Effects of Herb-Mix Supplementation on the Growth Performance and Serum Growth Hormone in Weaned Pigs

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ABSTRACT : Two hundred sixteen crossbred (Landrace×Yorkshire) castrates with an average weight of 7.4±0.3 kg were used in a 3×3 factorial treatment array. The treatments were three levels of Herb mixture (HM; 0, 0.40 and 0.80 g/kg BW/day) and three levels of dietary nutrient (17.30% CP, Level-1; 17.90% CP, Level-2; and 18.50% CP, Level-3). The influence of HM intake and nutrient level on growth performance and ADG in 0.40- and 0.80-HM pigs increased significantly ($p<0.01$) as nutritional level was elevated. Although very little enhancement of ADG was observed at Level-1, peak ADG occurred in 0.8-HM treated pigs at Level-3. Feeding of 0.80 g HM/kg/d to pigs consuming Level-1 diet resulted in a 8.7% increase in ADG compared with control pigs, whereas the increase in ADG as a result of 0.80-HM with Level-3 treatment was 39%. ADFI in Level-2 pigs improved linearly ($p<0.01$) as HM level was increased. Treatment with HM resulted in a 12.0% increase ranging 4.7 to 20% in the ADFI compared with respective controls. ADFI at all nutritional level was significantly higher in 0.80-HM pigs ($p<0.02$). F/G in Level-2 pigs improved significantly as HM was fed ($p<0.01$), and in HM-0.80 pigs was also significantly improved as nutritional level was increased ($p<0.05$). Pigs fed HM had higher bone mineral density (BMD) at Level-1, longer dorsal spine length (DSL) at level-2 ($p<0.05$) than pigs fed basal diets. Pigs fed HM tended to higher BMD and DSL than those fed basal diets. The level of GH secretion declined with age. There was no difference between treatments ($p>0.05$) in the serum growth hormone at the same age. The GH was higher in pigs fed HM than those fed basal diets and increased in all pigs after 2wks feeding. A positive effect of added Herb-Mix on growth performance in weaned pigs was demonstrated by measuring the serum growth hormone, bone mineral density and length of dorsal spine. (*Asian-Aus. J. Anim. Sci. 2000. Vol. 13, No. 6 : 791-794*)

Key Words : Herb-Mix, Piglet, Growth, Growth Hormone, Bone Mineral Density

INTRODUCTION

The growth and intake promoting effects of the specially formulated Herb mixture in human have been traditionally established in Korea. In order to promote the potency that are perceived to be caused by multiple factors, polyherbal formulation containing standard plant ingredients are employed. Traditional medicine in Korea recognizes the importance of herb as a whole in maintaining the well-being of the body. The benefits of consuming herb mixtures may be due to synergic effects. When considering the role of medicinal plants in relationships between humans and domestic animals, two aspects may be considered (Bye and Linares, 1999). The first is the experience of humans in the management of animals or animal husbandry; and second, the ability of the animals to recognize and take advantage of the plants upon which they feed. Because diet composition can directly affect nutrient partitioning and growth in pigs, an understanding of how these herb mixture alters these relationships should provide valuable information regarding the formulation of diets to achieve optimal growth in Herb mixture fed pigs. The impact of dietary components such as energy, protein (amino acids) and minerals have only been recently investigated in relationship to the influence of enhanced growth elicited by somatotropin (Campbell et al., 1988; Caperna et al., 1989, 1990; Goodband et al., 1990). Growth hormone treatment enhanced ash accretion in carcass (Caperna et al., 1991). Dual-energy X-ray absorptiometry (DXA) has been used to measure the body composition of live pigs (Mitchell and Scholz, 1997). The present experiment was conducted to titrate the effects of various doses of Herb mixture (HM) in weaned pigs at different diet level (DL). Growth performance, blood somatotropin, bone mineral density by DXA and dorsal spine length were collected to establish Herb mixture efficacy.

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MATERIALS AND METHODS

Animals and experimental design

Two hundred sixteen crossbred (Landrace×Yorkshire) castrates with an average weight of 7.4±0.3 kg were used in a 3×3 factorial treatment array. The treatments were three levels of Herb mixture (0, 0.40 and 0.80 g/kg BW/day) and three levels of dietary nutrient (17.30, 17.90 and 18.50% CP). Herb-mixture was composed of safflower seed

(*Carthamus tinctorius* L.) 13.5%, zizyphi spinosi semen (*Zizyphus jujuba* MILLER) 9.01%, achyranthes root (*Achyranthes japonica* LEVEILLE et VANIOT) 9.0%, dioscorea rhizome (*Dioscorea japonica* THUNBERG) 7.2%, cornus fruit (*Cornus officinalis* SIEBOLD et ZUCCARINI) 7.2%, moutan bark (*Paeonia moutan* SIMS) 4.5%, hoelen (*Poria coccos* WOLF) 4.5%, alisma rhizome (*Alisma orientale* JUZEPCZUK) 4.5%, cyperus rhizome (*Cyperus rotundus* L.) 4.5%, cimicifuga rhizome (*Cimicifuga heracleifolia* KOMAROW) 4.5%, wheat germ (*Hordeum vulgare* L.) 4.5%, Drynaria fortunei (*Drynaria fortunei* SMITH) 4.5%, phellodendron bark (*Phellodendron amureense* RUPRECHT) 4.5%, whey meneral 18.0%. The pigs were housed in an environmentally controlled (six pigs/pen; four replications/treatment) with pen dimensions of 1.3 m × 1.5 m, with woven wire floors, and one nipple waterer and one six-hole self-feeder per pen. On d 0, 14 and 28 after beginning of experiment, blood samples were taken from the jugular vein in thirty-six pigs (four pigs/treatment) for determination of somatotropin. Pigs were given *ad libitum* to access to experimental feeds (table 1) and water. Twenty-four pigs (four pig/treatment, level-1 and level-2 × Herb-0.4 and -0.8) were euthanized at 28 d after beginning of experiment for determination of the spine length and bone mineral density. Feed consumption and individual pig weights were measured at the end of each 14-d period. Response criteria measured were ADG, average daily feed intake (ADFI), feed/gain (F/G), bone mineral density, dorsal spine length and blood somatotropin.

Table 1. Ingredient and chemical composition of diets fed to weaned pigs

Item	Level-1 (L-1)	Level-2 (L-2)	Level-3 (L-3)
Ingredients			
Corn grain	53.33	49.45	45.58
Soybean meal	10.00	8.75	7.50
Potato protein	3.00	3.38	3.75
Meat protein	4.00	4.00	4.00
Fish protein	2.50	2.87	3.25
Plasma protein		0.75	1.50
Milk powder	1.00	1.00	1.00
Whey powder	10.00	13.13	16.25
Lactic ferment	4.00	4.00	4.00
Glucose	4.00	4.00	4.00
Soybean oil	3.50	4.00	4.50
Mono calcium phosphate	1.20	1.20	1.20
Limestone	0.80	0.80	0.80
DL-Methionine	0.15	0.15	0.15
L-Lysine HCl	0.17	0.17	0.17
Mecadox	0.05	0.05	0.05
Natuphos	0.10	0.10	0.10
Fumaric acid	1.50	1.50	1.50
Vit. min. premix[a]	0.70	0.70	0.70
Chemical composition[b]			
Crude protein	17.30	17.90	18.50
Crude fat	6.74	7.25	7.77
Crude fibre	2.27	2.19	2.12
Ca	0.83	0.86	0.88
P	0.59	0.62	0.64
DE (MJ/kg)	15.18	15.36	15.53

[a] Provided the following per kg of complete diet: Zn, 70 mg; Fe, 50 mg; Mn, 25 mg; Cu, 5 mg; Co, 0.5 mg; I, 0.7 mg; Se, 0.3 mg; vitamin A, 4,400 IU; vitamin D_3, 440 IU; vitamin E, 14.7 IU; vitamin K, 2.9 mg; riboflavin, 4.4 mg; niacin, 26.5 mg; d-patothenic acid, 17.6 mg and vitamin B_{12}, 17.6 μg.
[b] Calculated analysis of the diets.

Blood growth hormone analyses

The secretory patterns of growth hormone (GH) determined in plasma obtained from jugular blood samples at 0, 2 and 4 weeks after beginning of the experiment. The blood samples were collected into tubes containing heparin (20 unit per ml of blood) and centrifuged immediately to remove cells, and plasma samples were stored at -25℃ in separate portions. The growth hormone was quantified by using commercially available kits (Amersham Life Science).

Bone mineral density (BMD) measurement

The bone mineral density (BMD, g/cm^2) of the dorsal spine (D1-D5) was measured by dual-energy X-ray absorptiometry (Hologic QDR-1000TM, USA) with a 1 mm diameter collimator on the X-ray output. All measurements were made and analyzed by the same operator; the *in vivo* precision error in this laboratory for bone mineral density was 1% for the spine.

Statistical analysis

Data obtained from these experiments were analyzed using the General AOV procedure of STATISTIX (1996). When the data were significant, LSD method was used to compare significant differences between average means. Preplanned contrasts were used to separate treatment means in experiment. The comparisons made were control (basal diet) compared to Herb mixture supplementation at different nutritional level.

RESULTS AND DISCUSSION

Growth performance

ADG (table 2) was higher in pigs fed the high-nutrient diet ($p<0.01$) and HM ($p<0.05$). The influence of HM intake and nutrient level on ADG in 0.40- and 0.80-HM pigs increased significantly ($p<0.01$) as nutritional level was elevated. Although

very little enhancement of ADG was observed at Level-1, peak ADG occurred in 0.8-HM treated pigs at Level-3. Feeding of 0.80 g HM/kg BW/d to pigs consuming Level-1 diet resulted in a 8.7 % increase in ADG compared with control pigs, whereas the increase in ADG as a result of feeding 0.80-HM with Level-3 treatment was 39 %. ADFI was higher in pigs fed the high-nutrient diet ($p<0.05$) and HM ($p<0.01$). ADFI in Level-2 pigs improved linearly ($p<0.01$) as HM level was increased. Treatment with HM resulted in a 12.0 % increase ranging 4.7 to 20 % in the ADFI compared with respective controls. ADFI at all nutritional level was significantly higher in 0.80-HM pigs ($p<0.02$). F/G was lower in pigs fed the high-nutrient diet ($p<0.01$) and HM ($p<0.01$). Whereas DL × HM interaction was not exhibited. F/G in Level-2 pigs improved significantly as HM was fed ($p<0.01$), and in HM-0.80 pigs was also significantly improved as nutritional level was increased ($p<0.05$). With regard to general growth criteria such as daily gain and feed:gain, no nutrient level × Herb mix supplementation treatment interactions were observed.

Table 2. Effects of the level of Herb-Mix (HM) and nutrition on growth performance in weaned pigs

DL	HM	FBW	ADG	ADFI	F/G
L-1	0	19.24	0.46	0.86	1.90
	0.4	19.37	0.46	0.75	1.68
	0.8	21.19	0.50	0.90	1.79
L-2	0	21.73	0.52	0.89	1.72
	0.4	23.71	0.59	0.82	1.40
	0.8	22.88	0.59	0.94	1.60
L-3	0	22.44	0.56	0.92	1.69
	0.4	23.83	0.61	0.83	1.37
	0.8	24.94	0.64	0.99	1.56
SEE			0.01	0.02	0.05
Effect					
DL			**	*	**
HM			*	**	**
DL × HM			NS	NS	NS

[2] FBW, Final Body Weight; ADG, Average Daily Gain; ADFI, Average Daily Feed Intake, F/G; Feed/Gain.
SEE=Standard error of the estimate.
NS=Not significant ($p>0.05$); * $p<0.05$; ** $p<0.01$.

Bone mineral density and dorsal spine length

BMD was higher in pigs fed the HM ($p<0.05$), whereas it was not significantly affected by DL ($p>0.05$). Protein intake had minimal influence on ash accretion in pigs (Caperna et al., 1991). Growth hormone treatment enhanced ash accretion in carcass (Caperna et al., 1991). The linear nature of this relationship (between control and HM treated pigs) is further evidence to support the hypothesis that HM treated pigs respond not similarly to controls as DL is varied. dorsal spine length (DSL) was higher in pigs fed the high-nutrient diet ($p<0.01$) and HM ($p<0.01$). Pigs fed HM had higher bone mineral density (BMD) at Level-1, longer dorsal spine length (DSL) at Level-2 ($p<0.05$) than pigs fed basal diets (table 3). Pigs fed HM tended to higher BMD and DSL than those fed basal diets. Whereas DL × HM interaction was not exhibited.

Table 3. Effect of level of Herb-Mix supplementation and nutrition on the bone mineral density (BMD) and length of dorsal spine in weaned pigs

Level of Nutrition	HM	Bone mineral density g/cm^2	Dorsal spine length
L-1	0	0.85	59.00
	0.4	0.92	61.50
	0.8	1.28	62.50
L-3	0	0.55	60.75
	0.4	0.66	62.75
	0.8	0.72	66.00
SEE		0.06	0.66
Effect			
DL		NS	**
HM		*	**
DL × HM		NS	NS

SEE=Standard error of the estimate.
NS=Not significant ($p>0.05$); * $p<0.05$; ** $p<0.01$.

Growth hormone

The pattern of GH secretion is displayed in figure 1. The level of GH secretion declined with age. These results agree with Klindt and Stone (1984). As growth progressed, serum GH decreased in all treatment groups, but the magnitude of change was less in the HM group with higher nutrition level. The GH was higher in pigs fed HM than those fed basal diets and increased in all pigs after 2 wks feeding. There was no difference between treatments ($p>0.05$) in the serum growth hormone at the same age. Caperna et al. (1990) report that the characterized general growth, body composition, and hormone status in control and rpST-treated pigs fed various levels of dietary protein. Dietary treatment did not influence GH concentration in serum (data not shown). Results from this study indicate that HM is effective in modulating the pattern of GH secretion in pigs. We have quantified changes in serum GH as affected by dietary levels of control and HM-treated pigs.

A positive effect of added Herb-Mix on growth performance in weaned pigs was demonstrated by measuring the serum growth hormone, bone mineral density and length of dorsal spine.

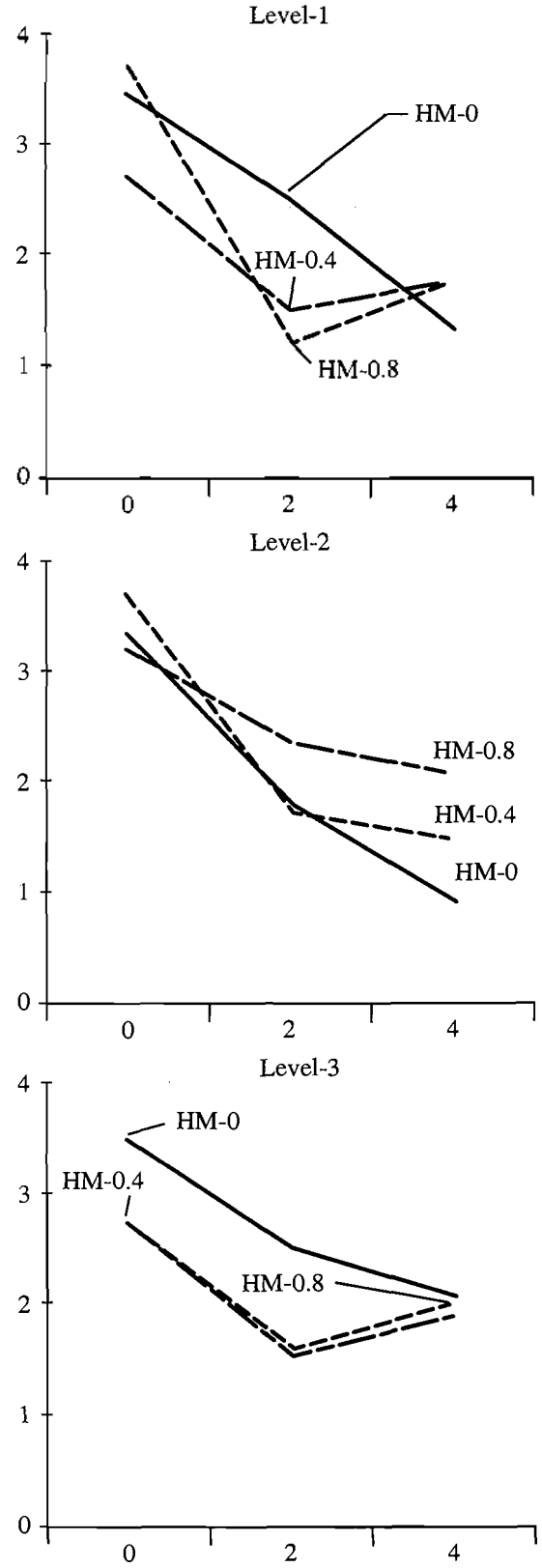

Figure 1. Effect of HM (HM-0, HM-0.4 and HM-0.8) and nutrition level (Level-1, Level-2 and Level-3) on GH (ng/ml) at different age (0, 2 and 4 weeks after beginning of experiments

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