby pig rooms were formulated by nutritionist at SR and produced by Nutrimin (Ans By, Denmark). The Control diet was formulated and produced by Mollerup Mølle (Nykøbing Mors, Denmark). The composition of the diets is given in Table 1 in Appendix B and the detailed prescription on the SR-Elite mixture is shown in Appendix C. All diets were made as meal feed and delivered in 25 kg bags on the test station.

The SR-Elite diet was formulated to contain only heat-treated wheat (Wheat R2 Gelatinized, R2 Agro) and only heat-treated barley (Barley R2 NutriFlakes, R2 Agro), 1.5 % unsoluble fibers (Arbocel, LCH Agro), 5% Blood plasma (Badenhop), 16% milk powder (Masterlac 17/20, Mosegaarden), 5% AX3 Digest (Triple A) and no soybean meal. It was intended to keep a low acid binding capacity (ABC) by using AX3 Digest instead of fish meal and soybean meal and by using 0.5% calcium formate instead of limestone ($CaCO_3$). In addition, the diet was supplemented with 0.5% benzoic acid (Vevovital, DSM) and 0.4% of FormaXOL (coated calcium formate and citric acid, Kemin).

The protein content was kept low (127 g digestible protein per FUp) and the amino acid content was increased, relative to the standard recommendations, with 18% for lysin, methionine, threonine and tryptophane, respectively, and with 14% for valine. The lysine source used was lysin-chloride instead of lysine-sulphate to keep the sulphate level low (<1%).

Vitamins were dosed according to the OVN principles (DSM), and the supplemented iron and zinc was the organically bound Availa-Fe (Zinpro) and Availa-Zn (Zinpro), respectively. Additionally, the total iron content was reduced compared with the standard recommendations. Finally, the diet also contained a probiotic source of Bacillus Subtilis (CLOSTAT XCL, Kemin).

All piglets in the SR-Elite group received 0,2 % of an acid blend (Selko pH E, Trouw Nutrition) in the drinking water.

The compositions of the test diets were unknown for the personnel at the test station.

In each pen two different feeding troughs (vertical and horizontal) were used for manual feeding of dry feed and manual feeding of wet feed (dry feed + water), respectively (see picture in Appendix A). The pigs were fed *ad libitum* with dry feed in the vertical feeders. The wet feed (dry feed mixed and soaked with water) was fed 4 times each day during the working hours (evenly distributed between 07:00 and 15:00 hours) and one time in the evening (between 20:00-23:00 hours). The pigs had permanent access to fresh water from a nipple drinker located in the pen.

Registration in the BabyPig period

The piglets were weighed when allocated to the pens at the day of insertion and when the BabyPig period was finalised at day 14. All pigs in one pen were weighed as a unit. Whenever a pig was taken out of the study due to death or disease the date and weight was recorded.

Every time a new 25 kg bag was opened it was noted for which pen it was used. Each bag was dedicated for only one pen.

Every day, during the whole test period, the faeces in every pen was visually evaluated and it was noted if 0/3, 1/3, 2/3 or 3/3 of the pigs in each pen had diarrhoea (Appendix F).

The standard procedure was followed in respect of registration of any medical treatment (including date and treatment days) against diarrhoea and other infections.

Weaning period

At day 14 after weaning the piglets were moved into the standard weaning rooms. Eight similar rooms of 12 double-pens where used. Of the 12 double-pens per room only 2 (4 single pens) were used for this trial. The double-pens were traditionally structured sharing two dry feed dispensers integrated in the mid-pen wall partitioning the double-pen in two pens (photo of pen design in Appendix A).

In the weaning rooms the piglets were placed in pens together with their pen mates from the baby pig room.

In the weaning rooms all pigs were fed the experimental diets (Control and SR-Elite) for the first 2 days followed by gradual shift (over 3 days) the to the standard weaning diet produced on the farm (Appendix D)

The shift between the three standard diets (feeding phases) was also gradually over 3 to 4 days from one phase to the next. The gradually shift between the phases was automatically controlled (Agrisys, Denmark).

Registration in the weaning rooms

The piglets were weighed at the day of insertion and after 29 days. All pigs in one pen were weighed as a unit.

The amount of feed produced per feed dispenser per day was recorded by the feeding computer.

Whenever a pig was taken out of the study due to death or disease the weight was recorded. Any medical treatment (including treatment days) against diarrhoea and infections was registered.

Calculations and statistics

Average daily gain per piglet was calculated as the difference in weight at insertion (day 1) and exit of the BabyPig room (day 14), For the final four weeks the average daily gain was calculated as the difference in the weight at insertion in the weaning room (day 14) and weight at day 43 (exit of test). The body weight used was an average of the piglets in each pen.

In the BabyPig rooms Feed Intake (FI) per pen was calculated as the total amount of feed used for this pen (number of bags x 25 kg) minus the amount of feed (kg) in the last bag opened and minus any feed residues in the dry feed dispenser. The wet feed troughs were always emptied by the pigs before the test was finalised.

In the standard weaning rooms two pens shared one feed dispenser and hence the FI per pen was registered as 50% of feed produced per feed dispenser minus 50% of the remaining feed residues

The average number (means) of days with 0/3, 1/3, 2/3 or 3/3 diarrhoea was calculated per dietary treatment.

In all calculations, data were adjusted for number and weight of piglets taken out of trial (only the number of days that the piglet was in test was used).

Pigs taken out of study (PTO) was calculated as percentage of the initial number of piglets.

All statistical analyses were done in cooperation with the Danish Technological Institute, Department of field trials, technology and analysis, Aarhus, Denmark. Animal performance data were statistically analysed by the GLMM procedure of R (R Core Team, 2014).

ADG, FI and FCR in the BabyPig rooms and in the weaning rooms were analysed in a Gaussion mixed effect model including initial body weight (BW) at day 0, weekly batch number, diet (Control and SR-Elite) and interactions between BW and diet. “Weekly batch number” was included in the model as a random parameter and “diet” was included in the model as a fixed parameter. When the effect of interactions between BW and diet was not statistically significant ($P<0.05$), it was removed from the model.

The faecal score data were analysed by a Poisson regression model including initial body weight at day 0, weekly batch number, diet (Control and SR-Elite). “Weekly batch number” was included in the model as a random parameter and “diet” was included in the model as a fixed parameter.

Statistical significance was accepted at $P<0.05$.

Results and comments

Health parameters in the BabyPig period

In general, all piglets in this trial performed very well throughout the study period. Only one piglet received antibiotic treatment against diarrhoea with injections of Borgal® (Ceva Santé Animale) for 3 on each other following days. This piglet was from the SR-Elite group. In addition to this antibiotic treatment against diarrhoea, 3 piglets from the SR-Elite group were treated for arthritis with injections of Streptocillin® (Boehringer Ingelheim) for 3 on each other following days. In the Control group 3 piglets were treated for cerebrospinal meningitis and 1 piglet was treated for hoof inflammation with injections of Streptocillin® (Boehringer Ingelheim) for 3 on each other following days.

The prevalence of diarrhoea was very limited in this trial both in the Control and SR Elite group and as mentioned above only one pig (out of all 1072 pigs) was given medical treatment for diarrhoea throughout the whole test period. This very low incidence of diarrhoea was surprising as it is very common on this test farm that the small newly weaned piglets in the baby rooms require antibiotic treatments against diarrhoea. Interestingly, it was observed that the first batch of newly weaned piglets after this trial was finalised required antibiotic treatment due to diarrhoea outbreak. These piglets, that were not in test, were fed a standard weaning diet without medical zinc, but with 5% blood plasma.

The results from the daily registrations on diarrhoea, observed as 0/3, 1/3, 2/3 or 3/3 of the faeces visible at the floor in each pen, is presented in Table 1. It shows that on average all pens in the Control group had 0.9 day where 1/3 of the piglets had diarrhoea and the pens in the SR-Elite group had 1.7 days where 1/3 of the piglets had diarrhoea. Similarly, it shows that the pens on average had 0.1 and 0.4 days where 2/3 of the pigs had diarrhoea. However, these differences were not significant ($P=0.28$ and $P=0.30$, respectively) and the number of days with signs of diarrhoea was very limited in both groups. None of the pens had any days where all piglets had diarrhoea.

Table 1. Average number of days with signs diarrhoea per pen (1/3, 2/3 or 3/3 of all piglets) fed the experimental diets.

	Diet		
	Control	**SR Elite**	**P-value**
Days with 1/3 diarrhoea[y]	0.9	1.7	0.28
Days with 2/3 diarrhoea[y]	0.1	0.4	0.30
Days with 3/3 diarrhoea[y]	0	0	-

[y] Values are LS-means (n=20),

In Table 2 the performance parameters in terms of ADG, FI and FCR is presented. In the BabyPig period the ADG tended to (P=0.13) to be higher in the SR-Elite group compared with the control group (198 and 173 g/d, respectively). The FI was similar (P=0.53) between the two groups with 265 and 275 g/d in the Control and SR-Elite group, respectively. However, the FCR was significantly (P=0.03) influenced by the dietary treatments and the SR-Elite feed was most efficient utilized, with 1.40 kg feed/kg gain compared with 1.51 kg feed/kg gain in the Control group. Due to differences in FUp per kg feed, differences in FCR expressed as FUp/kg gain were even more pronounced (P=0.007) with 1.96 and 1.78 FUp/kg gain in the Control and SR-Elite group, respectively.

Table 2. Initial Body Weight (BW), Intermediary BW and Final BW, Average daily gain (ADG), feed intake (FI) and feed converstion ratio (FCR) in the BabyPig period (day 1-14), in the weaning period (day 14-43) and for the total test period (day 1-43) of pigs fed the two experimental diets.

		Diet		P-values		
	Day	**Control**	**SR Elite**	**Diet**	**BW x diet**	**LSD**
Body Weight:						
Initial BW, kg[y]	1	4.2 (±0.5)	4.1 (±0.6)	NA	NA	-
Intermediary BW, kg	14	6.6 (±0.8)	6.9 (±0.8)	NA	NA	-
Final BW, kg[y]	43	22.8 (±1.8)	22.6 (±2.0)	NA	NA	-
BabyPig room:						
ADG, g/d[x]	1-14	173	198	0.13	0.007	37
FI, g/d[x]	1-14	265	275	0.53	NS	36
FCR, kg feed/kg gain[x]	1-14	1.51	1.40	0.03	<0.001	0.16
FCR, FUp/kg gain	1-14	1.96	1.78	0.007	<0.001	0.20
Weaning room:						
ADG, g/d[x]	14-43	549	533	0.50	NS	57
FI, g/d[x]	14-43	820	741	0.25	NS	80
FCR, kg feed/kg gain[x]	14-43	1.43	1.38	0.21	NS	0.09
Total test period:						
ADG, g/d[x]	1-43	427	424	0.85	NS	38
FI, g/d[x]	1-43	620	599	0.32	NS	49
FCR, kg feed/kg gain[x]	1-43	1.44	1.38	0.03	NS	0.07

[y] Values are means ± SD (n=20), [x] Values are LS-means (n=20). BW x diet: Interactions between initial BW and diet, NA: Not analysed, NS: non signficant

In the weaning period (day 14-43), where all piglets shifted to the same standard weaning diet, there were no significant effect of diet on ADG, FI or FCR (P=0.5, 0.25 and 0.21, respectively). However, ADG was numerically higher in the Control group compared with the SR-Elite group (549 g/d and 533 g/d, respectively). Similarly, FI was higher in the Control group compared with the SR-Elite group (820 and 741 g/d, respectively). However, FCR was numerically improved in the SR-Elite group compared with the control group (1.38 and 1.43 kg feed/kg gain, respectively).

For the total test period (day 1-43) the ADG and FI was similar in the two dietary groups (P=0.85 and P=0.32, respectively). However, FCR differed significantly (P=0.03) with the most efficient feed utilization in the SR-Elite group.

The LSD values (Table 2) indicate that the test was scaled to identify differences of 37 g/d, 36 g/d and 0.16 kg feed/kg gain in ADG, FI and FCR, respectively, in the BabyPig period and differences of 57 g/d, 80 g/d and 0.09 kg feed/kg gain in ADG, FI and FCR, respectively, in the weaning period.

The statistical analysis of ADG and FCR in the baby pig period revealed significant interactions between dietary treatment and initial bodyweight (Table 1). These interactions are illustrated in figure 1 (Appendix G). Figure 1a illustrates that the FI increased with the initial BW for both diets. However, the response in terms of ADG differed between the diets as the ADG in general was higher for the small piglets (<4kg) in the SR-Elite group compared with the small (<4kg) piglets in the Control group. Figure 2c, illustrates that the differences in FCR between the two diets (Table 1), mainly was a consequence of that the very small piglets (<4kg) utilised the SR-Elite diet more efficiently compared with the Control diet.

These interactions between initial BW and diet indicates that the SR-Elite diet was especially beneficial for the extra small piglets after weaning. An explanation could be that these small piglets are restrained in their feed intake capacity as well as their digestive system and consequently the content of highly digestible nutrients, low ABC- and pH values etc. in the SR-Elite diet may have a higher impact on these small piglets that were behind their littermates in weight gain at the time of weaning.

The mortality was identical for the two dietary groups in the total test period (Table 3), where 1.5% of the piglets died in each of the dietary groups. In Appendix E, details regarding the number of pigs taken of the study in the babyPig- and weaning period, respectively, is presented. The reasons, for taking the pigs out, included different kinds of veterinary observations e.g., diarrhoea, hernia, arthirits etc. The data does not imply a difference between in the two groups in PTO, neither in terms of numbers or reasons.

Table 3. Pigs taken out of study (PTO) as % of total number of pigs in test (day 0-43)

	Control	**SR-Elite**
Dead, %	1.5	1.5
Disease pen, %	1.1	1.9

The experiences from the qualitative tests at three commercial farms (Appendix H) supports the finding in this trial. In general, piglets fed the SR-Elite diet in the three herds performed on the same level (or slightly better) compared with piglets fed the Control diets including medical doses of zinc. In these 3 herds the diarrhoea frequency was also slightly higher for piglets fed the SR-Elite diet compared with piglets fed the Control diets. But as was the case in this controlled trial the prevalence of diarrhoea was also relatively limited in the three herds that tested the SR-Elite diet.

Conclusion

It is concluded, that the SR-Elite diet in general performed just as well as the positive control diet that contained medical doses of zinc from ZnO. The prevalence of diarrhoea was very low (nearly absent) in both dietary groups. The number of days with feaces on the floor that was scored to be of diarrhoea consistency did not differ significantly between the two dietary groups, however numerically it was slightly higher in the SR-Elite group.

The smallest of the small piglets utilised the SR-Elite diet very efficient, which indicates that the SR-Elite diet is particularly beneficial for the extra small piglets after weaning

Appendix A. Photo of the pens used for test

Pens in a BabyPig room

Pens in a standard weaning room

Appendix B. Feed ingredients of diets used the first 2 weeks after weaning.

Table 1. Feed ingredients of the two diets used in the baby rooms for the first two weeks after weaning (3-6 kg).

	Control, %	**SR Elite, %**
Wheat (Wheat R2 Gelatinized, R2 Agro)		52.8
Wheat, heat treated	20.0	
Wheat	24.3	-
Barley (Barley R2 NutriFlakes, R2 Agro)		13.5
Corn, flakes	3.0	-
Milk powder (Masterlac 17/20, Mosegaarden)	-	16.0
Milk powder	18.0	-
Lactose powder	9.1	-
Soy protein concentrate	10.0	-
Soy protein concentrate (AX3 Digest, Triple A)	-	5.0
Potato protein	7.0	-
Plasma (Badenkop)	-	5.0
Lignocellulose (Arbocel, LCH Agro)	-	1.5
FormaXOL (Kemin)	-	0.4
Fat	2.7	1.0
Benzoic acid	0.5	0.5
Calcium formate	0.5	0.5
Zink Oxide premix	0.3	-
Organic iron and zinc (Zinpro)	-	0.2
Minerals, vitamins, amino acids etc.	4.6	3.6
Bacillus subtilis (Clostat XCL dry)	-	0.08
FUp per kg feed (calculated)	1.30	1.27
Ileal Digestible protein (g/FUp) (calculated)	131	127

Appendix C Detailed prescription on the SR-Elite mixture

Recept: 700696-0L	SR Eliteblanding			
Navn	Nutrimin A/S	Tlf. / mobil	87500880 /	
Adresse	Bodalen 11, 8643 Ans By	Email	info@nutrimin.dk	GMP+ FSA assured

Kode	Navn	Pct	Mængde
0045106	Barley, heattreated flakes	13,500	13,500
0045009	Wheat, heattreated	52,816	52,816
0070013	Milkpowder, fatrich	16,000	16,000
0045506	Arbocel RC Fein	1,500	1,500
0035179	Sojaprot.konc. AX3 Digest	5,000	5,000
0035333	Plasma Powder / Badenkop	5,000	5,000
0010209	Monocalcium phosphate	1,291	1,291
0030109	Dustbinder	1,012	1,012
0055009	L-Lysine	0,764	0,764
0055108	DL-methionine	0,271	0,271
0055202	L-threonine	0,294	0,294
0055305	DL-Tryptophan	0,082	0,082
0055406	L-Valine	0,132	0,132
0050107	Calciumformiate	0,500	0,500
0050008	Benzoeic acid	0,500	0,500
0050391	Forma XOL, Acid Blend	0,400	0,400
0025813	Clostat XCL Dry, '	0,075	0,075
0075273	Aroma, Luctarom Advance	0,100	0,100
0015243	Iron Chelate of Amino Acid, Zinpro	0,071	0,071
0016023	Zink Chelate, of Amino Acids Zinpro	0,118	0,118
0021693	SR Eliteblanding, Premix	0,500	0,500
800023-0L	Forbl Små SR Eliteblanding	0,075	0,075
		100,000	100,000

Næringsstof		Pr. kg	Pr. energi	Næringsstof		Pr. kg	Pr. energi
-------- Energy ---------		0	0	Magnesium	g	0,94	0,74
Mass volume	kg/l	0,5368	0,4227	Clorine	g	5,53	4,35
Feed Units Pigs	FEsv	1,2700	1,0000	Potasium	g	4,86	3,83
Feed Units Sows	FEso	1,2463	0,9814	Electrolyte balance	meq	109,89	86,53
Dry Matter	%	92,35	92,35	-- Micromineralsr --		0	0
Crude protein	%	17,91	14,10	Fe - added	mg	63,50	50,00
Crude fat	%	5,90	4,65	Fe, iron (II) -aminosyrechelat, l	mg	63,50	50,00
Crude ash	%	5,09	4,01	Cu - Added	mg	135,00	106,30
Fiber	%	3,44	2,71	Mn, added	mg	52,44	41,29
Protein from soya products	%	3,40	2,68	Zn, added	mg	118,00	92,91
Starch	g	395,90	311,73	Zn, zinkaminosyrechelat, hydra	mg	118,00	92,91
Lactose	g	64,00	50,39	I, added	mg	1,31	1,03
------- Amino Acids ------		0,00	0,00	Se, added	mg	0,45	0,35
St. Dig. Protein	g	161,33	127,03	Se, sodium selenite	mg	0,45	0,35
Lysin	g	15,96	12,57	-------- Vitamins --------		0	0
St. Dig. Lysin	g	14,99	11,80	A-vitamin - Added	1000	15,00	11,81
Methionin	g	5,17	4,07	25-hydroxy-vitamin D3, 1000 i	1000 i.e	2,00	1,57
St. Dig. Methionin	g	4,93	3,88	E-vitamin - Added	i.e.	200,00	157,48
St. Dig. Methionin + Cystein	g	8,20	6,46	E-vitamin/dl-alfa-tokoferol	mg	182,00	143,31
Threonin	g	10,05	7,91	K3-vitamin - Added	mg	9,00	7,09
St. Dig. Threonin	g	9,27	7,30	B1-vitamin/ Thiamin - Added	mg	4,50	3,54
Tryptofan	g	3,46	2,73	B2-vitamin/Riboflavin - Added	mg	12,50	9,84
St. Dig. Tryptofan	g	3,18	2,50	B6-vitamin/ Pyridoxin - Added	mg	7,00	5,51
St. Dig. Isoleucin	g	6,23	4,91	B12-vitamin - Added	mg	0,0600	0,0472

Info 29-09-2021 11:50:11 Udskrevet af JM AgroSoft WinOpti.Net 1 / 2

Recept: 700696-0L SR Eliteblanding

Navn	Nutrimin A/S	Tlf. / mobil	87500880 /
Adresse	Bodalen 11, 8643 Ans By	Email	info@nutrimin.dk

GMP+ FSA assured

Næringsstof		Pr. kg	Pr. energi	Næringsstof		Pr. kg	Pr. energi
St. Dig. Leucin	g	12,49	9,84	Niacin - Added	mg	70,00	55,12
St. dig. Histidin pigs	g	4,06	3,19	Biotin vitamin H - Added	mg	0,40	0,31
St. dig. Fenylanin	g	7,51	5,91	D-pantotenenic acid, added	mg	40,00	31,50
Valin	g	10,31	8,12	Folinic acid, added	mg	2,25	1,77
St. Dig. Valin	g	9,27	7,30	Cholinchlorid - Added	mg	650,00	511,81
-- Macrominerals --		0	0	C-vitamin - Added	mg	225,00	177,17
Calcium	g	6,94	5,47	------- Other -------		0	0
Phosfor	g	6,87	5,41	Benzosyre	mg	5.000	3.937
Dig. Phosfor 0% fytase	g	3,47	2,73	Calciumformiat	mg	5.000	3.937
Dig. Phosfor 60% fytase	g	3,76	2,96	Beta xylanase (3.2.1.8)	TXU	840,00	661,42
Dig. Phosfor 100% fytase	g	3,88	3,06	Beta gluconase (3.2.1.4)	TGU	375,00	295,28
Dig. Phosfor 150% fytase	g	3,96	3,12	Bacillus subtilis	mia	3,00	2,36
Dig. Phosfor 200% fytase	g	4,06	3,19	Diatomaceous earth (E551c)	mg	9,32	7,34
Ford. fosfor, 300 % fytase	g	4,14	3,26	Clostat XCL Dry	mg	750,00	590,55
Ford. fosfor, 400 % fytase	g	4,19	3,30	Forma XOL	mg	4.000,00	3.149,61
Natuphos (3.1.3.26)	FTU	1.400,00	1.102,36	Aroma	mg	1.000,0	787,4
Sodium	g	3,25	2,56				

Appendix D. Diets used in the standard weaning rooms

Table 1. Feed ingredients (%) in the starter diet 6-9 kg.

	%
Wheat	65.0
Fish Meal	6.5
Soy oil	2.4
Premix[1]	26.1[1]

[1]Containing soy-, potato-, and milk proteins, vitamins, minerals, amino acids, phytase, antioxidants, xylanase and organic acids

Table 2. Feed ingredients (%) in the transition diet (9-15 kg).

	%
Wheat	61.1
Barley	10.0
Soybean meal	10.0
Soy oil	1.5
Alpha Soy	10.1
Premix[1]	7.3

[1]Containing potato protein, vitamins, minerals, amino acids, phytase, antioxidants and organic acids

Table 2. Feed ingredients (%) in the final diet (15-30 kg).

	%
Wheat	41.3
Barley	25.0
Soybean meal	26.9
Soy oil	1.7
Premix[1]	5.1

[1]Containing vitamins, minerals, amino acids, phytase, antioxidants and organic acids

Appendix E. Pigs Taken Out of study (PTO) and medical treatments.

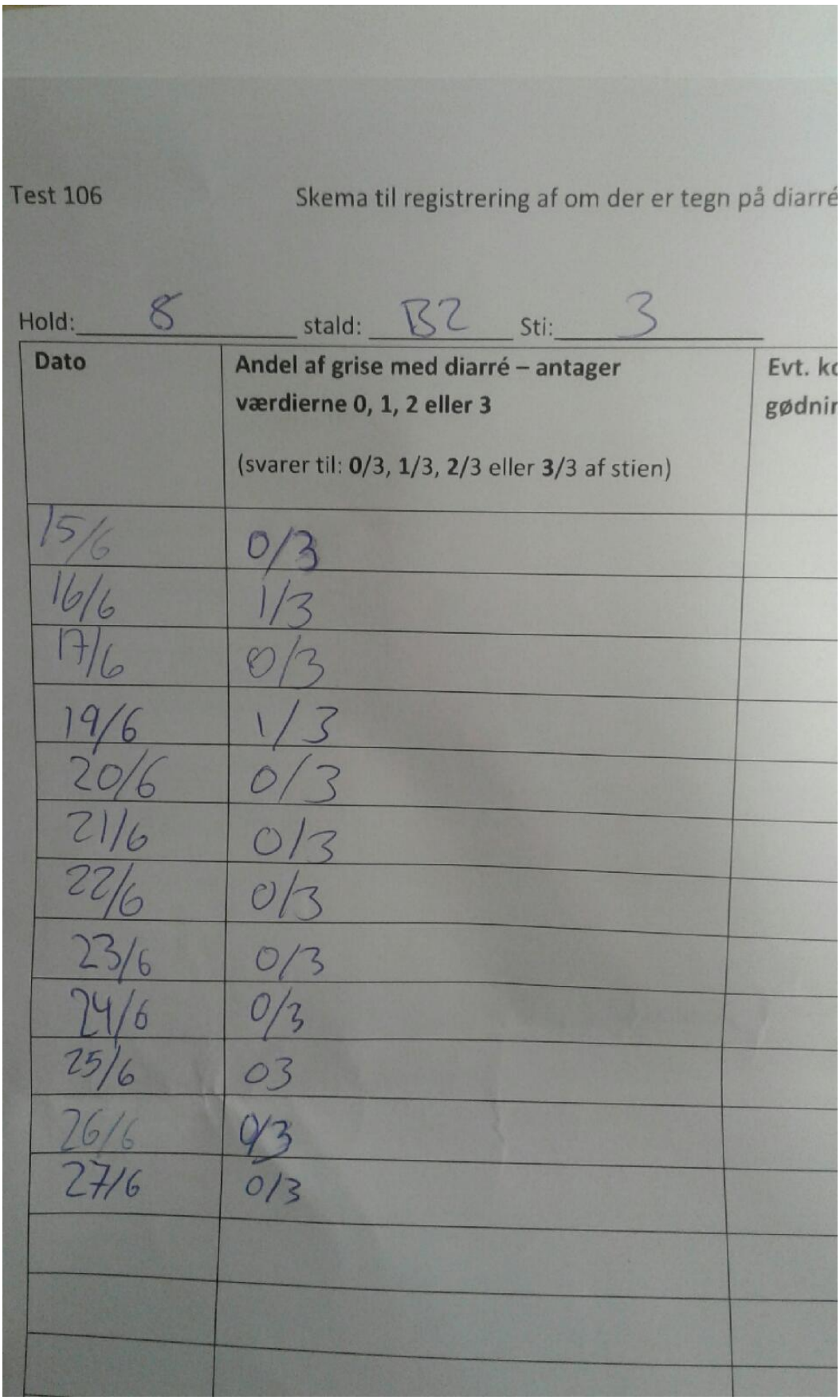
Table 1. Pigs taken out of study (PTO, number of pigs) in the test period (day 0-14) and the reason for taking it out and PTO in % of total number of experimental pigs.

	Control	**SR-Elite**
PTO:		
Dead	5	1
Disease pen	0	0
Reason:		
Cerebrospinal Meningitis	0	0
Diarrhoea	0	0
Arthritis	3	0
Hernia	0	0
Un-thriving	1	0
Other	1	1
PTO as % of total number of pigs	0.93	0.19

Table 2. Pigs taken out of study (PTO, number of pigs) in the test period (day 14-43) and the reason for taking it out and PTO in % of total number of experimental pigs.

	Control	**SR-Elite**
PTO:		
Dead	3	7
Disease pen	6	10
Reason:		
Cerebrospinal Meningitis	0	4
Diarrhoea	0	0
Arthritis	3	5
Hernia	3	0
Un-thriving	2	2
Other	1	6
PTO as % of total number of pigs	1.7	3.2

Appendix F. Daily registration of prevalence of diarrhea in each pen.



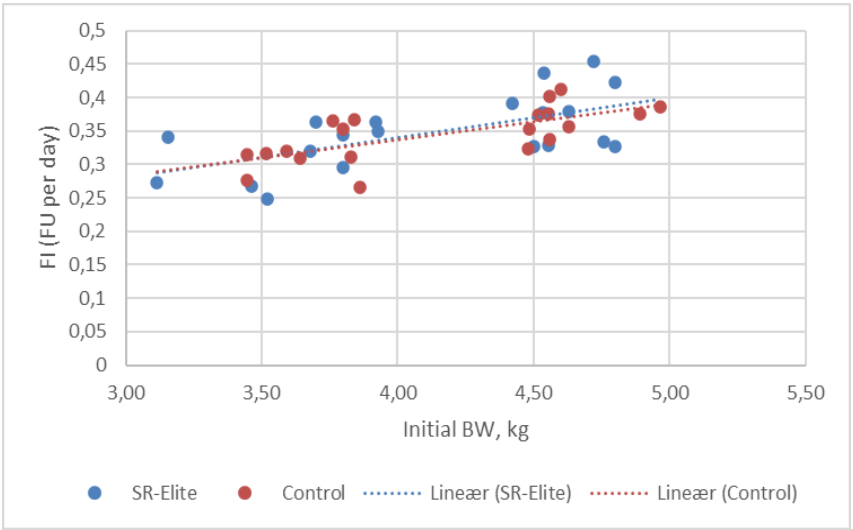
Test 106 Skema til registrering af om der er tegn på diarré

Hold: 8 stald: B2 Sti: 3

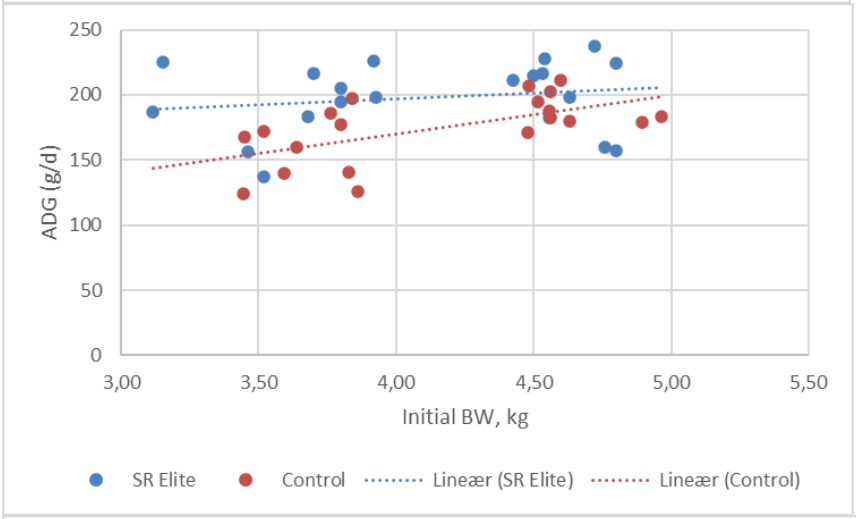
Dato	Andel af grise med diarré – antager værdierne 0, 1, 2 eller 3 (svarer til: **0**/3, **1**/3, **2**/3 eller **3**/3 af stien)	Evt. kg gødnir
15/6	0/3	
16/6	1/3	
17/6	0/3	
19/6	1/3	
20/6	0/3	
21/6	0/3	
22/6	0/3	
23/6	0/3	
24/6	0/3	
25/6	03	
26/6	0/3	
27/6	0/3	

Appendix G. Correlations between (a) initial BW and FI, (b) initial BW and ADG and (c) initial BW and FCR

a)



b)



c)

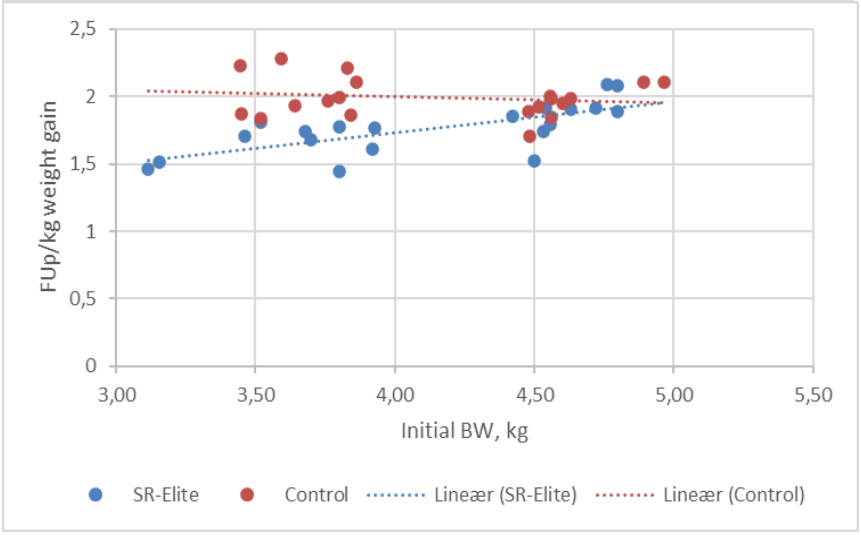


Figure 1. Correlations between (a) initial BW and FI, (b) initial BW and ADG and (c) initial BW and FCR during the first 14 days of the trial (BabyPig period)

Appendix H. Qualitative test in three commercial herds

The SR-Elite diet was also tested qualitatively in three commercial pig herds. The method used was to exchange the normal starter diet containing medical doses of zinc oxide (3 kg/ton) with the SR-Elite diet (including 0.2% acid in the drinking water) in one or more week-batches of pigs. The objective was to obtain a qualitative evaluation from three commercial pig herds as a supplement to the main trial presented in this report.

Herd 1

Two week batches of pigs (2 x 200 pigs) with an average weight of 7.0 kg, were fed SR Elite Diet for two weeks instead of the normal starter diet (with medical doses of zinc) used.

No pigs were weighed after entry. Thus, no growth data are available. Treatments for diarrhoea were recorded.

The starter diet with medical doses of zinc normally used in herd 1 (Control diet) contained: Wheat (35%), barley (19%), cake-mix (10%), EP200 (15%), expanded oats (6%), milk products (5%), potato protein concentrate (1%), soybean oil (2.2%), Ca-formate (0.75%), benzoic acid (0.5%), **zinc oxide (0.3%)**, probiotic feed additive. Protein 18.1% (125 g digestible protein/FU), Calcium: 6.9 g/kg, Energy: 1.24 FU/kg.

The qualitative feedback from the manager in herd 1 was:

1. Feed intake seemed to be higher than normal with the SR Elite Diet. The pigs seemed visually bigger after 14 days than pigs fed the normal starter diet.

2. The smallest 20% of the pigs fed the SR-Elite diet, were treated with antibiotics for diarrhoea. This is usually not necessary when using the starter diet with medical doses of zinc (control, which is normally used on this farm (Control diet).

Herd 2

At weaning 120 pigs with an average weight of 6.3kg were divided into two treatment groups (2 pens with 30 pigs in each group). One group was fed the SR-Elite diet for 14 days, and the other was fed the starter diet normally used at the herd (with medical doses of zinc).

No pigs were weighed after entry. Thus, no growth data are available. Treatments for diarrhoea were recorded.

The starter diet with medical doses of zinc normally used in herd 2 (Control diet) contained: Wheat (48%), barley (10%), milk products (12%), HP300 (11%), cake-mix (4%), potato protein concentrate (4%), wheat bran (1,3%), soybean oil (1.7%), Ca-formate (1.0%), benzoic acid (0.5%), **zinc oxide (0.3%)**. Probiotic feed additive. Protein 18.2% (131 g digestible protein/FUp), Calcium: 7.1 g/kg, energy: 1.22 FUp/kg.

The qualitative feedback from the manager in herd 2 was:

1. Feed intake and weight of the pigs fed SR-Elite diet seemed visually to be similar to the control diet with medical doses of zinc.

2. A total of 35 treatments for diarrhoea were used in the two pens fed the SR-Elite diet. In the two pens fed the Control diet only 12 treatments for diarrhoea were used.

Herd 3

A total of 250 pigs were divided into two treatment groups at weaning. Of these, 150 pigs (average 6.30kg at weaning) were allocated into 3 pens (50 pigs/pen) and fed the SR-Elite diet. The remaining 100 pigs (average 6.55kg at weaning) were allocatated into 2 pens and fed the Control diet normally used in the herd (with medical doses of zinc). After 3½ weeks both groups were gradually switched onto wet feed.

All pigs were weighed at weaning, day 18 and day 46 after weaning. Feed intake (FI) for each pen was recorded. Feed conversion (FCR) was calculated as (FU/kg weight gain). Treatments for diarrhoea were only recorded the first 14 days after weaning.

The starter diet with medical doses of zinc normally used in herd 3 (Control diet) contained: Wheat (58%), barley (10%), soyprotein concentrate (10%), milk products (6%), fish meal (5%), potato protein concentrate (2,2%), soybean oil (2.3%), Ca-formate (0.7%), benzoic acid (0.5%), **zinc oxide (0.3%).** Protein 19.1% (137 g digestible protein/FUp), Calcium: 7.3 g/kg, energy: 1.22 FU/kg.

The qualitative feedback from the manager herd 3 was:

1. At day 18 FI was 0.14 FU/day higher, ADG was 47 g higher, but FCR was +0.25 (worse) for pigs fed the SR-Elite diet compared to the pigs fed Control diet with medical doses of zinc.

2. At day 46 (end of trial) FI was only marginally (0.03 FU/day) higher, ADG was 24 g higher and FCR was -0.03 (better) for pigs fed the SR-Elite diet compared to the pigs fed Control diet.

3. Treatments for diarrhoea (only the first 14 days) were at a very low level. Number of treatments for diarrhoea were similar or less for SR-Elite diet compared to the Control diet.

Overall conclusion for herd 1, 2 and 3:

- At day 14 (or 18) FI and ADG were similar or better for the pigs fed the SR-Elite diet compared to pigs fed a starter diet with medical doses of zinc oxide (0.3%).

- Treatments for diarrhoea were slightly higher for pigs fed the SR-Elite diet. The general prevalence of diarrhoea was low.

- The above conclusions support the findings of the main trial (this report).