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Growth performance, breast yield and gastrointestinal weight in conventional and slow-growing strains of broiler chickens fed corn-soybean meal diet without or with multi-enzyme supplement

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Emerging market differentiation for broiler meat production in terms of conventional (**C**) and slow-growing (**SG**) strains is necessitating comparative research on various production aspects of these strains. We investigated effects of dietary multi-enzyme supplement (**MES**) on growth performance, breast yield and gastrointestinal (**GIT**) weight in C and SG strains of broiler chickens. A total of 640 1 d-old chicks of 4 strains (C3 and 3 SG: F6, J10, and N14) were housed in metabolic cages (10 birds/cage). The strains differed by time they took to reach 2.2 kg BW corresponding to 37, 43, 47, and 50 d for C3, F6, J10, and N14, respectively. An antibiotic-free corn soybean meal-basal diet was formulated for a two-phase program (starter and grower), with 3040 and 3090 kcal/kg ME, respectively. Half the birds per strain received the basal diet with 0.04% MES containing phytase, protease, cellulase,  $\beta$ -glucanase at 4,000 FYT/g, up to 15,000 PRT/g, 213 U/g and 186.7 U/g, respectively. Diets were allocated by strain, creating a 4x2 factorial arrangement of treatments (n=8). Birds were allocated equal amount of feed in each phase (starter, 476 g; grower, 1360 g) and had free access to water. Birds were sacrificed at the end of the trial for breast, gizzard, small intestine and ceca weights. Strains C3 and F6 took 28 d to finish feed allocation whereas strains J10 and N14 took 31 d. Hatch BW was used as covariate in growth data analyses. There was no interaction ( $P>0.10$ ) between strain and diet on growth, breast yield and GIT weight. There was strain effect ( $P<0.01$ ) on BW, BWG, and FCR throughout the experiment. Overall, C3 (1.45) and F6 (1.70) birds showed better FCR than J10 (1.93) and N14 (2.08), with J10 being better than N14. A diet effect was only observed in grower phase; birds fed MES had higher BWG (713 vs. 684 g/d,  $P=0.03$ ) than birds not fed without MES. Subsequently, birds fed MES had a tendency for higher final BW (1,104 vs. 1,072 g,  $P=0.08$ ) compared with the control. There was no ( $P>0.10$ ) MES effect on FCR. Strain C3 and F6 had higher ( $P>0.01$ ) breast yield compared with strains J10 and N14 which were in turn had similar ( $P>0.10$ ) breast yield. Gizzard and ceca (g/kg BW) weights were higher ( $P\leq 0.02$ ) for strain N14 compared with strain C3 whilst strains J10 and F6 were intermediate. Birds fed MES had 8.8% ( $P=0.02$ ) heavier gizzard compared with birds not fed MES. The data indicated that SG strains (J10 and N14) gained less on allocated feed allowance but also exhibited poorer feed efficiency and breast yield linked to heavier GIT mass. The MES improved growth and gizzard weight independent of strain, indicating effects of feed enzymes are not influenced by genetic background of broiler chickens.

**Key words:** conventional broilers, enzyme, growth performance, slow-growth broilers

**Table 1.** Composition of the basal diets, as fed basis

Item	Starter (d 0-14)		Grower (d 15-28)	
	Control	Victus	Control	Victus
<b>Ingredients</b>				
Corn grain	50.01	51.08	53.53	55.60
Soybean meal-46%	28.12	27.07	26.06	23.72
Wheat	7.48	10.00	7.66	10.00
Corn gluten meal-60%	4.42	4.73	2.67	3.83
Choline Chloride, 60%	0.22	0.22	0.20	0.20
Limestone	1.65	1.58	1.48	1.42
NaCl	0.36	0.36	0.37	0.36
Mono calcium phosphate	1.82	1.01	1.61	0.80
NaHCO <sub>3</sub>	0.29	0.21	0.20	0.14
L-lysine HCl; 78%	0.33	0.32	0.28	0.31
DL-methionine	0.27	0.25	0.26	0.24
L-threonine-98%	0.09	0.06	0.08	0.06
VT Permixon*	1.00	1.00	1.00	1.00
Soybean oil	3.94	2.07	4.40	2.08
TiO <sub>2</sub>	0.00	0.00	0.20	0.20
Victus™	0.00	0.04	0.00	0.04
<b>Calculated nutrient contents</b>				
AME, mcal/kg	3.04	3.04	3.09	3.09
Crude protein, %	21.5	21.5	19.71	19.71
SID Lys, %	1.15	1.15	1.05	1.05
SID Met + Cys, %	0.86	0.86	0.80	0.80
SID Thr, %	0.75	0.75	0.69	0.69
SID Trp, %	0.22	0.22	0.21	0.21
Ca, %	0.96	0.96	0.86	0.86
Available P, %	0.48	0.48	0.43	0.43
Ca:aP ratio	2.00	2.00	2.00	2.00
Na, %	0.22	0.22	0.20	0.20
Cl, %	0.28	0.28	0.28	0.28

\*Provided per kilogram of diet: vitamin A, 8,800.0 IU; vitamin D<sub>3</sub>, 3,300.0 IU; vitamin E, 40.0 IU; vitamin B<sub>12</sub>, 12.0 mg; vitamin K<sub>3</sub>, 3.3 mg; niacin, 50.0 mg; choline, 1,200.0 mg; folic acid, 1.0 mg; biotin, 0.22 mg; pyridoxine, 3.3 mg; thiamine, 4.0 mg; calcium pantothenic acid, 15.0 mg; riboflavin, 8.0 mg; manganese, 70.0 mg; zinc, 70.0 mg; iron, 60.0 mg; iodine, 1.0 mg; copper, 10 mg; and selenium, 0.3 mg.

**Table 2.** Effect of Multi enzyme supplement on growth performance of different strains of broiler chickens\*

Strain	MES	Starter (Target feed 500 g)				Grower (Target feed 1470 g)				Overall	
		Duration, d	BW, g	BWG, g	FCR	Duration, d	BW, g	BWG, g	FCR	BWG, g	FCR
C	-	14	441.16 <sup>a</sup>	398.90 <sup>a</sup>	1.23 <sup>a</sup>	14	1333.11 <sup>a</sup>	891.95 <sup>a</sup>	1.54 <sup>a</sup>	1290.84 <sup>a</sup>	1.45 <sup>a</sup>
F6	-	14	425.24 <sup>a</sup>	382.97 <sup>a</sup>	1.26 <sup>a</sup>	14	1112.67 <sup>b</sup>	687.44 <sup>b</sup>	1.97 <sup>b</sup>	1070.41 <sup>b</sup>	1.71 <sup>b</sup>
J10	-	15	364.55 <sup>b</sup>	322.28 <sup>b</sup>	1.39 <sup>a</sup>	16	942.31 <sup>c</sup>	577.77 <sup>c</sup>	2.21 <sup>c</sup>	900.05 <sup>c</sup>	1.94 <sup>c</sup>
N14	-	15	322.58 <sup>b</sup>	280.32 <sup>b</sup>	1.57 <sup>b</sup>	16	901.01 <sup>c</sup>	578.42 <sup>c</sup>	2.32 <sup>c</sup>	858.74 <sup>c</sup>	2.11 <sup>c</sup>
C	+	14	437.87 <sup>a</sup>	395.60 <sup>a</sup>	1.21 <sup>a</sup>	14	1355.57 <sup>a</sup>	917.71 <sup>a</sup>	1.53 <sup>a</sup>	1313.31 <sup>a</sup>	1.44 <sup>a</sup>
F6	+	14	426.15 <sup>a</sup>	383.88 <sup>a</sup>	1.25 <sup>a</sup>	14	1154.86 <sup>b</sup>	728.71 <sup>b</sup>	1.90 <sup>b</sup>	1112.60 <sup>b</sup>	1.69 <sup>b</sup>
J10	+	15	360.35 <sup>b</sup>	318.09 <sup>b</sup>	1.43 <sup>b</sup>	16	975.91 <sup>c</sup>	615.55 <sup>c</sup>	2.18 <sup>c</sup>	933.64 <sup>c</sup>	1.91 <sup>c</sup>
N14	+	15	339.55 <sup>b</sup>	297.28 <sup>b</sup>	1.50 <sup>b</sup>	16	930.65 <sup>c</sup>	591.10 <sup>c</sup>	2.24 <sup>c</sup>	888.38 <sup>c</sup>	2.06 <sup>c</sup>
SEM			11.322	11.322	0.036		28.091	21.207	0.058	28.091	0.043
Main effects of strain											
C			439.51 <sup>a</sup>	397.25 <sup>a</sup>	1.22 <sup>a</sup>		1344.34 <sup>a</sup>	904.83 <sup>a</sup>	1.54 <sup>a</sup>	1302.08 <sup>a</sup>	1.45 <sup>a</sup>
F6			425.69 <sup>a</sup>	383.43 <sup>a</sup>	1.25 <sup>a</sup>		1133.77 <sup>b</sup>	708.08 <sup>b</sup>	1.94 <sup>b</sup>	1091.50 <sup>b</sup>	1.70 <sup>b</sup>
J10			362.45 <sup>b</sup>	320.19 <sup>b</sup>	1.41 <sup>b</sup>		959.11 <sup>c</sup>	596.66 <sup>c</sup>	2.20 <sup>c</sup>	916.85 <sup>c</sup>	1.93 <sup>c</sup>
N14			331.07 <sup>c</sup>	288.80 <sup>c</sup>	1.53 <sup>c</sup>		915.83 <sup>c</sup>	584.76 <sup>c</sup>	2.28 <sup>c</sup>	873.56 <sup>c</sup>	2.08 <sup>d</sup>
SEM			8.873	8.675	0.028		21.523	16.249	0.044	21.524	0.033
Main effects of MES											
No			388.38	346.12	1.36		1072.28	683.89 <sup>b</sup>	2.01	1030.01	1.80
Yes			390.98	348.71	1.35		1104.25	713.27 <sup>a</sup>	1.96	1061.98	1.78
SEM			5.117	5.117	0.016		12.700	9.585	0.026	12.697	0.019
P-Value											
MES			0.72	0.72	0.51		0.08	0.03	0.20	0.08	0.35
Strain			<0.01	<0.01	<0.01		<0.01	<0.01	<0.01	<0.01	<0.01
MES×Strain			0.71	0.71	0.32		0.98	0.88	0.92	0.98	0.98

\*Abbreviations: C, conventional strain; F6, J10, N14, slow-growth strains; SEM, standard error; MES, multi-enzyme blend, Victus™, DSM; BW, body weigh; BWG, body weight gain; FCR, feed conversion ratio.

**Table 3.** Effect of Multi enzyme supplement on breast yield, the weight of gut organs and excreta moisture content\*

Strain	MES	g/kg of BW				Excreta moisture, %
		Breast yield	Gizzard	S. Intestine	Ceca	
C	-	208.13 <sup>a</sup>	15.82 <sup>a</sup>	55.41	2.19 <sup>b</sup>	74.90 <sup>ab</sup>
F6	-	203.38 <sup>ab</sup>	15.99 <sup>a</sup>	54.83	3.49 <sup>ab</sup>	74.91 <sup>ab</sup>
J10	-	158.53 <sup>d</sup>	17.84 <sup>ab</sup>	59.87	4.68 <sup>a</sup>	72.62 <sup>b</sup>
N14	-	161.3 <sup>cd</sup>	17.47 <sup>ab</sup>	54.48	3.98 <sup>ab</sup>	76.87 <sup>a</sup>
C	+	205.64 <sup>ab</sup>	16.81 <sup>ab</sup>	54.39	2.86 <sup>b</sup>	73.16 <sup>b</sup>
F6	+	209.32 <sup>a</sup>	17.49 <sup>ab</sup>	52.28	3.66 <sup>ab</sup>	75.00 <sup>ab</sup>
J10	+	163.39 <sup>c</sup>	18.84 <sup>ab</sup>	55.20	4.21 <sup>ab</sup>	75.27 <sup>ab</sup>
N14	+	165.39 <sup>c</sup>	19.86 <sup>ab</sup>	52.62	3.86 <sup>ab</sup>	73.94 <sup>ab</sup>
SEM		4.961	0.869 <sup>b</sup>	2.200	0.314	0.667
Main effects of strain						
C		206.88 <sup>a</sup>	16.32 <sup>b</sup>	54.90	2.89 <sup>c</sup>	74.03
F6		206.35 <sup>a</sup>	16.74 <sup>ab</sup>	53.55	3.58 <sup>bc</sup>	74.96
J10		160.96 <sup>b</sup>	18.34 <sup>ab</sup>	57.54	4.44 <sup>a</sup>	73.95
N14		163.21 <sup>b</sup>	18.66 <sup>a</sup>	53.54	3.92 <sup>ab</sup>	75.41
SEM		3.508	0.615	1.553	0.223	0.471
Main effects of MES						
No		182.77	16.78 <sup>b</sup>	56.14	3.76	74.83
Yes		185.93	18.25 <sup>a</sup>	53.62	3.65	74.34
SEM		2.481	0.435	1.098	0.157	0.333
P-Value						
MES		0.37	0.02	0.11	0.62	0.31
Strain		<0.01	0.02	0.23	<0.01	0.09
MES×Strain		0.83	0.84	0.86	0.79	<0.01

\*Abbreviations: C, conventional strain; F6, J10, N14, slow-growth strains; SEM, standard error; MES, multi-enzyme blend, Victus™, DSM.