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Effect of Polyherbal Additives on Intake, Growth and Nutrient Digestibility in Yorkshire Male Pigs

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ABSTRACT

Growth trial of thirteen weeks' duration was carried out on 24 pigs (2 months age; 12.5 kg b. wt.) which were divided into four groups of 6 pigs each and were fed with control diet concentrated feed mixture (CFM) (T0), CFM plus polyherbal superliv (500 g/ton) (T1), CFM plus polyherbal Ruchamax (500g/ton) (T2) and CFM plus AV/AGP/10 polyherbal (500g/ton) (T3). The dry mater intake (DMI) (g/d) in T0, T1, T2 and T3 groups were 1152.80, 1277.59, 1204.73 and 1186.13 respectively where significantly ($P<0.01$) higher dry mater intake (DMI) was observed in T1 group. Significant ($P<0.01$) difference was observed among treatment groups in organic matter (OM), crude protein (CP), ether extract (EE), crude fibre (CF), nitrogen free extract (NFE), neutral detergent fibre (NDF), acid detergent fibre (ADF), cellulose and hemicellulose intake. Similarly, significantly higher ($P<0.05$) weight gain, feed conversion ratio (FCR) and feed efficiency ratio (FER) was noticed in T1 group when compared to other groups. The digestibility of DM, OM, NFE, NDF, Cellulose and Hemicellulose were significantly ($P<0.01$) different. It was concluded that superliv polyherbal supplemented group significantly improved weight gain, FCR and net profit than the other polyherbal supplemented and control group without any deleterious effect on pigs.

Keywords: AV/AGP/10, Feed conversion ratio, Growth performance, Polyherbs, Ruchamax and Superliv

Possibilities of using polyherbs as feed additives in livestock were explored in response to ban on use of synthetic antibiotic as feed additive as some of the plant parts used as herbal found to be contained amino acids, essential oils, liver stimulator and growth promoter (Windisch *et al*., 2008). Herbs in the diet of farm animals as flavouring agents can influence the feeding/eating pattern, secretions of digestive juices and total feed intake.

The mechanism of action of herbs in the animal for growth promotion includes changes in intestinal microbiota, increased digestibility and nutrient absorption in addition to their pharmacological effect like stimulation of immune system, antibacterial activity, coccidiostatic, antihelmenthic, antiviral and anti-inflammatory properties (Costa *et al.,* 2007). Recent trend is use of polyherbs is more significant in non-ruminants particularly in poultry and swine than in ruminants. The beneficial effect of polyherbal liver stimulant in the diet has increased feed intake and increased body weight recorded in poultry by Singh *et al.,* 2009, in swine by Nihar *et al.* (2011) and in piglets by Praveen kumar *et al.,* 2015. The use of herbal growth promoter (AV/AGP/10) in growth, feed intake and body weight gain (Kumar *et al.*, 2014 and Debanth *et al.,* 2014). The herbal extract Ruchamax (Ayurvet, India) in diet had a beneficial effect on lactating performance of sows (Lipinski *et al.,* 2014). However, the data available on usage of various commercial polyherbal formulations on different species of livestock is lacking with respect to their dose and safety as feed supplement. Hence, the present experiment was undertaken to study the effects of some commercial polyherbal feed additives on growth

performance and nutrient utilization in Yorkshire male pigs.

MATERIALS AND METHODS

Twenty four Yorkshire male pigs (aged; 2 months, body weight; 12.50-12-52 kg with 80% Yorkshire blood line) were divided into 4 groups of 6 pigs each following completely randomized block design (CRD). All groups were fed with common concentrate feed mixture (CFM), the group fed only CFM without any additive served as control group (T0), T1 group was supplemented with liver stimulant polyherbal (Superliv®), T2 with appetite stimulant and digestive tonic polyherbal (Ruchamax®) and T3 with bacteriostatic and growth promoter with essential oils polyherbal (AV/AGP/10) (Table 1).

Table 1: Ingredient composition (%) of concentrate feed mixture fed to experimental pigs

Ingredient	(%)	CP*(%)	DE*(kcal/kg)	ME*(kcal/kg)
Maize	50.0	4.51	1727.5	1697.0
SBM	25.0	11.28	1052.5	975.8
DORB	22.7	3.93	499.2	472.4
Trace minerals mixture	0.25	0	0	0
Salt	0.5	0	0	0
Lime stone powder	0.5	0	0	0
Vitamins	0.05	0	0	0
DCP	1.0	0	0	0
Total	**100**	**19.72**	**3279.2**	**3145.2**

Note:

1. Trace mineral mixture contained Ferrous sulphate, monohydrate, iron (E1)-63000mg; cupric sulphate, pentahydrate, copper (E4)-22400mg; zinc oxide, zinc (E6)-6750mg; manganous oxide, manganese (E5)- 67500mg; coated granulated cobalt (II) carbonate, cobalt (3b304) -270mg; potassium iodide, iodine (E2)-1350mg; sodium selenite, selenium (E8) -315mg.
2. Vitamin premix contains Vitamin A- 26,000,000 IU, Vitamin-$D_3$10, 000,000 IU, Vitamin E-80,000IU, Vitamin B_1-6,000mg, Vitamin B_2-18,000mg, Vitamin B_6-7,999.99 mg, Vitamin B_{12}-30,000 mcg, Biotin-300,000 mcg, Vitamin K_3-8,000 mg, Calcium d-pantothenate-30,000mg, Folic acid-4,000mg, Nicotinic acid-100,000mg.

*calculated (NRC, 2012).

Pigs were fed as per the requirement of NRC (2012) based on body weight and rate of weight gain. The pigs weighing between 11-25kg was offered one kilo of CFM so as to support 585g gain per day and pigs weighing between 25-50 kg was offered about 1.5kg CFM to support an average gain of 750-800g gain per day. All pigs were housed individually in metal crates in a metabolic shed throughout the experimental period with good ventilation and were provided with similar management practices. Each crate had separate facilities for feeding and watering. All pigs were dewormed using Fenbendazole (Panacur®, 50 mg/kg body weight) and Metronidazole (Flagyl®, 20-60 mg/kg B.wt) as per the standard schedule. Feeding trial was carried out for 90 days (13 weeks). During the experimental period, daily feed intake and weekly body weight were recorded. After completion of 8 weeks of feeding trial, the digestion trial was conducted for 5 days on all 24 pigs where total collection of faeces voided by each pig was done manually. The CFM and faecal samples of individual pig were subjected to Proximate analysis (AOAC, 2000) and fiber fraction (Van Soest *et al.,* 1991). Nitrogen in wet faecal samples was determined by macro kjeldhal method (AOAC, 2000). The gross energy, digestible energy and metabolizable energy of CFM were calculated by using the following formula (NRC, 2012):

$$GE = 4142 + (56 \times \%EE) + (15 \times \% CP) - (44 \times \%Ash) \quad \ldots 1$$

$$DE = 4168 - (9.1 \times \% Ash) + (1.9 \times \%CP) + (3.9 \times \% EE) - (3.6 \times \% NDF) \quad \ldots 2$$

$$ME = 4194 - (9.1 \times \% Ash) + (1.9 \times \% CP) + (3.9 \times \% EE) - (3.6 \times \% NDF) \quad \ldots 3$$

Data on dry matter intake (DMI), nutrient intake, body weight gain and digestibility were analyzed by statistical analysis system (SAS, 2012) and results were interpreted accordingly (Table 3 and 4).

RESULTS AND DISCUSSION

The chemical composition of CFM is given in Table 2. The CP (%) content of the CFM was ranged from 19.06 to 21.03 which was quite higher than the levels of the diets used in several experiments (Praveen *et al.,* 2014; Suryanarayana and Ramana, 2014; Praveen *et al.,* 2015). The other proximate constituents and fiber fractions of CFM did not vary much when compared to the diets used in other growth studies as ingredient composition was same in all CFMs except polyherbal addition in CFM-1, 2 and 3. The predicted DE and ME values (kcal/kg) of

Table 2: Chemical composition (% on DMB) and energy values of concentrate feed

Particular	CFM-0	CFM-1	CFM-2	CFM-3
Organic Matter	90.36	90.59	91.00	90.31
Crude Protein	19.36	21.03	19.06	20.38
Ether Extract	1.59	2.74	2.03	2.12
Crude Fibre	8.03	6.63	8.72	6.63
Nitrogen Free Extract	61.38	60.20	61.19	61.17
Total Ash	9.64	9.41	9.00	9.69
Acid Insoluble Ash	0.39	0.40	0.38	0.39
Neutral Detergent Fibre	35.03	34.47	32.75	30.37
Acid Detergent Fibre	13.52	14.52	15.98	13.02
Cellulose	11.77	11.77	11.77	11.77
Hemicellulose	21.51	19.95	16.77	17.35
Acid Detergent Lignin	3.89	3.89	3.89	3.89
GE#, kcal/kg	3694	4692	4182	4120
DE#, kcal/kg	2459	2577	2612	2662
ME#, kcal/kg	2339	2445	2494	2530

Predicted values (NRC, 2012)

Table 3: Mean daily DM intake, nutrient intake and energy intake of experimental pigs

Parameter	T0	T1	T2	T3	SEM	P-Value
DMI, g/d	1152.80^{a}	1277.59^{b}	1204.73^{ab}	1186.13^{ab}	12.218	0.01
per 100 kg Bwt	4.29	4.30	4.32	4.39	0.050	0.90
OMI, g/d	1041.67^{a}	1157.37^{b}	1096.3^{ab}	1071.19^{ab}	11.059	0.01
per 100 kg Bwt	3.88	3.91	3.93	3.94	0.046	0.97
CPI, g/d	223.18^{a}	268.68^{b}	229.62^{a}	241.73^{a}	2.424	<0.01
per 100 kg Bwt	0.83^{ab}	0.91^{a}	0.82^{b}	0.89^{ab}	0.010	0.016
EEI, g/d	18.33^{a}	35.01^{b}	24.46^{c}	25.15^{c}	0.248	<0.01
per 100 kg Bwt	0.07^{a}	0.12^{b}	0.09^{c}	0.09^{c}	1.134	<0.01
CFI, g/d	92.57^{b}	84.7^{a}	105.05^{c}	78.64^{a}	0.931	<0.01
per 100 kg Bwt	0.34^{b}	0.29^{a}	0.38^{b}	0.29^{a}	4.092	<0.01
NFEI, g/d	707.59^{a}	769.11^{b}	737.17^{ab}	725.56^{ab}	7.467	0.05
per 100 kg Bwt	2.64	2.60	2.64	2.67	0.030	0.88
NDFI, g/d	403.83^{a}	440.39^{b}	394.55^{a}	360.23^{c}	4.058	<0.01
per 100 kg Bwt	1.50^{a}	1.49^{a}	1.41^{ab}	1.33^{b}	0.017	<0.01
ADFI, g/d	155.86^{a}	185.51^{b}	192.52^{b}	154.43^{a}	1.720	<0.01
per 100 kg Bwt	0.58^{ac}	0.63^{a}	0.69^{b}	0.57^{c}	7.138	<0.01
Cellulose Intake, g/d	137.45^{a}	153.34^{b}	146.09^{ab}	140.89^{a}	1.430	<0.01
per 100 kg B.wt	0.51	0.52	0.52	0.52	0.006	0.97
Hemicellulose Intake, g/d	247.97^{a}	254.88^{a}	202.03^{b}	205.79^{b}	2.349	<0.01
per 100 kg Bwt	0.92^{a}	0.86^{a}	0.72^{b}	0.76^{b}	0.009	<0.01
Energy intake, kcal/d						
DE, kcal/d	2835^{b}	3293^{a}	3146^{ab}	3158^{a}	62.719	<0.01
ME, kcal/d	2708^{a}	3159^{b}	3040^{a}	2970^{ab}	47.930	<0.01

**P≤0.05, ** P≤0.01*, Means with different superscripts in a row differ significantly

Table 4: Mean body weight, daily gain, FCR, FER, feed intake and nutrient digestibility in experimental pigs

Parameters	T0	T1	T2	T3	SEM	P-Value
Body weight						
Initial, kg	12.50	12.50	12.52	12.51	0.308	1.000
Final, kg	51.88^{b}	58.15^{a}	54.54^{ab}	53.51^{ab}	0.824	0.050
Gain, g/d	432.71^{b}	501.70^{a}	461.70^{ab}	450.55^{ab}	9.318	0.050
Feed intake	1280.76	1367.48	1295.33	1310.29	13.39	0.144
FCR	3.99^{ab}	4.50^{a}	3.54^{b}	3.96^{ab}	0.105	0.033
FER	0.26^{ab}	0.22^{b}	0.29^{a}	0.26^{ab}	0.007	0.037
Nutrient digestibility (%)						
DM	77.13^{a}	71.55^{b}	72.19^{ab}	73.45^{ab}	0.437	0.033
OM	80.24^{a}	75.7^{b}	76.34^{ab}	77.29^{ab}	0.386	0.043
CP	77.69	73.34	74.25	75.61	0.391	0.081
EE	58.18	65.28	53.59	57.42	0.916	0.094
CF	31.98	23.08	20.69	27.97	1.162	0.152
NFE	82.30^{a}	78.32^{b}	79.84^{ab}	78.90^{ab}	0.356	0.049
NDF	56.17^{a}	46.21^{ab}	43.95^{b}	43.86^{b}	0.730	0.007
ADF	21.19	13.78	15.09	17.01	1.032	0.321
Cellulose	49.54^{a}	38.22^{b}	41.21^{ab}	47.07^{ab}	0.736	0.018
Hemicellulose	78.16^{a}	70.47^{ab}	67.24^{b}	64.75^{b}	0.699	0.002

**P<0.05, **P<0.01*, Means with different superscripts in a row differ significantly

Table 5: Economics of polyherbal supplementation on growing pigs

		T0	T1	T2	T3
I.	**Expenditure**				
a	Cost of pigs@ ₹ 100/kg live weight, average body weight of pigs 12.5kg	1250	1250	1252	1251
b	Total feed consumed during 3 months (kg).	100	107	101	102
c	Cost of the feed including polyherbal (₹/ kg)	20.56	20.86	20.63	20.76
d	Total cost of feed consumed during 3 months (₹)	2056	2232	2084	2118
e	Cost of labor during 3 months (₹/pig)	750	750	750	750
f	Cost of medicine (₹)	12.5	12.5	12.5	12.5
A	**Total expenditure (a + d + e + f)**	**4068.5**	**4244.5**	**4098.5**	**4131.5**
II	**Income**				
a	Total body weight gained during 3 months (kg)	39.38	45.65	42.02	41.00
b	Sale of pigs @ ₹ 150/kg liveweight	5907	6848	6303	6150
B	**Total income**	**5907**	**6848**	**6303**	**6150**
III	**Net income (B – A)**	**1838.5**	**2603.5**	**2204.5**	**2018.5**
IV	**Benefit cost ratio (B:C)**	**1.45**	**1.61**	**1.53**	**1.48**

CFM ranged from 2459 to 2662; 2339 to 2530 which were lower than NRC (2012) recommendation for the growing pigs at different phases of growth. This was due to incorporation of de-oiled rice bran (DORB) in CFM whereas NRC (2012) requirements were based on corn and soybean based diets without DORB. However, ME of CFM in this study represented significant proportion of DE around 96%. The energy values reported in this study

were lower than the values reported in earlier studies (Annongu *et al.,* 2011; Igbalsan and Olugosi, 2013; Huishaung *et al.,* 2013; Praveen *et al.*, 2015).

Significantly higher (P<0.01) DM, OM, CP, EE and NFE intake were observed in T1 group, polyherbal supplement, superlive being a liver stimulant improved the intake over other polyherbal supplemented groups. Suryanarayana and Ramana (2014) reported significantly higher DMI and lower CPI and EEI in pigs supplemented with polyherbal than the values reported in this study whereas Praveen *et al*. (2015) reported lowered DMI in pigs fed herbal supplements. But CF and ADF intake were significantly higher in T2 group and this difference was attributed to variation in the level of CF and ADF in CFM. The intake of fiber fractions obtained in this study was higher than the values reported in the growing piglets fed with turmeric, amla and ginger herbal supplements (Suryanarayana and Ramana, 2014).

Body weight gain was significantly higher (P<0.05) in T1 group followed by T2, T3 and T0 groups (Table 4). However, no significant difference between T0, T2 and T3 groups. Only 74-85% of the targeted weight gain of NRC (2012) was achieved even though the feed supplied was optimum according to requirement. Because diets of pigs of this experiment comprised maize, soybean and DORB whereas NRC (2012) requirement were arrived based on the corn soybean based diets. The other possible reason was that the Yorkshire blood level of the experimental pigs was 80% whereas the NRC (2012) requirements were for pure Yorkshire breeds.

The FCR was found to be significantly higher (P<0.01) in T1 group which was due to higher body weight gain and FCR achieved in this experiment was higher than the values (2.94) reported for pigs diet supplemented with AV/AGP/10 (Kumar *et al.,* 2014), yakrifit bolus (2.84) and liquid (2.94) (Praveen *et. al.,* 2015), Barbados seed at different levels (2.1 – 2.28) whereas similar FCR was reported in piglets fed polyherbal (3.61 -3.94) (Suryanarayana and Ramana, 2014).

The DM, OM and NFE digestibility was significantly higher (P<0.05) in T1 group whereas NDF digestibility was significantly higher (P<0.01) in T2 group. The digestibility of CP, EE, CF and ADF was not significantly different among the treatment groups. No herbal products influenced nutrient digestibility in experimental pigs. However, the Ruchamax supplemented group (T2) has improved the NDF digestibility. Similarly, polyherbals didn't have any effect on cellulose and hemicellulose digestibility when compared to control group. Similar results were reported in other experiments with respect to DM, OM and CP digestibility in piglets fed with polyherbal residues (Cullen *et al.,* 2005; Suryanarayana and Ramana, 2014). The NDF digestibility reported in this study was higher than the values reported by Suryanarayana and Ramana, (2014) but lower than the values reported by Cullen *et al.* (2005). The cellulose and hemicellulose digestibility were higher than the values reported in younger pigs fed with different polyherbals (Suryanarayana and Ramana, 2014). Significantly higher energy intake (DE and ME, kcal/day) was noticed in T1 group which was due to higher content of energy and higher DMI which was reflected in significantly higher weight gain in T1 group.

The net income obtained due to addition of polyherbal supplementation in the diet of growing pigs for 3 months was ₹ 1838.5, 2603.5, 2204.5 and 2018.5 in T0, T1, T2 and T3 groups respectively. The percent increase in the net profit in the polyherbal supplemented groups was 41.16, 19.42, and 9.79 in T1, T2 and T3 groups. The percent increase in the net profit was higher in T1 group followed by T2 and T3 groups (28.98 v/s 18.1%) (Table 5).

Based on the results of the above study, it can be concluded that the polyherbal Superliv supplemented group (T1) showed significant improvement in daily body weight gain and FCR when compared to other polyherbals; Ruchamax (T2) and AV/AGP/10 (T3) supplemented groups. But all polyherbal supplements have increased the margin of profit compared to control group without any adverse effects on pigs. However, the better performance in growing pigs can be achieved by increasing the dose of polyherbal in the diets of growing pigs.

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REFERENCES

A.O.A.C. 2000. Official Methods of Analysis. Association of Official Analytical Chemists. 17th Edition, Washington, D.C.

Annongu, A.A., Toy, A.A. and Ogunbode, A.A. 2011. The influence of allelochemicals of pride of Barbados seed in nutrition of swine. *J. Eviron. Agri Devp. Ctries.,* **3**(1): 137-144.

Costa, L.B., Panhoza, Tse, M.L.P. and Miyada, V.S. 2007. Herbal extracts as alternatives to antimicrobial growth for weanling pigs. *Brazilian. J. of Anim. Sci.,* **36**: 589–595.

Cullen, S.P., Monahan, F.J., Callan. and Doherty. J.V.O. 2005. The effect of dietary garlic and rosemary on grower finisher pig performance and sensory characteristics of pork. *Irish J. of Agri. Food. Res*., **44**: 57-67.

Debnath, B.C., Choudhary, K.B.D., Ravikanth, K. Thakur, A. and Shivini, M. 2014. Comparative efficacy of natural growth promoter with antibiotic growth promote on overall growth performance and intestinal morphometry in broiler birds., *Int. J. of Pharm. Sci. and Health care.,* **4**(2): 155-168.

Hui-Shuang,Yeh., Kou-Joong, Li. and Chun-Kuang, Chou. 2013. Effects of supplemental Chinese traditional herbal medicine complex on the carcass quality of pigs. *J. Anim. Sci.*, **1**(2): 73-86.

Igbasan, F.A. and Olugosi, O.A. 2013. Performance characteristic, biochemical profiles of broilers chicken fed synthetic and herbal methionine supplemented diet. *Afriacan J. Food. Sci*., **7**(6): 159-167.

Kumar, P., Ravikanth, K., Thakur, A. and Maini, S. 2014. Evaluation of efficacy of supplementation of natural growth promoter AV/AGP/10 in improving growth and performance in piglets. *World J. Pharm. Res*., **4**(3): 1454-1460.

Lipinski, K., Sajko, S., Purwin. and Kucman, E. 2014. A note on the effect of dietary supplementation with herbal extracts on sow and litter performance. *South African J. of Anim. Sci.,* **44**(2): 110-113.

National Research Council. 2012. Nutrient Requirement of swine, 11th edition (National Academy Press, Washington DC.

Nihar. R.S., Swaraj, R., Choudhary, K.B.D., Das, A., Pankaj, P. K., Shivini. M. and Ravikanth, K. 2011. Efficacy of poly herbal liver tonic products in promoting growth performances in post weaned ghungroo piglets. *Research Opinions in Animal & Vet. Sci.,* **1**(3): 284-287.

Praveen, K., Ravikanth, K. and Adarsh, C. 2014. Role of supplementing herbal liver tonic products in weaned piglets upto grower stage. *J. Envir. Agri. Devlop. Ctries Pharm. Res*., **3**(1): 634-644.

Praveen, K., Ravikanth, K. and Adarsh, C. 2015. Herbal antibiotic growth promoter supplementation to improve growth indices and performance in weaned pigs up to grower stage. *World. J. Pharm. Res*., **3**(4): 1136-1144.

Singh, V.K., Chauhan, S.S., Ravikanth, K., Maini, S. and Rekhe, D.S. 2009. Effect of dietary supplements of polyherbal liver stimulant on growth performance and nutrient utilization in broilers. *Vet. World.,* **2**(9): 350-352.

Statistical Analysis System. 2012. SAS/STAT User's guide: statistics, Version 10.0, Cary, NC, USA: SAS Institute Inc.

Suryanarayana, M.V.A.N. and Ramana, J.V. 2014. Effect of exogenous enzymes and herbal residues on the performance, nutrient utilization and balance in growing crossbred pigs. *Int. J. Food, Agri. Vet. Sci*., **4**(2): 56-60.

Van Soest, P.J., Robertson, J.B. and Lewis, B.A. 1991. Methods for dietary fibre, neutral detergent fibre and non-starch polysaccharides in relation to animal nutrition. *J. Dairy Sci*., **74**: 3583-3597.

Windisch, W.M., Schedule, K., Plitzner, C. and Kroisemayr, A. 2008. Use of phytogenic products as feed additives for swine and poultry. *J. Anim. Sci*., **86**: 140-148.