

EFFICACY OF VTR-XYLANASE IN POST-WEANING PIGLETS FROM D 25 TO D 66 OF AGE

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INTRODUCTION

The objective of this study was to evaluate the efficacy of VTR-XYLANASE at 1,000 to 2,000 U/kg feed on post-weaning piglets of both genders from d 25 to d 66 of age (d 1 to d 42 on trial). Responses were characterized by growth performance throughout the 42-d feeding period. In addition, apparent total-tract digestibility, N-retention, and apparent metabolizable energy content (AME) in feeds were measured from d 39 to d 42 on trial (d 63 to d 66 of age). For comparison post-weaning piglets were fed the basal diets without VTR-XYLANASE (control group).

MATERIALS AND METHODS

A total of 80 healthy post-weaning piglets (DanBred x Duroc) from d 25 to d 66 of age were used. Piglets were allocated equally according to litter, gender, and body weight to 40 pens within two compartments of the house for post-weaning piglets such that there 20 piglets per treatment and 2 piglets of both gender per pen (replicate). Piglets were fed energy reduced wheat-, rye-, barley-, soybean meal-based experimental starter (d 1 to d 14 of age) and grower diets (d 15 to d 42 of age) throughout the 42-d feeding period. VTR-XYLANASE was added to T2 (1,000 U/kg), T3 (1,500 U/kg), and T4 (2,000 U/kg) diets at graded dose levels. T1 was control. The basal diets were calculated to meet the nutritional requirements for weaned piglets as recommended by the Society of Nutrition Physiology (2006) with exception of AME. All diets were manufactured in a commercial feed mill and were formulated with no added antibiotics, organic acids, polysaccharides, enzymes, yeast/egg products, porcine plasma, or zootechnical feed additives and the concentrations of zinc and copper was at adequate (nutritional) but not at excess concentrations, to avoid the potential confounding effect of these additives. Piglets had *ad libitum* access to mash feed and drinking water.

The piglets were identified by ear-tags. Before weaning, the standard commercial practice was to inject suckling piglets with iron at d 3 of age (Fe 200 mg) and then offered a creep feed for suckling piglets from d 8 of age up to weaning (d 25 of age) with no other feed additives, other than trace elements, amino acids and vitamins.

Throughout the 42-d feeding period the house temperature, relative humidity, lighting and forced ventilation (air speeds from 0.6 (d 25 of age) up to 1.2 m/s from d 35 of age onwards) were controlled. Environmental and management conditions were in accordance with targets used in commercial pig breeding farms. The average house temperature was kept at about 29 °C during the first week after weaning. From the second week after weaning onwards the house temperature was reduced by approximately 2 °C per week up to about 22.5 °C from week 5 after weaning onwards. The relative humidity was within the range of 50 to 60%. The

lighting regime (natural/artificial) consisted of a 16h light- (about 400 lux) and 8h dark- cycle (about 4 lux).

Data were analysed by one-way ANOVA using SPSS software.

Table 1. Feed composition and calculated analysis of the experimental starter diets from d 25 to d 38 of age (as is)					
Treatment groups		T1	T2	T3	T4
Ingredients					
Wheat	%	25.6880	25.6880	25.6880	25.6880
Barley	%	25.0000	25.0000	25.0000	25.0000
Soybean meal (49% CP)	%	23.6500	23.6500	23.6500	23.6500
Rye	%	20.0000	20.0000	20.0000	20.0000
Limestone	%	1.6500	1.6500	1.6500	1.6500
Monocalcium phosphate	%	1.3000	1.3000	1.3000	1.3000
Mineral and vitamins ¹⁾	%	1.2000	1.2000	1.2000	1.2000
L-Lysine HCL	%	0.5800	0.5800	0.5800	0.5800
Soybean oil	%	0.5000	0.5000	0.5000	0.5000
L-Threonine	%	0.2000	0.2000	0.2000	0.2000
DL-Methionine	%	0.1900	0.1900	0.1900	0.1900
L-Tryptophan	%	0.0400	0.0400	0.0400	0.0400
Tixosil ²⁾	%	0.0020	0.0010	0.0005	
VTR-XYLANASE	%		0.0010	0.0015	0.0020
Calculated analysis					
AME ³⁾	MJ kg	13.30	13.30	13.30	13.30
Crude protein	%	20.00	20.00	20.00	20.00

Table 2. Feed composition and calculated analysis of the experimental grower diets from d 39 to d 66 of age (as is)					
Treatment groups		T1	T2	T3	T4
Ingredients					
Barley	%	27.2980	27.2980	27.2980	27.2980
Wheat	%	25.6900	25.6900	25.6900	25.6900
Soybean meal (49% CP)	%	21.5800	21.5800	21.5800	21.5800
Rye	%	20.0000	20.0000	20.0000	20.0000
Limestone	%	1.5200	1.5200	1.5200	1.5200
Minerals & vitamins ¹⁾	%	1.2000	1.2000	1.2000	1.2000
Monocalcium phosphate	%	1.1800	1.1800	1.1800	1.1800
Soybean oil	%	0.5000	0.5000	0.5000	0.5000
L-Lysine HCL	%	0.4600	0.4600	0.4600	0.4600
Titanium(IV)-dioxide	%	0.3000	0.3000	0.3000	0.3000
L Threonine	%	0.1300	0.1300	0.1300	0.1300
DL-Methionine	%	0.1200	0.1200	0.1200	0.1200
L-Tryptophan	%	0.0200	0.0200	0.0200	0.0200
Tixosil ²⁾	%	0.0020	0.0010	0.0005	
VTR-XYLANASE	%		0.0010	0.0015	0.0020

		Calculated analysis			
AME ³⁾	MJ kg	12.30	12.30	12.30	12.30
Crude protein	%	19.00	19.00	19.00	19.00

RESULTS AND CONCLUSIONS

The results of this study indicate that the supplementation of VTR-XYLANASE at 1,000 to 2,000 U/kg feed to energy reduced wheat-, rye-, barley-, soybean meal-based diets is efficacious in significantly improving overall (d 1 to d 42 on trial) body weight gain and feed-to gain ratio as compared with the control group. In addition, VTR-XYLANASE at 1,500 and 2,000 U/kg showed significantly positive impacts on apparent total-tract digestibility of dry matter, organic matter, gross energy and apparent metabolizable energy in feeds in comparison with the control group. Although dose level responded linearly significant effect of xylanase level was limited to overall feed-to-gain ratio among 1,000 and 2,000 U/kg feed as well as on apparent metabolizable energy in feeds among 1,000 U/kg feed and 1,500 or 2,000 U/kg feed, respectively. The significantly enhanced apparent metabolizable energy content in feed (AME) in comparison with the control group may suggest that AME can be decreased by an average of 0.50 MJ/kg feed by VTR-XYLANASE supplementation at 1,500 and 2,000 U/kg feed.

Table 3. Effects of VTR-XYLANASE on productive performance of post-weaning piglets from d 1 to d 42 on trial (d 25 to d 66 of age)

Item/Treatment groups		T1	T2	T3	T4	SEM	P Anova
Post-weaning piglets	n ^o	20	20	20	20		
Replicates	n ^o	10	10	10	10		
d 1 to d 14 on trial (starter feeding period)							
Body weight - start	kg	8.07 ± 0.74	8.06 ± 0.70	8.06 ± 0.70	8.06 ± 0.70	0.108	1.000
Body weight - end	kg	12.36 ± 0.98	12.66 ± 1.02	12.70 ± 0.69	12.86 ± 0.90	0.141	0.665
Body weight gain	kg	4.29 ± 0.57	4.60 ± 0.53	4.64 ± 0.33	4.79 ± 0.44	0.078	0.141
Daily body weight gain	g	307 ± 41	328 ± 38	332 ± 24	342 ± 32	5.598	0.141
Cumulative feed intake	kg	5.89 ± 0.77	6.04 ± 0.74	6.01 ± 0.42	6.06 ± 0.58	0.098	0.933
Daily feed intake	g	420 ± 53	431 ± 53	429 ± 30	433 ± 41	7.023	0.933
Feed-to-gain ratio		1.691 ± 0.043 ^a	1.640 ± 0.067 ^{ab}	1.599 ± 0.042 ^{ab}	1.598 ± 0.028 ^b	0.012	0.009
Fecal scores ¹⁾		0.38 ± 0.26	0.35 ± 0.30	0.36 ± 0.33	0.39 ± 0.31	0.046	0.990
d 15 to d 42 on trial (grower feeding period)							
Body weight - start	kg	12.36 ± 0.98	12.66 ± 1.02	12.70 ± 0.69	12.86 ± 0.90	0.141	0.665
Body weight - end	kg	27.69 ± 0.97 ^a	28.71 ± 1.00 ^{ab}	29.16 ± 1.00 ^b	29.02 ± 0.89 ^b	0.174	0.007
Body weight gain	kg	15.33 ± 0.43 ^a	16.05 ± 0.64 ^b	16.46 ± 0.54 ^b	16.17 ± 0.24 ^b	0.099	<0.001
Daily body weight gain	g	548 ± 16 ^a	573 ± 23 ^b	588 ± 19 ^b	577 ± 8 ^b	3.547	<0.001
Cumulative feed intake	kg	25.91 ± 0.60	26.29 ± 0.75	26.30 ± 0.44	25.83 ± 0.51	0.095	0.172
Daily feed intake	g	925 ± 21	939 ± 27	939 ± 16	923 ± 18	3.404	0.172
Feed-to-gain ratio		1.691 ± 0.043 ^a	1.640 ± 0.067 ^{ab}	1.599 ± 0.042 ^b	1.598 ± 0.028 ^b	0.009	<0.001
Fecal scores ¹⁾		0.10 ± 0.15	0.14 ± 0.11	0.15 ± 0.11	0.13 ± 0.11	0.019	0.940

		d 1 to d 42 on trial (starter & grower feeding period)					
Body weight - start	kg	8.07 ± 0.74	8.06 ± 0.70	8.06 ± 0.70	8.06 ± 0.70	0.108	1.000
Body weight - end	kg	27.69 ± 0.97 ^a	28.71 ± 1.00 ^{ab}	29.16 ± 1.00 ^b	29.02 ± 0.89 ^b	0.174	0.007
Body weight gain	kg	19.62 ± 0.54 ^a	20.64 ± 0.78 ^b	21.10 ± 0.55 ^b	20.96 ± 0.43 ^b	0.129	<0.001
Daily body weight gain	g	467 ± 13 ^a	491 ± 18 ^b	502 ± 13 ^b	499 ± 10 ^b	3.063	<0.001
Cumulative feed intake	kg	31.80 ± 0.74	32.33 ± 0.90	32.31 ± 0.68	31.89 ± 0.84	0.127	0.319
Daily feed intake	g	757 ± 18	770 ± 21	769 ± 16	459 ± 20	3.012	0.319
Feed-to-gain ratio		1.621 ± 0.031 ^c	1.568 ± 0.053 ^b	1.532 ± 0.030 ^{ab}	1.521 ± 0.019 ^a	0.008	<0.001
Fecal scores ¹⁾		0.23 ± 0.14	0.21 ± 0.11	0.22 ± 0.16	0.22 ± 0.15	0.021	0.981

Notes:

Values are means of 10 pens/treatment with 2 piglets/pen. ± Standard Deviation. SEM = Standard Error of the Mean.

¹⁾ 0 = well-formed feces, firm to cut; 1 = pasty feces without falling out of shape; 2 = pasty feces falling out of shape upon contact with surfaces; 3 = liquid diarrhea.

Different superscripts in same row are significant (a/b: P ≤ 0.05).

Table 4. Effects of VTR-XYLANASE on apparent total-tract digestibility, N-retention, and apparent metabolizable energy in feeds of post-weaning piglets from d 39 to d 42 on trial (d 63 to d 66 of age)							
Items/Treatment groups		T1	T2	T3	T4	SEM	P Anova
Piglets	n°	20	20	20	20		
Replicates	n°	10	10	10	10		
Characteristics of feces (d 39 to d 42 on trial)							
Dry matter	%	37.74 ± 1.60	37.49 ± 1.83	37.97 ± 1.76	37.26 ± 1.17	0.248	0.780
Apparent total-tract digestibility (d 39 to d 42 on trial)							
Dry matter	%	74.90 ± 1.40 ^a	76.20 ± 1.89 ^{ab}	77.25 ± 1.71 ^b	76.95 ± 1.25 ^b	0.281	0.010
Crude ash	%	39.68 ± 2.97	41.31 ± 2.77	42.52 ± 3.22	42.29 ± 2.93	0.486	0.152
Organic matter	%	76.94 ± 1.35 ^a	78.23 ± 1.90 ^{ab}	79.26 ± 1.67 ^b	78.96 ± 1.17 ^b	0.275	0.009
Gross energy	%	76.71 ± 1.17 ^a	78.03 ± 1.71 ^a	79.93 ± 1.44 ^b	79.78 ± 1.24 ^b	0.301	<0.001
Crude protein	%	69.09 ± 1.89 ^a	70.58 ± 2.90 ^{ab}	72.17 ± 2.10 ^b	72.88 ± 2.12 ^b	0.419	0.003
Crude fat	%	71.18 ± 2.37 ^x	72.12 ± 1.80 ^{xy}	73.55 ± 1.75 ^y	72.98 ± 1.86 ^{xy}	0.331	0.054
Crude fibre	%	5.43 ± 7.68	5.33 ± 6.74	6.04 ± 9.80	6.49 ± 5.66	1.161	0.985
N-retention¹⁾ (d 39 to d 42 on trial)							
Cumulative	g	48.18 ± 6.41	49.87 ± 7.10	51.48 ± 5.95	51.67 ± 5.75	0.987	0.580
Apparent metabolizable energy²⁾ content in feeds from d 39 to d 42 on trial							
AME	MJ/kg	12.46 ± 0.19 ^a	12.66 ± 0.27 ^a	12.98 ± 0.23 ^b	12.94 ± 0.20 ^b	0.048	<0.001

Notes:

Values are means of 10 pens/treatment with 2 piglets/pen). ± Standard Deviation. SEM = Standard Error of the Mean.

¹⁾ N-intake - N-feces - N-urine.

²⁾ Gross energy intake - gross energy feces - gross energy urine.

Different superscripts in same row are significant or trending (a/b: P ≤ 0.05; x/y 0.05 <P ≤ 0.10).