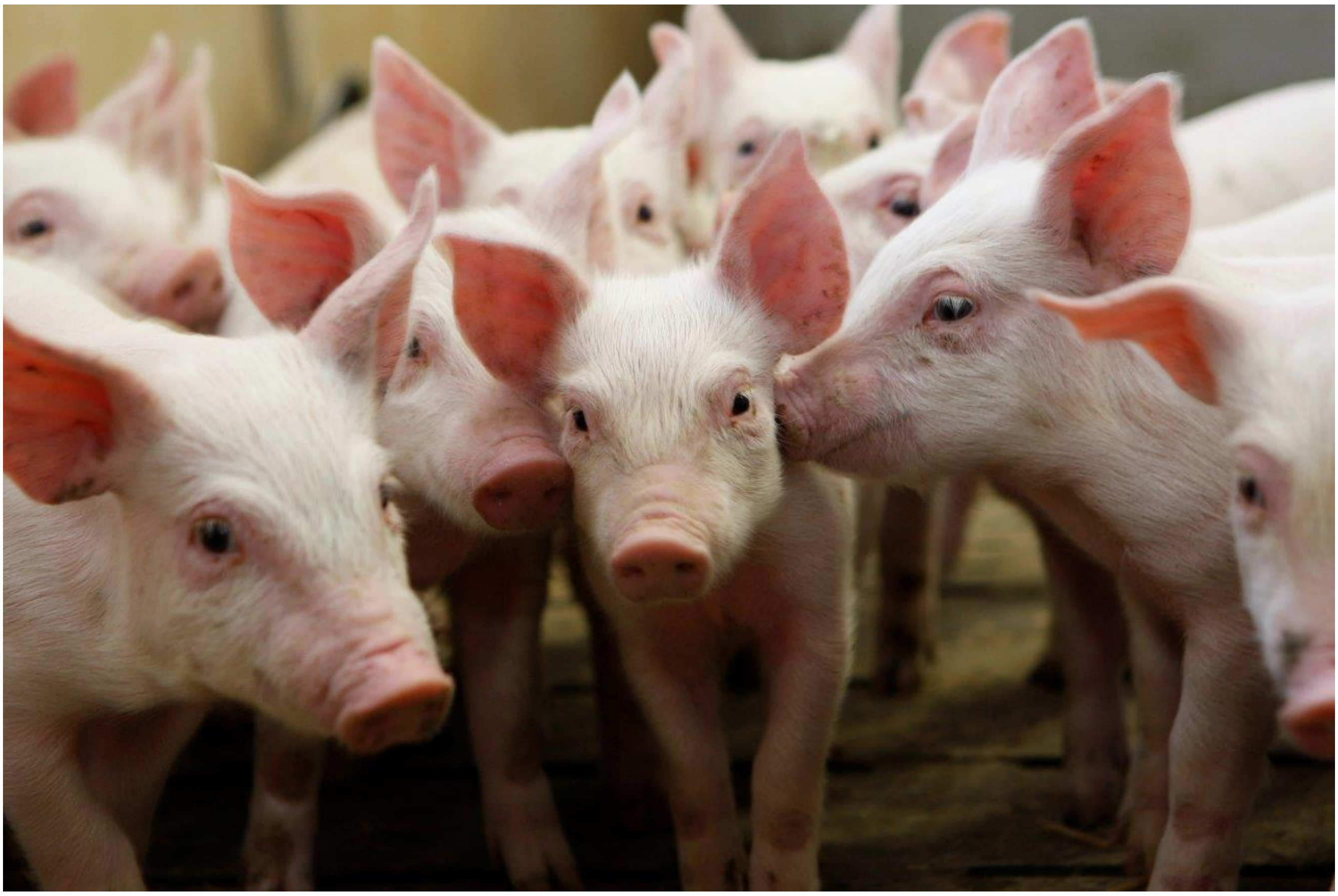
Skjoldborg test station

TestGris***

SvineRådgivningen

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



The effect of MatanXL (sugar bound amino acids) on performance in weaned pigs

Test conducted on request from A-One

Authors: Dorthe Carlson and Niels Ove Nielsen

January, 2019

Sammendrag
Denne afprøvning havde til formål at undersøge effekten af MatanXL (sukkerbundne syntetiske aminosyrer) på grises produktionsresultater de første 3-6 uger efter fravænning. Produktionsresultaterne, der blev målt var daglig tilvækst (ADG), Foderoptagelse (FI) og Foderudnyttelse (FU).

To forskellige niveauer af sukkerbundne aminosyrer (AA) blev testet dvs. de sukkerbundne AA blev brugt til at opfylde hhv. 100 % eller 90 % af aminosyrenormen i en lav-protein blanding (hhv. behandling B2 og B3). Derudover indgik der to kontrol behandlinger i testen, en negativ kontrol (B1: Lav protein og standard syntetiske AA på norm niveau) og en positiv kontrol (B4: Høj protein og standard syntetiske AA på norm niveau).

Testen viste ingen forskelle mellem den positive (B1) og den negative (B4) kontrolgruppe, hvilket viser at det højere protein niveau i B4 foderet ikke forbedrede på produktionsresultaterne i denne test.

ADG blev ikke påvirket af de forskellige foder-behandlinger igennem hele testen, men der var en tendens (ikke signifikant) til at FI var højere i B2 og B3 gruppen sammenlignet med B1 og B4. Dette resultat antyder at de sukkerbundne aminosyrer forbedrer smagen af foderet. Tendensen til øget foderoptagelse påvirkede ikke ADG, til gengæld var FU signifikant reduceret hos grise der fik B3 foderet sammenlignet med den positive kontrol (B4) i fase B.

Konklusionen er at sukkerbundne AA kan erstatte standard syntetiske AA (1:1) uden at påvirke grisenes produktionsresultater de første 3-6 uger efter fravænning. Det er stadig uklart, hvor meget AA indholdet fra sukkerbundne AA kan reduceres i forhold til normen uden at gå på kompromis med foderudnyttelsen.

Summary
This study aimed to test the effect of MatanXL (sugar-bound synthetic amino acids) on piglet performance during week 3-6 after weaning. The performance parameters measured were average daily gain (ADG), Feed Intake (FI) and Feed Utilization (FU).

Two levels of sugar-bound amino acids (AA) were tested, i.e. the sugar-bound AA was used to meet 100% or 90% of the standard AA requirement in a low protein diet (treatment B2 and B3, respectively). In addition, two control diets were included in the test, a negative control diet (B1: low protein and standard synthetic AA at requirement level) and a positive control diet (B4: high protein and standard synthetic AA at requirement level).

The test did not reveal any difference between the positive (B1) and negative (B4) control group for any of the performance parameters, showing that the extra protein in diet B4 had no effect on pig performance in this test.

All the dietary treatments resulted in the same level of ADG throughout the test period, but even though not statistical significant, there was a tendency to higher FI in group B2 and B3. This may indicate a higher palatability of the diets containing sugar-bound AA. The tendency to increased FI in group B2 and B3 did not improve the ADG in these groups. Instead the FU was significantly reduced in pigs fed the B3 diet compared to the positive control (B4) diet in phase B.

It is concluded that sugar-bound AA can replace the standard synthetic AA (1:1) without any detrimental effect on pig performance during week 3-6 after weaning. It is still unclear how much the AA content can be reduced from the standard requirements when added as sugar-bound AA, without compromising on feed utilization.

Introduction

This study was conducted on request from A-One in the period July 09 (2018) to October 09 (2018) at Skjoldborg test station.

The study aimed to test the effect of MatanXL (sugarbound synthetic amino acids) on piglet performance during week 3-6 after weaning. Due to an expected higher utilization of sugar bound amino acids (AA) compared to standard synthetic AA it was hypothesized that the AA requirements could be fulfilled in piglets fed only 90% of the standard AA requirements.

Two levels of sugar-bound AA were tested, i.e. the sugar-bound AA used in the formulations was used to meet 90% or 100% of the standard AA requirement in a low protein diet. The diets with sugar-bound AA were compared to a negative control diet (standard synthetic AA) and a positive control diet which contained a higher level of standard digestible protein. Both the negative and positive control diets were formulated to provide 100% of the AA requirement with standard synthetic AA.

The 4 test diets were designated B1, B2, B3 and B4, respectively and the 4 diets were planned to differ in protein and AA content as follows:

B1: "Negative control" - Low protein (135 g and standard digestible protein / Feed Unit) and AA requirements 100% fulfilled with standard synthetic AA

B2: Low protein (135 g standard digestible protein / Feed Unit) and AA requirements 100% fulfilled with sugar bound synthetic AA

B3: Low protein (135 g standard digestible protein / Feed Unit) and AA requirements 90% fulfilled with sugar bound synthetic AA

B4: "Positive control" - High protein (145 g standard digestible protein / Feed Unit) and AA requirements 100% fulfilled with standard synthetic AA

During phase A (week 1-2) all piglets were fed the same standard diet and in phase B and C the test diets were fed.

The test was designed to test the effect of diets on average daily gain (ADG), feed intake (FI) and feed utilisation (FU; kg feed per kg gain) in weaned piglets under practical pig production conditions.

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, the sows are farrowing and piglets are weaned.

The test included a total of 4007 Danbred crossbred (Landrace/Yorkshire x Duroc) female and castrated male piglets with approximately the same number of both gender. The piglets where weaned at 25 ± 3 days of age.

Housing conditions for piglets complied fully with EU and Danish legislation. Eight similar rooms of 12 double-pens where used. Rooms were cleaned and disinfected before insertion of piglets. The double-pens were traditionally structured sharing two dry feed dispensers integrated in the mid-pen wall partitioning the double-pen in two pens. Of the 12 double-pens per room only 8 were used for this trial. The piglets were group housed in pens and allocated randomly; females and castrated males mixed on both sides of the feed dispensers. Thus, two pens around 2 feeders constitute one observation (photo of pen design in Appendix A). Around 31 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, small/medium, large/medium and Large). The average body weight of piglets in the pens was in the range of 4.9 to 7.6 kg. The double-pens were allocated to one of four diets i.e. two dry feed dispensers for each diet per room. The average initial body weight of the piglets were 6.2, 6.2, 6.2 and 6.2 kg for diet B1, diet B2, diet B3 and diet B4, respectively

The test period was initiated at the day of weaning and was divided into three phases (Phase A, B and C). Phase A was from day 0 to day 14 (15 days), phase B was from day 14 to day 28 (14 days) and phase C was from day 28 to 42 (14 days), resulting in a total test period of 43 days.

In Phase A all pigs were fed the same diet, whereas in phase B and C all piglets were fed the test diets B1, B2, B3 and B4.

Prior to weaning, piglets received a pre-starter diet containing corn, wheat, oat, milk powder, soy protein concentrate, plasma and potato protein.

The diet fed in Phase A was formulated by TestPig***. The diets fed in phase B and phase C were formulated by A-one. All diets, except diet B3 that was reduced in AA content, were optimized to provide nutrients according to the Danish feeding standards for piglets in the weight intervals of 6-9, 9-15 kg and 15-30 kg. The composition of the diets is given in Appendix B. Diets were produced on farm under the supervision of TestPig***. The compositions of the test diets were unknown for the personnel at the test station.

All the diets were fed as meal feeds *ad libitum*. The diets were supplied when requested by a sensor in one of the 2 feed dispensers up to several times per day. When delivered to the individual feed dispensers, the amount of diet dropped into the feeders was registered by weight. The pigs had permanent access to fresh water from 2 types of nipple drinkers; one separate and one that was built into the feed dispensers.

Registrations

The piglets were weighed when allocated to the pens at the day of insertion. Subsequently, they were weighed when changing to phase B and phase C diets and at the end of test. 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 weight was recorded.

The amount of feed used per feed dispenser was recorded, before changing to the next diet. The feed residue in the feed dispenser was weighed and subtracted from the amount supplied before a new diet was fed.

Furthermore, the standard procedure was followed in respect of registration of any medical treatment (including treatment days) against diarrhoea and infections.

Feed analyses

Every week throughout the test period a sample was taken from feed dispensers that contained the four diets in phase B and C. The samples representing each week were pooled and a sample representing each diet from the whole test period was made for chemical analyses. The samples were analysed for the content of dry matter, crude protein, fat, ash, feed units (FEsv), lysine, methionine, Cysteine and threonine. The chemical analyses were performed by Eurofins.

Calculations and statistics

Average daily gain per piglet was calculated as the difference in weight at insertion and exit of each feeding phase (A, B and C) as well as the overall period from weaning to end of trial at day 43. The body weight used was an average of the piglets in the double pen sharing the two dry feed dispensers.

Feed intake (FI) was calculated as the amount of feed provided per feed dispenser minus the remaining feed residues and feed taken out for chemical analyses in the feeding periods (Phase B and phase C).

In all calculations, data were adjusted for number and weight of piglets taken out of trial.

Pigs taken out of study (PTO) were calculated as percentage of the initial number of piglets in each phase (A, B and C) as well as the total period (A-C).

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 FU in phase A, phase B, phase C and the total test period were analysed in a Gaussion mixed effect model including initial body weight at day 0, diet (B1, B2, B3, B4) and room number. Statistical significance was accepted at $P<0.05$.

The number of observations did not allow for statistical analysis of PTO.

Results

The expected and analysed chemical composition of the diets is presented in Appendix C. The analysed protein and AA content confirms that diet B4 was higher in protein than diet B1, B2 and B3 and that diet B3 was lower (approx. 90%) in lysine, methionine and threonine compared to the other 3 diets.

The pig performance data are presented in Table 1. As expected the 4 dietary groups performed similar in respect of ADG, FI and FU in phase A (P=0.78, P=0.74 and P=0.69, respectively) as they were all fed the same diet.

In phase B, ADG and FI were not significantly affected by the dietary treatments (P=0.97 and P=0.23, respectively), however FU was significantly impaired in the B3 group compared the positive control group (B4) (P=0.02) in phase B. When looking at the numerically values of ADG and FI the data indicates that the reduced FU was a consequence of a higher FI rather than reduced ADG in the B3 treatment group.

In phase C, ADG, FI and FU were not significantly influenced by the dietary treatments (P=0.66, P=0.12 and P=0.79, respectively). However, the data indicates a tendency (P=0.12) to a slightly higher FI (28 and 49 g/d) in the B2 and B3 group, respectively, compared with the negative control group B1.

For the total test period (phase A-C) dietary treatments did not result in significant differences in any of the performance parameters (P=0.67, 0.11 and 0.21 for ADG, FI and FU, respectively). Similar results (P=0.75, P=0.11 and P= 0.19 for ADG, FI and FU, respectively) were found when only data from the 28 days, where the test diets were fed (phase B and C), were merged.

The average pig weight (± standard deviations) on day 43 was 26.5 (± 2.9), 26.8 (± 2.8), 27.0 (± 2.5) and 26.7 (± 2.8) kg for treatment B1, B2, B3 and B4, respectively.

The values of least significant differences (LSD) indicate that the test was scaled to identify differences in ADG of 15 to 37 g/day and differences in FU of 0.03 to 0.06 kg feed/kg gain.

Table 1. Average daily gain (ADG), feed intake (FI) and feed utilisation (FU) in phase A (6-9 kg) phase B (9-15 kg), phase C (15-30 Kg) and the whole test period (A-C) of pigs fed the four experimental diets.[x]

	Phase	**B1**	**B2**	**B3**	**B4**	**P-value**
ADG, g/d	A	224	230	230	225	0.78
	B	492	494	497	498	0.97
	C	739	758	758	747	0.66
	B-C	616	626	628	623	0.75
	A-C	479	488	489	484	0.67
FI, g/d	A	268	273	275	269	0.74
	B	669	674	694	665	0.23
	C	1155	1183	1204	1166	0.12
	B-C	913	930	940	916	0.11
	A-C	688	701	712	690	0.11
FU,	A	1.19	1.20	1.20	1.21	0.69
kg feed/kg gain	B	1.37^{ab}	1.38^{ab}	1.39^{b}	1.34^{a}	0.02
	C	1.56	1.56	1.58	1.57	0.79
	B-C	1.48	1.48	1.51	1.48	0.19
	A-C	1.43	1.43	1.46	1.44	0.21

[x] Values are LS-means (n=16).
[ab] LS-Means within rows without a common superscript differ (P<0.05).

In general, piglets maintained good health during the experiment. Based on veterinary diagnosis, all pigs in test received treatment with Doxycyclin (Doxx-Sol®) in the drinking water for the first 5 days after weaning. In 3 out of the 8 sections signs of diarrhoea was observed around the diet change (phase A to B) and all pigs in these 3 sections were treated with Doxycyclin (Doxx-Sol®) in the drinking water for 5 days. In addition, diarrhoea outbreak was observed in 2 sections in the final week of phase B, also all piglets in these 2 sections were treated with Doxycyclin (Doxx-Sol®) in the drinking water for 5 days. There were no other treatment days against any specific diseases for pigs that stayed in test.

Table 2. Pigs taken out of study (PTO, %).

	Phase	**B1**	**B2**	**B3**	**B4**

PTO	A	1.2	0.4	0.6	0.5
	B	2.6	1.3	1.0	1.9
	C	1.4	1.5	0.7	1.0
	A-C	5.2	3.2	2.3	3.4

In table 2, the number of pigs taken out in percentage of the number of pigs inserted in each phase of the study and the total 6 week test period is presented. The reason for taking the pigs out included different kinds of veterinary observations e.g. diarrhoea, hernia, arthirits etc. The trial was not designed to analyse health data. The data indicates that the PTO is random and not related to the dietary treatments.

Discussion and Conclusion

The test did not reveal any difference between the positive (B1) and negative (B4) control group, showing that the extra protein in diet B4 had no effect on pig performance in this test.

Furthermore, the sugar bound AA included in treatment B2 and B3 to fulfil the AA requirements 100% or 90%, respectively, resulted in the same level of ADG as the B1 and B4 diet. Even though no statistical significance could be determined, there was a tendency to higher FI in group B2 and B3 especially in phase C, where the FI was higher with 28 and 49 g/d, respectively, compared to the negative control group (B1). The higher feed intake in group B3 may indicate that the animal body tried to compensate for the lower AA intake by increasing the FI. On the other hand as the FI was also slightly increased in the B2 group it may indicate a higher palatability of the diets containing sugar-bound AA.

The tendency to increased FI in group B3 did not improve the ADG in this group. Instead the FU was significantly reduced in pigs fed the B3 diet compared to the positive control (B4) diet in phase B. This may indicate that the low AA content in the B3 diet tended to not fulfil the AA requirement in this group.

It is concluded that sugar-bound AA can replace the standard synthetic AA (1:1) without any detrimental effect on pig performance during week 3-6 after weaning. It is still unclear how much the AA content can be reduced from the standard requirements when added as sugar-bound AA, without compromising on feed utilization.

Appendix A. Photo of the pens used for test

Appendix B. Feed ingredients in test diets

Table 2. Feed ingredients (%) in the test diet used in phase A (6-9 kg).

	Content %
Wheat	60.5
ZnO premix[1]	3.0
Fish Meal	9.0
Soy oil	2.5
Concentrate[2]	25

[1] based on wheat

[2] containing Alphasoy 530, potato protein, milk proteins, lactose, vitamins, minerals, amino acids and enzymes

Table 1. Feed ingredients (%) in the test diets used in phase B (9-15 kg).

	B1	B2	B3	B4
Wheat	46.6	44.7	44.0	42.5
Barley	25.0	25.0	25.0	25.0
Soy Bean Meal	10.5	10.3	11.3	14.6
Alpha Soy 530	10.0	10.0	10.0	10.0
Soy oil	2.8	2.6	2.7	3.1
Premix[1]	5.1	7.4	7.0	4.8

[1]Premix containing vitamins, minerals, amino acids and enzymes

Table 1. Feed ingredients (%) in the test diets used in phase C (15-30 kg).

	B1	B2	B3	B4
Wheat	51.3	49.1	48.8	47,4
Barley	25.0	25.0	25.0	25.0
Soy Bean Meal	18.7	18.6	19.4	22.6
Soy oil	0.6	0.5	0.5	0.9
Premix[1]	4.4	6.8	6.3	4.1

[1]Premix containing vitamins, minerals, amino acids and enzymes

Appendix C. Chemical composition of feed (E=expected and A=analysed)

Expected (E) and analysed (A) chemical composition of the phase B diets[a]

	B1		B2		B3		B4	
	E	A	E	A	E	A	E	A
Dry matter, %	87.3	89.3	87.3	89.4	87.2	89.3	87.3	89.5
Crude protein (N*6.25), %	17.8	18.2	17.8	18.1	17.8	18.0	19.1	19.4
Total fat, %	4.9	4.9	4.7	4.7	4.8	4.6	5.2	4.9
Total Ash, %	6.0	5.5	6.0	6.0	6.0	5.8	6.1	5.8
FEsv, per 100 kg	114	117.8	114	116.4	114	116.1	114	116.7
Lys, g/kg	13.2	13.4	13.2	13.9	12.0	13.0	13.3	13.7
Met, g/kg	4.2	4.2	4.2	4.2	3.8	3.9	4.2	4.2
Cys, g/kg	3.0	2.9	3.0	2.9	3.0	3.0	3.2	3.1
Thr, g/kg	8.3	9.0	8.3	8.7	7.6	8.2	8.4	9.0

[a] The chemical analyses (A) were performed by Eurofins. All parameters are on an "as is" basis. n=1.

Expected (E) and analysed (A) chemical composition of the phase C diets[a]

	B1		B2		B3		B4	
	E	A	E	A	E	A	E	A
Dry matter, %	86.1	88.4	86.1	88.3	86	88.3	86.2	88.4
Crude protein (N*6.25), %	16.6	17.4	16.7	16.5	16.7	16.9	17.8	18.0
Total fat, %	2.8	2.8	2.7	2.8	2.7	2.9	3.1	3.2
Total Ash, %	5.8	4.9	5.9	5.4	5.8	5.4	6.0	4.8
FEsv, per 100 kg	107	112	107	111	107	111	107	111
Lys, g/kg	12.3	12.0	12.3	11.2	11.2	10.6	12.4	11.6
Met, g/kg	3.9	3.7	3.9	3.5	3.5	3.5	3.9	3.6
Cys, g/kg	2.9	2.8	2.9	2.7	3.0	2.8	3.1	2.9
Thr, g/kg	7.8	7.7	7.8	7.5	7.1	7.5	7.9	7.8

[a] The chemical analyses (A) were performed by Eurofins. All parameters are on an "as is" basis. n=1.