Wayamba Journal of Animal Science – ISSN: 2012-578X; P241 - P246, 2012
First Submitted February 13, 2012; Number 1330779125

NUTRIENT DIGESTIBILITY STUDY IN THREE LINE CROSS BRED PIGS SUPPLEMENTED WITH SPENT BREWERS YEAST

Sreeparvathy, M[1]., Gangadevi, P[2]., Mercy, A. D[3]., Gleeja A[4] , Dipu, M. T[5]., Anuraj, K.S[6]

[1] Suguna Poultry Farms Ltd, [2]Department of Animal Nutrition , [3]Department of Animal Nutrition., [4] Department of Statistics, [5]Department of Animal Nutrition, [6]IVRI. College of Veterinary and Animal Sciences, Kerala Veterinary and Animal Sciences, University Mannuthy, Thrissur, Kerala, India.

An experiment was carried out to evaluate the nutrient digestibility and apparent mineral availability of spent brewers yeast supplemented diet in cross bred (Large White Yorkshire X Duroc X Desi) pigs. The piglets were divided into three identical groups having six replicates in each group with two piglets in each replicate. The three groups were randomly allotted to one of the three dietary treatments T_1, T_2 and T_3 consisting of standard diets with 0, 2.5 and 5 per cent spent brewers yeast respectively. All the animals were maintained on their respective dietary regimen from weaning to an average slaughter weight of 70 kg. Daily dry matter intake was recorded through out the experiment. A digestibility trial was conducted towards the end of the study. Digestibility of nutrients and apparent availability of minerals were found statistically similar for the three dietary treatments indicating spent brewers yeast is effectively utilized by the animals.

Key words : spent brewers yeast, nutrient digestibility, availability of minerals

Evaluation of potential alternative protein source is needed for least cost diet formulation of livestock. Spent brewers yeast (SBY) which is an alternate source of protein is a fermented product containing inactive yeast cells and metabolites formed during fermentation. It is also an excellent source of non starch polysaccharides, B-complex vitamins, minerals and several other unidentified growth factors. The present study was planned to evaluate the nutrient digestibility and apparent availability of minerals in spent brewers yeast supplemented diets in cross bred pigs (Large White Yorkshire X Duroc X Desi).

MATERIALS AND METHODS

Thirty six, Large White Yorkshire X Desi X Duroc piglets were weaned on 56 days of age and were divided into three groups as uniformly as possible with regard to number, age, sex and body weight. The twelve piglets in each group were distributed into six replicates of two piglets in each replicate. The three groups of piglets were randomly allotted to one of the three dietary treatments - T1, T2 and T3. Piglets in each group were allotted randomly to six pens with one pen for each replicate. All the experimental animals were housed in same shed with facilities for feeding and watering and were maintained under identical management conditions. Quantity of feed offered in each pen was weighed before feeding. The pigs were allowed to consume as much feed as they could, within a period of one hour and the balance feed was collected and weighed after each feeding to calculate the daily dry matter intake (DMI). Quantity of feed offered was increased accordingly as and when the animals finish the entire feed offered, before one hour. Clean drinking water was

provided *ad libitum* in all the pens throughout the experimental period.

The experimental diets were made iso caloric and iso nitrogenous as per NRC (1998), requirements for swine. The three dietary treatments were; T_1 - standard diet with 0 per cent spent brewers yeast (Control), T_2 - diet with 2.5 per cent spent brewers yeast, T_3 – diet with 5 per cent spent brewers yeast. Spent brewers yeast utilized for the study was inactivated yeast biomass (*S. carlsbergensis / S. uvarum*) procured from United breweries, Palakkad, Kerala, India.

All the three experimental diets and spent brewers yeast were analyzed for the proximate and mineral composition as per standard procedures (AOAC, 1990). The viability of spent brewers yeast was assessed by using the dilution plate technique with Sabouraud agar medium incorporating chloramphenicol. The sample was found to contain dead yeast cells only. The ingredient composition and chemical composition of the spent brewers yeast, grower and finisher diets are given in Tables 1 and 2.

Table 1. Ingredient composition of grower and finisher diets.

Ingredients	Grower			Finisher		
	T_1	T_2	T_3	T_1	T_2	T_3
Yellow maize, kg	66.00	67.00	67.00	72.00	71.50	71.00
Soybean meal, kg	18.00	15.00	13.00	16.50	14.50	12.50
Wheat bran, kg	5.50	5.00	5.00	6.00	6.00	6.00
Unsalted dried fish, kg	10.00	10.00	9.50	5.00	5.00	5.00
Spent brewers yeast, kg	-	2.50	5.00	-	2.50	5.00
Salt, kg	0.50	0.50	0.50	0.50	0.50	0.50
Total	100	100	100	100	100	100
To 100 kg of the above mixture added Nicomix AB_2D_3K, g*	10.00	10.00	10.00	10.00	10.00	10.00
Nicomix BE, g**	10.00	10.00	10.00	10.00	10.00	10.00
Zinc sulphate, g	20.00	20.00	20.00	7.50	7.50	7.50
Calcite, g	-	-	-	250	250	250

The experimental animals of the three dietary treatments were maintained on their respective dietary regime for a period of 95 days, till they attained an average slaughter weight of 70kg. Daily dry matter intake of all the experimental animals was registered throughout the experimental period.

Digestibility trial was conducted towards the end of the experiment to determine the digestibility of nutrients and percentage availability of minerals of the experimental diets by total collection method. Before the commencement of the actual collection period, animals were subjected to a preliminary period of three days when they were fed the same quantity of the feed.

Faecal matter was collected for three consecutive days as and when they were voided, uncontaminated with feed, dirt or urine. Faecal matter collected daily from each pen was weighed and representative samples were taken after thorough mixing. The representative samples of feed offered

Table 2. Chemical composition*of spent brewers yeast, grower and finisher diets, %

Nutrient moiety	SBY	Grower ration			Finisher ration		
		T_1	T_2	T_3	T_1	T_2	T_3
Dry matter	92.77	90.28	90.35	90.44	90.56	90.63	90.69
Crude protein	39.49	18.15	17.94	17.87	15.76	15.88	16
Crude fiber	0.16	4.00	3.12	4.10	4.76	4.09	3.87
Ether extract	0.51	4.56	3.37	3.69	4.26	3.15	3.12
Total ash	6.35	6.55	6.38	6.21	5.00	4.98	4.96
Nitrogen free extract	53.49	66.74	69.19	68.13	70.22	71.9	72.05
Acid insoluble ash	0.54	2.00	1.93	1.86	1.44	1.43	1.42
Calcium	0.11	0.71	0.69	0.68	0.67	0.64	0.62
Phosphorous	1.54	0.87	0.80	0.77	0.75	0.71	0.71
Magnesium	0.09	0.18	0.17	0.17	0.20	0.19	0.17
Manganese, ppm	8.10	20.25	18.68	18.09	23.66	22.29	22.19
Copper, ppm	0.93	6.08	5.42	4.95	5.28	4.86	4.44
Iron, ppm	65.73	102.32	102.71	103.00	93.48	88.30	85.62
Zinc, ppm	64.58	100.78	100.61	95.38	82.21	81.87	73.56

*On dry matter basis

Table 3. Digestibility of nutrients of three experimental diets, %

Nutrients	Percentage digestibility[1]		
	T_1	T_2	T_3
Dry matter	82.54 ± 0.46	81.87 ± 0.52	80.36 ± 0.79
Crude protein	80.81 ± 0.91	79.73 ± 1.12	78.13 ± 1.11
Ether extract	68.19 ± 1.35	59.70 ± 2.29	52.55 ± 2.80
Crude fibre	38.83 ± 1.62	29.76 ± 3.09	28.07 ± 4.93
Nitrogen free extract	91.36 ± 0.26	90.63 ± 0.37	89.59 ± 0.48

[1]Mean of six values

Table 4. Availability of minerals of three experimental diets, %

Minerals	Percentage availability[1]		
	T_1	T_2	T_3
Calcium	69.15 ± 2.74	69.20 ± 3.11	69.41 ± 2.65
Phosphorous	58.43 ± 2.65	59.03 ± 3.76	58.84 ± 5.82
Magnesium	61.10 ± 2.79[a]	79.23 ± 4.39[b]	71.44 ± 4.87[b]
Manganese	44.98 ± 2.09[a]	44.22 ± 1.31[a]	35.83 ± 2.80[b]
Iron	36.66 ± 4.23	38.67 ± 2.48	35.62 ± 6.82
Copper	18.58 ± 3.46	26.50 ± 1.56	17.10 ± 3.27
Zinc	31.79 ± 4.73	35.98 ± 6.27	32.54 ± 4.18

[1]Mean of six values

a, b - Means of different superscripts within the same row differ significantly.

* - significance ($p<0.05$)

and balance feed, if any, during the collection period were also taken daily for analysis.

The faecal samples and feed samples were analyzed for proximate principles and various major and trace minerals (AOAC, 1990). Minerals such as Ca, Mg, Mn, Fe, Cu and Zn contents were analyzed using atomic absorption spectrophotometer (Perkin Elmer 3110) after wet digestion, using nitric acid and perchloric acid (2:1). P content of both feed and faecal samples were analyzed by colorimetry (vanado-molybdate method), using spectrophotometer (spectronic 1001 plus, Milton Roy, USA). The digestibility coefficients and mineral availability were calculated using data on digestibility trial and chemical composition of feed and feces. The data collected on various parameters were statistically analyzed as per the methods described by Snedecor and Cochran (1994).

Fig.1. Digestibility of nutrients of three experimental diets

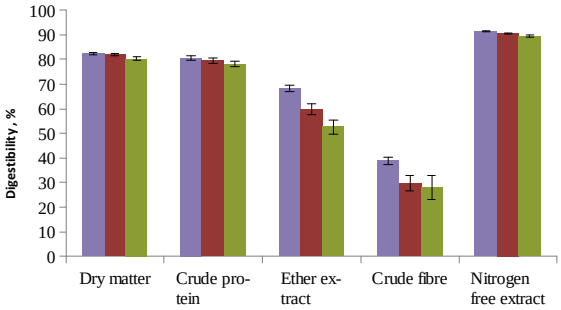
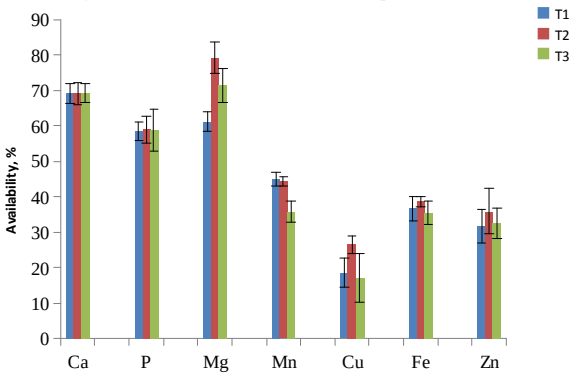


Fig.2. Availability of minerals of three experimental diets



RESULTS AND DISCUSSION

The data on digestibility coefficient of various nutrients of the three experimental diets of T_1, T_2 and T_3 are presented in Table 3 and graphically depicted in Fig. 1 and data on percentage availability of minerals are presented in Table 4 and depicted in Fig 2.

Dry Matter

The digestibility of DM of the three experimental diets with 0, 2.5 and 5 per cent spent brewers yeast (T_1, T_2 and T_3) were 82.54, 81.87 and 80.36 per cent, respectively. There was no significant difference in DM digestibility of the three experimental diets. Kornegay et al. (1995) suggested that inclusion of yeast culture did not affect the digestibility of DM, which is in accordance with the present study. Park et al. (2003), Sekar (2003) and Shen et al. (2009) recorded increased DM digestibility in pigs fed diets supplemented with yeast at varying levels. Contrary to the above findings Veum et al. (1995) and VanHeugten et al. (2003) could observe reduction in DM digestibility on yeast supplementation .

Crude Protein

Digestibility coefficient of CP in the experimental diets T_1, T_2 and T_3 were 80.81, 79.73 and 78.13 per cent, respectively. No significant difference was noticed among the three dietary treatments. Different authors reported that inclusion of yeast culture did not affect the digestibility of CP which is in accordance with the present study. Kornegay *et al.* (1995) obtained a digestibility of CP as 81.40 and 80.30 per cent for yeast supplemented and control diet respectively. Veum *et al.* (1995) and Sekar (2003) also reported that inclusion of yeast culture did not affect the digestibility of CP. VanHeugten *et al.* (2003) in their study on growth performance, nutrient digestibility and fecal microflora in weanling pigs fed live yeast obtained digestibility of protein for yeast supplemented diet and control diet as 70.10 and 71.60 per cent respectively for pre starter and 78.10 and 79.50 per cent, respectively for starter diets. Shen *et al.* (2009) also could not observe any effect on CP digestibility as a result of yeast supplementation in the diet of nursing

pigs. However, Park *et al.* (2003) observed increased digestibility of protein when yeast culture was added at 0.10 and 0.20 per cent levels to the growing and finishing pigs' diet.

Ether Extract

The average EE digestibility in experimental pigs maintained on diet containing 0, 2.5 and 5 per cent spent brewers yeast (T_1, T_2 and T_3) were 68.19, 59.70 and 52.55 per cent respectively. The EE digestibility coefficient was statistically similar for the three experimental diets. In accordance with the present study Kornegay *et al*. (1995) observed that the inclusion of yeast culture did not affect EE digestibility. VanHeugten *et al*. (2003) obtained digestibility of 62.60 and 70.30 per cent for pre starter diet and 77.30 and 81.10 per cent for starter diet in yeast supplemented group and control group respectively and concluded that yeast supplementation reduced the digestibility of EE. Sekar (2003) obtained EE digestibility of 53.00, 57.00 and 61.20 per cent for 0, 0.25 and 0.50 percent bakers yeast supplementation, indicating a higher digestibility for 0.50 per cent yeast supplemented group. He opined that increase in EE digestibility observed, could be due to the presence of enzymes lipase, lecithinase and phospholipase in live yeast.

Crude Fibre

The digestibility of CF in the three experimental diets T_1, T_2 and T_3 were 38.83, 29.76 and 28.07 per cent respectively. Digestibility of CF values did not differ significantly among the three dietary treatments. Kornegay *et al*. (1995) obtained a digestibility of 53.30 and 49.10 for neutral detergent fiber and 37.20 and 34.00 per cent for acid detergent fiber respectively for yeast supplemented group and control group and reported that the inclusion of yeast culture did not affect the digestibility of fibre fraction, which is in agreement with the present study. Harrison *et al.* (1998) reported that addition of yeast in diet has a positive effect on fiber digestion, by increasing cellulolytic bacteria. Park *et al.* (2003) observed that the addition of yeast culture at 0.10 and 0.20 per cent to the growing and finishing pigs' diet increased the digestibility of fibre. Significantly higher CF digestibility on yeast supplementation was also reported by Sekar (2003).

Nitrogen Free Extract

The digestibility coefficient of NFE for the three experimental diets T_1, T_2 and T_3 were 91.36, 90.63 and 89.59 per cent, respectively. The statistical analysis of data revealed no significant difference between the treatments. In accordance with the present study Veum *et al*. (1995), Kornegay *et al*. (1995) and Sekar (2003) reported that the inclusion of yeast culture did not affect the digestibility of NFE.

Minerals

The apparent availability of minerals of the three dietary rations T_1, T_2 and T_3 were 69.15, 69.20 and 69.41 per cent for Ca, 58.43, 59.03 and 58.84 per cent for P, 61.10, 79.23 and 71.44 per cent for Mg, 44.98, 44.22 and 35.83 per cent for Mn, 36.66, 38.67 and 35.62 per cent for Fe, 18.58, 26.50 and 17.10 per cent for Cu and 31.79, 35.98 and 32.54 per cent for Zn respectively. Statistical analysis of the data revealed no significant difference in the availability of Ca, P, Fe, Zn and Cu between the three dietary treatments. Experimental animals of both yeast fed groups registered higher ($p<0.05$) Mg availability than control (T_1), 5 per cent yeast supplementation group (T_3) being higher than 2.5 percent (T_2). Availability of Mn for T_3 is found to be lower ($p<0.05$) than that of T_1 and T_2, while, no statistical difference could be seen between T_1 and T_2. Various authors reported non significant difference in the availability of Ca and P, on dietary yeast supplementation in pigs, which is in agreement with the result of the present study. The apparent availability for P obtained by VanHeugten *et.al*, (2003) was 37.90 and 32.90 per cent for yeast supplemented group and control respectively. Shen *et al.* (2009) obtained

50.80 and 50.10 per cent respectively for Ca and P availability for yeast supplemented group.

Results of the digestion trial conducted indicate that there were no marked differences in the digestibility of nutrients & apparent availability of minerals in the three diets. Non-significant difference obtained in regard to the digestibility of DM, CP, EE, CF and NFE and the availability of Ca, P, Fe, Zn & Cu between the three diets clearly reveal that spent brewers yeast incorporated diets was as efficiently utilized as control diet by cross bred pigs.

CONCLUSION

On summarizing the overall results of the study, it can be observed that digestibility of nutrients and apparent availability of minerals of the experimental diets incorporating spent brewers yeast exhibited similar efficiency as that of control diet. . Thus it could be inferred that spent brewers yeast was effectively utilized as a protein supplement for pigs.

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