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BUTIREX VFA C4 IMPROVES WEANER PRODUCTIVITY

TRIAL REPORT NO. 971

Butirex VFA C4, which is a butyric acid product, improves productivity in weaners. Once the costs of adding the product are covered, production value was positively affected when 0.3 % Butirex VFA C4 was added to weaner feed.

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PUBLISHED: 27 JUNE 2013

Abstract

Productivity improved when 0.3 % Butirex VFA C4 was added to weaner feed. The improvement more than made up for the extra costs of adding Butirex VFA C4. Butirex VFA C4 contains sodium butyrate (the salt of butyric acid).

Butirex VFA C4 was studied on one farm with weaners in a trial comprising two groups:
- Group 1: Control
- Group 2: Trial (incl. 0.3 % Butirex VFA C4)

Background

The market for new products and diets for weaners is constantly growing. It is therefore necessary to analyse the production value of these products to enable the Danish pig producers to assess the economic potential in using these products.

Spanish producer of Butirex VFA C4 Novation requested documentation of the effect of adding their product to weaner feed. Butirex VFA C4 is based on sodium butyrate, which is the salt of butyric acid. According to Novation, Butirex VFA C4 has a positive impact on the intestinal function in pigs by increasing the length of intestinal villi, which is expected to improve the absorption of nutrients in the feed. The product is furthermore thought to restrict the growth of pathogen bacteria and stimulate the growth of beneficial bacteria.

The aim of the trial was to investigate the effect of Butirex VFA C4 in weaner feed recorded on pig productivity.

Materials and method

The trial was conducted at Pig Research Centre's experimental station Grønhøj, which is an SPF herd with weaners and finishers, in two sections: one with 12 pens and one with 18 pens. Each pen accommodated ten pigs and was equipped with a dry feeder and a nipple drinker. The percentage of female pigs and castrates and the start weight in the two groups were identical and it was ensured that both groups were evenly divided between the two sections. The trial comprised two groups with 18 pens each (replicates) totalling 180 pigs per group. The trial design is shown in table 1.

Table 1. Trial design.

Group	1. Control	2. Butirex VFA C4
Starter diet (first 12 days post-weaning)	Control	0.3 % Butirex VFA C4
Weaner diet	Control	0.3 % Butirex VFA C4

The pigs' weight averaged 7.3 kg at the start of the trial and 31.0 kg by the end of the trial.

Feed and feeding

The diets for both groups were pelleted and produced at Danish Agro's feed mill. The diets used in the trial group were largely identical to those used in the control group with the exception of the addition of 0.3 % Butirex VFA C4 to both the starter diet and the weaner diet. A technician from Pig Research Centre was present during the production of the weaner diet, but not during the production of the starter diet. The first batch of the starter diet had to be discarded due to errors resulting in carry-over

from one diet to the other, wherefore a new batch of the starter diet was produced. The planned amount of Butirex VFA C4 was weighed out manually and added to the mixer.

Butirex VFA C4 adds extra energy to the feed, and to compensate for this, the percentage of wheat in the trial diets was reduced. The inclusion of Butirex VFA C4 was the rate recommended by Novation. 2,500 ppm VetZink was added to the starter diet, which was fed to the pigs the first 12 days of the trial followed by a three-day gradual switch to the weaner diet. The composition of the diets is shown in appendix 1. The starter diet was weighed out manually from feed carts with scales, and the weaner diet was fed at pen level using a Spotmix feeding system. Spotmix is a computerised feeding system that weighs out feed at pen level.

Diet formulations complied with the current Danish standards [1]. Furthermore, the content of the amino acids lysine, methionine, threonine, tryptophan and valine was 5 % above the current nutrient standards as a guarantee against variations in the crude protein content of the ingredients. Green microgrits were added to the control feed and red microgrits were added to the trial feed thereby making it possible routinely during the trial to check that the correct diet was fed to the right group.

Recordings
All recordings were made at pen level. Daily gain, feed intake, treatments for disease, mortality and pigs moved to hospital pens were recorded.

Analyses of feed
Samples of each diet were taken according to the TOS principles (Theory Of Sampling) with the automatic sampling equipment at the feed mill. Each of the four diets was produced in one round, and production was planned so that the starter diet and the weaner diet, respectively, were produced on the same day. Four samples of the starter diet and four of the weaner diet were analysed for content of energy, crude protein, fat and ash. Two samples of each diet were also analysed for content of lysine, methionine, cystine, threonine, calcium, phosphorus, zinc and phytase. These analyses were conducted at Eurofins Steins Laboratory. One sample of each diet was analysed twice for content of butyric acid. Novation had these analyses made at a Spanish laboratory (Nutega) on samples marked with colour codes.

Calculations and statistics

Production results, daily gain and FCR were pooled in one value; the production value. The below variables were used for calculating the production value:

- Value of gain
- Feed costs
- Productive days

The below values based on the prices of five years (September 1, 2007 – September 1, 2012) were also used:

Average price of a 7 kg pig: DKK 205 per pig, DKK ± 9.65 per kg
Average price of a 30 kg pig: DKK 348 per pig, DKK -5.80/+5.96 per kg
Starter diet: DKK 3.33 per FUgp
Weaner diet: DKK 1.98 per FUgp

Definition of each variable:
Value of gain = pigs' daily gain in kg during the trial × value of 1 kg gain

The value of 1 kg gain used in the calculations was DKK 6.16, which was the average gain throughout the entire period.

Feed costs calculated on the basis of the content of analysed feed units (calculated with the EDOMi method[1]) were determined with the below equation:
Feed costs = (end weight – start weight) × FUgp per kg gain × DKK per FUgp

Production value (PV) per place unit per day was calculated as described below:
Production value in DKK per place unit per day: (value of gain – feed costs) / productive days

Productive days = the number of days that the average pig was included in the trial.

The production value per place unit/day was analysed as primary parameter with start weight as co-variable. The model included section, block and group as variables. Furthermore, normal distribution and prevalence of outliers were analysed. No pens were discarded from the data set. Mortality and treatments for disease were analysed as secondary parameters using logistic regression.

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[1] EDOMi = Enzyme Digestible Organic Matter, ileum

Results and discussion

Analyses of feed

Appendix 2 shows the results of the analyses of the feed. The analysed content of protein and amino acids in the starter diet for the control group deviated from the declared content by approx. -10 %. Results confirmed that the starter diet for the trial group contained the expected levels of protein and amino acids. In both groups, analyses revealed lower content of phosphorus than declared, and particularly the trial feed contained less phytase than declared.

In the weaner diet, analyses confirmed largely identical content of protein and amino acids in both groups – all with good agreement with the declared values. In both diets (control + trial), analyses revealed far lower content of phytase than actually added.

The analysed content of butyric acid in the starter diet for the trial group was lower than expected (945 mg/kg analysed vs 1,500 mg/kg expected). The weaner diet for the trial group also contained less butyric acid than expected (1,058 mg/kg vs 1,500 mg/kg expected) – cf. appendix 2. As mentioned above, Butirex VFA C4 was weighed out and mixed manually into the feed, and it is therefore uncertain whether the lower content found in the analyses is attributed to a lower concentration of acid in the product, analysis inaccuracies or to "dissolution" of the product over time. Samples were analysed approx. 3-4 months after feed was produced.

Overall, the variations in the starter diet may have favoured the trial group slightly, whereas no remarks were made to the analyses of the weaner diet, which the pigs were fed for the main part of the trial period. Phytase content was low in both groups, and that has therefore not affected the comparison between the two groups.

Productivity and production value

The production results are shown in table 2, and the production value based on the production results is shown in table 3. The production value was significantly positively affected by the addition of Butirex VFA C4 when calculated with identical feed prices in both groups. The pigs fed the diet containing Butirex VFA C4 had a higher feed intake; a higher daily gain; and a better FCR.

With the +10 index points, the feed may cost up to DKK 16 more per 100 FUgp with the price conditions used for the calculations in this trial when compared with the price of the control diet. According to Novation, Butirex VFA C4 costs approx. € 2.70/kg. This corresponds to an increase in the feed price of approx. DKK 6 per 100 kg (DKK 759 per € 100) when adding 0.3 % Butirex VFA C4. Overall, there is an economic benefit in using Butirex VFA C4.

Table 2. Production results (corrected average).

Group	1. Control	2. Butirex VFA C4	Statistics
Blocks	18	18	
Pigs	180	180	
Before intermediate weighing (approx. 7-9 kg) – starter diet			
Daily gain, g	190	230	P=0.0003
Daily feed intake, FUgp	0.28	0,30	P=0.006
FCR, FUgp/kg gain	1.48	1.34	P=0.005
After intermediate weighing (approx. 9-30 kg) – weaner diet			
Daily gain, g	572	607	P=0.0007
Daily feed intake, FUgp	0.97	1.01	P=0.008
FCR, FUgp/kg gain	1.70	1.67	P=0.006
Entire trial period (approx. 7-30 kg)			
Daily gain, g	484	519	P=0.0002
Daily feed intake, FUgp	0.81	0.85	P=0.0042
FCR, FUgp/kg gain	1.68	1.64	P=0.0007

Table 3. Production value (PV) based on 5 years' prices (2007-2012) and identical feed prices.

Group	1. Control	2. Butirex VFA C4	Statistics
PV, DKK/place unit/day	1.30	1.43	P<0.0001
Index	100	110	P<0.0001

There must be a minimum difference of 3.7 index points between two groups for the difference to be significant.

Health

Treatments for disease and mortality were recorded as secondary parameters in the trial, ie. the trial is not designed to test small differences in these parameters. Consequently, it is not possible to make any certain conclusions in terms of disease and mortality.

Table 4 shows the frequency of treatments, mortality rate and number of culled pigs. Analyses revealed no significant differences between the two groups.

Table 4. Dead and culled pigs and treatments for disease (corrected values for treatments for disease and raw averages for mortality).

Group	1. Control	2. Butirex VFA C4
Total treatments for disease, days/pig	4.1	4.8
Treatments for diarrhoea before intermediate weighing, days/pig	0.4	0.3
Treatments for diarrhoea after intermediate weighing, days/pig	3.7	4.5
Dead and culled, %	3.9	3.3
Overall mortality, %	0	1.1

Conclusion

The outcome of this trial demonstrated that the addition of 0.3 % Butirex VFA C4 to feed for weaners improved productivity significantly, and that this improvement more than outweighed the extra costs of adding Butirex VFA C4 to the feed.

References

[1]   Nutrient Standards, 17th edition, Pig Research Centre.

Participants

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Statistical assistance: Mai Britt Friis Nielsen

Trial no. 1182

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Appendix 1

Composition of the feed

Starter diet, composition in %

Group	1. Control	2. Butirex VFA C4
Wheat	45.933	45.629
Barley	15.00	15.00
Soybean meal, toasted, dehulled	7.00	7.00
Vilosoy, soy protein concentrate	9.921	9.970
Fishmeal, low in ash	5.00	5.00
Dried whey Variolac 960	6.00	6.00
Molasses, sugar beet	1.00	1.00
Potato protein concentrate	3.30	3.30
Palm oil	3.052	3.008
Feed lime	0.751	0.750
Mono calcium phosphate 22.7 %	1.231	1.233
Salt	0.313	0.314
Lysine, 98 % HCL	0.406	0.405
Methionine, DL 98 %	0.123	0.123
Threonine, 98 %	0.129	0.129
Tryptophan, 99 %	0.043	0.043
Valine, L 98.5 %	0.027	0.027
Vitamins and minerals	0.40	0.40
Ronozyme NP*	0.020	0.020
Microgrits	0.05	0.05
Zinc oxide (VetZink)	0.30	0.30
Butirex VFA C4	-	0.30

*To both diets, 2,000 units phytase and 5,000 units xylanase were added.

Weaner diet, composition in %

Group	1. Control	2. Butirex VFA C4
Wheat	53.011	52.714
Barley	15.00	15.00
Soybean meal, toasted, dehulled	16.00	16.00
Vilosoy, soy protein concentrate	5.061	5.102
Molasses, sugar beet	1.00	1.00
Potato protein concentrate	3.00	3.00
Palm oil	2.452	2.408
Feed lime	1.590	1.589
Mono calcium phosphate 22.7 %	1.192	1.195
Salt	0.427	0.427
Lysine, 98 % HCL	0.455	0.455
Methionine, DL 98 %	0.143	0.143
Threonine, 98 %	0.140	0.140
Tryptophan, 99 %	0.032	0.032
Valine, L 98.5 %	0.026	0.026
Vitamins and minerals	0.40	0.40
Ronozyme NP*	0.02	0.02
Microgrits	0.05	0.05
Butirex VFA C4	-	0.30

*To both diets, 2,000 units phytase and 5,000 units xylanase were added.

Appendix 2

Analyses of feed

Nutrient content, starter diet - declared and analysed values

Group	1. Control		2. Butirex VFA C4	
Content	Analysed	Declared	Analysed	Declared
FUgp per 100 kg (EDOMi) [1]	116.0	116	117.3	116
Crude protein, % [1]	19.2	20.9	20.5	20.9
Crude fat, % [1]	5.4	5.3	5.4	5.3
Crude ash, % [1]	5.2	6.1	5.5	6.1
Lysine, g/kg [1]	13.9	14.8	15.2	14.8
Methionine, g/kg [2]	4.2	4.8	4.9	4.8
Cystine, g/kg [2]	3.0	3.3	3.3	3.3
Meth + Cys, g/kg [2]	7.2	8.1	8.2	8.1
Threonine, g/kg [2]	8.5	9.3	9.6	9.3
Calcium, g/kg [2]	7.2	7.9	7.5	7.9
Phosphorus, g/kg [2]	6.4	7.0	6.6	7.0
Zinc, mg/kg [2]	1,929	2,470	2,274	2,470
Phytase, FTU/kg [2]	1,664	2,000	1,193	2,000
Butyric acid, ppm (mg/kg) [2]	0	0	945	1,500

1) Average of 4 analyses. 2) Average of 2 analyses.

Declared values for zinc and phytase are added values, ie. do not include the natural content of the feed.

Nutrient content, weaner diet - declared and analysed values

Group	1. Control		2. Butirex VFA C4	
Content	Analysed	Declared	Analysed	Declared
FUgp per 100 kg (EDOMi) [1]	114.7	111	114.9	111
Crude protein, % [1]	18.7	19.4	19.3	19.4
Crude fat, % [1]	4.7	4.5	4.7	4.5
Crude ash, % [1]	5.4	6.1	5.4	6.1
Lysine, g/kg [1]	13.8	13.6	13.9	13.6
Methionine, g/kg [2]	4.1	4.3	4.2	4.3
Cystine, g/kg [2]	3.3	3.3	3.4	3.3
Meth + Cys, g/kg [2]	7.4	7.6	7.6	7.6
Threonine, g/kg [2]	8.5	8.6	8.7	8.6
Calcium, g/kg [2]	8.6	9.4	8.3	9.4
Phosphorus, g/kg [2]	6.0	6.1	5.8	6.1
Zinc, mg/kg [2]	160	100	132	100
Phytase, FTU/kg [2]	711	2,000	919	2,000
Butyric acid, ppm (mg/kg) [2]	0	0	1,058	1,500

1) Average of 4 analyses; 2) Average of 2 analyses

Declared values for zinc and phytase are added values, ie. do not include the natural content of the feed.

Appendix 3

Information on Butirex VFA C4, incl. Danish supplier

Producer	Novation E-28823 Coslade Madrid Spain Danish supplier: Chr. Olesen Jægersborg Allé 164 DK-2820 Gentofte www.chr-olesen.dk
Content	Contains sodium butyrate.
Expected effect	Increases length of intestinal villi. Stimulates beneficial flora and restricts growth of pathogen bacteria in the gastro-intestinal tract.
Guiding price	€ 2.70 per/kg. Feed price increases by DKK 6.15/100 kg feed at an exchange rate of EUR of 759 and an inclusion of 0.3%.