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Economics of feeding wet brewer's spent grains, dried moringa leaves and rice gluten meal to large white Yorkshire pigs at finisher stage

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Abstract
A biological experiment was conducted to explore the economics of Large White Yorkshire piglets fed with conventional concentrate diet incorporated with wet brewer's spent grains (T_1), *Moringa oleifera* leaves (T_2) and rice gluten meal (T_3) at 10, 10 and 5% level, respectively and conventional concentrate diet kept as control (T_4). The study was carried out using 24 weaned Large White Yorkshire pigs available at Instructional Livestock Farm Complex, Veterinary College and Research Institute, Namakkal for 60 days period. The data on feed cost, total body weight gain and feed consumed per kilogram gain during the finisher period are worked out and among the treatment groups the pigs fed with 10% wet brewer's spent grains (T1) had registered the lowest feed cost (2158.80) followed by 10% *Moringa oleifera* leaves (2228.14) and conventional concentrate control diet (2324.70). Cost of feed (Rupees) per kg gain per pig was lower (75.20) for the pigs fed with 10% wet brewer's spent grains followed by 5% rice gluten meal (76.93). The pigs fed with 10% wet brewer's spent grains (T1) and 5% rice gluten (T3) meal recorded a net gain of Rs. 64.00 and Rs. 34.20 respectively during the finisher period over the control group. Hence, it is concluded that among the treatment groups, 10% wet brewer's spent grains was considered more suitable, economical alternative protein source to the small holding farmers which can be included at finisher stage.

Keywords: Large White Yorkshire pigs, alternate protein sources, economics

Introduction
Pigs are competing with humans and other livestock for the conventional cereals. Moreover, conventional feed resources (cereals, legumes *etc.*) for pig production are scarce and highly expensive in many parts of the world. Thus, searching for an alternative unconventional feed source that may have valuable components of animal diets is indispensible. For instance, feeding by-products from agricultural and food processing industries to pigs can be one of the alternate viable solutions.

Brewer's spent grains (BSG) are available at low or no cost throughout the year and are produced in large quantities not only by large but also small breweries. Brewer's spent grain was found to be a satisfactory source of energy in pigs and poultry rations (Yeong, 2000; Truinin, 2001 and Madubuike *et al*., 2004). Spent grain has often been used for duck, guinea fowl and pig production by small-holder farmers (Ahaotu *et al.*, 2013 and Chukwu *et al.*, 2013).

The use of forage resources as pig feeds does have several drawbacks including low digestibility of forage owing to their high fibre content, presence of anti-nutritive compounds and lack of suitable conservation methods. However, compared to cereals, they have distinct advantages justifying their use by farmers: low cost, non-competitiveness with human food, high levels of protein, minerals and vitamins. As feed is the most critical expense in pig rearing activity, it can be profitable to substitute a significant part of a concentrate based diet with some forage ingredients (Kaensombath *et al.*, 2013).

Rice gluten meal is the dried residue from rice after the removal of starch and separation of the bran by the process employed in wet milling manufacture of rice starch or syrup or glucose. Rice gluten meal has an above average essential amino acid profile, added vitamins and high protein content. Thus it is an excellent option for animal feeds for reducing ration cost by replacing portions of expensive soya bean meal, groundnut oilcake and is also ideal for livestock having corn and wheat allergies. Rice gluten meal has a higher biological value than wheat gluten and corn gluten because of its low cost and better results.

Taking into account the overall shortage of protein rich feeds and their relative costs, there is

a need to explore economical and alternate protein sources which are locally available and easy to produce / purchase.

Materials and Methods

A biological experiment was conducted to evaluate the economics of Large White Yorkshire piglets fed with conventional concentrate diet incorporated with wet brewer's spent grains (WBSG), dried *Moringa oleifera* leaves (MOL) and rice gluten meal (RGM). The weaner piglets available in the Instructional Livestock Farm Complex, Veterinary College and Research Institute, Namakkal were utilized for the study. A total of 24 LWY piglets at the age of three and half months old were selected and grouped into 4, each treatment comprised of 6 animals. The house is well ventilated and provided with concrete floor, feeder and waterier facility. At the start of the trial, 3 piglets per pen totally 24 piglets were accommodated in the shed. Wet Brewer's spent grains and rice gluten meal were purchased from the market and incorporated in the conventional concentrate diet at 10% and 5% inclusion level, respectively. *Moringa oleifera* leaves were collected and shade dried and the dried leaves were incorporated in the feed at 10% inclusion level. Known quantities of diets (restricted feeding) were offered twice daily in the morning and evening and the left over feed was collected and weighed daily before each feeding. *Ad libitum* potable water supply was made available.

The nutrient composition (%DM basis) of conventional concentrate feed, wet brewer's spent grains, dried *Moringa oleifera* leaves and rice gluten meal are as follows:

Proximate analysis of feed and fodder samples

Experimental feed	Proximate principles (per cent)						
	Dry matter	Crude protein	Crude fibre	Ether extract	Total ash	Nitrogen free extract	Gross energy (Kcal/kg)
Wet brewer´s spent grains	33.43	32.06	14.27	7.23	3.71	42.73	4774.15
Dried *Moringa oleifera* leaves	92.67	25.24	6.22	8.70	9.06	50.78	4528.97
Rice gluten meal	88.71	45.32	2.18	4.94	5.80	41.76	4785.25
Concentrate feed	91.15	24.21	5.21	2.40	7.03	61.15	4253.43

Results

The data on feed cost, total body weight gain and feed consumed per kilogram gain during the finisher period are worked out and are furnished in the Table.

The total feed cost (Rupees) incurred per pig during the finisher period for 10% wet brewer's spent grains (T1), 10% *Moringa oleifera* leaves (T2), 5% rice gluten meal (T3) and conventional concentrate control diet (T4) groups were 2158.80, 2228.14, 2436.00 and 2324.70, respectively. Among the treatment groups the pigs fed with 10% wet brewer's spent grains (T1) had registered the lowest feed cost (2158.80) followed by 10% *Moringa oleifera* leaves (2228.14) and conventional concentrate control diet (2324.70). The pigs fed with 5% rice gluten meal (T3) recorded the highest total feed cost (2436.00) per pig during the finisher period. Cost of feed (Rupees) per kg gain per pig was lower (75.20) for the pigs fed with 10% wet brewer's spent grains followed by 5% rice gluten meal (76.93) and conventional concentrate control diet (78.03). The pigs fed with 10% *Moringa oleifera* leaves recorded the highest feed cost (91.57) per kg gain in body weight.

The pigs fed with 10% wet brewer's spent grains (T1) and 5% rice gluten (T3) meal recorded a net gain of Rs. 64.00 and Rs. 34.20 respectively during the finisher period over the control group. But, the pigs fed with 10% *Moringa oleifera* leaves registered a loss of Rs. 531.61 per pig over the control.

Cost of production of pigs fed with alternate protein sources during finisher period

Sl. No	Particulars	T1	T2	T3	T4
1	Number of pigs per group	6	6	6	6
2	Total initial body weight (kg) of the group	287.25	287.00	302.00	296.50
3	Total final body weight (kg) of the group	459.50	433.00	492.00	475.25
4	Total body weight gain (kg) by the group	172.25	146.00	190.00	178.75
5	Total feed consumed (kg) by the group	630.00	529.25	630.00	630.00
6	Feed cost per kg (Rs.)	20.56	25.26	23.20	22.14
7	Total feed cost (Rs.) per group	12952.80	13368.86	14616.00	13948.20
8	Total feed cost (Rs.) per pig	2158.80	2228.14	2436.00	2324.70
9	Feed cost per kg gain (Rs.)	75.20	91.57	76.93	78.03
10	Feed conversion ratio	3.51	3.81	3.16	3.36
11	Cost of production on feed basis (Rs.) (FCR x Cost of feed per kg)	72.17	96.24	73.31	74.39
12	Net gain per kg production over control (Rs.)	+2.23	-21.85	+1.08	-
13	Net gain per pig over control (Rs.)	+64	-531.61	+34.20	-

Discussion

The feed cost per kg (Rupees) for the pigs fed with 10% wet brewer's spent grains (Table) was lower (20.56 versus 22.14) during the finisher period as compared to control. The feed cost per kg gain (75.20 versus 78.03) as well as the total feed cost per pig (2158.80 versus 2324.70) were markedly reduced in pigs fed with 10% wet brewer's spent grains compared to conventional concentrate control diet. The pigs fed with 10% wet brewer's spent grains recorded a net gain of Rs. 64.00 per pig over control diet during the finisher period.

In close accordance with the above findings Enwerem *et al*. (2013) observed that the feed cost per kg gain was reduced in

pigs fed brewer's spent grains at 30% level as a replacement for fish meal whereas, Murashi *et al*. (2015) reported that the pigs fed with dried brewer's grains at 35% inclusion level had highest economic return as compared to 0, 25 and 45% dried brewer's grains. Luu *et al.* (2000, 2003) also observed reduced feed cost with increasing levels of wet brewer's spent grains in pigs and best economic return at 30% replacement level compared to control.

The pigs fed with 10% *Moringa oleifera* leaves recorded higher feed cost per kg gain (Rs. 91.57 versus 78.03) and poor net gain (Rs. -531.61) per pig over control diet (T4) group during the finisher period. But, Oduro-Owusu *et al*. (2015) reported that the pigs fed diets containing 5% inclusion of *Moringa oleifera* leaf meal had the best feed cost to gain ratio compared to 0, 1, 2.5 and 3.5% inclusion levels.

The pigs fed with 5% rice gluten meal showed lower feed cost per kg gain (Rs. 76.93 versus 78.03) and also had positive net gain (Rs. 34.20) per pig over control diet (T4) pigs. Similarly, Rohit kumar *et al*. (2016) who replaced groundnut oilcake with rice gluten meal at 0, 50 and 75% inclusion level in calves and observed lower feed cost (USS 2.06 versus 2.19 and 2.06 versus 1.97) per kg live weight gain compared to control during the finisher period.

Conclusion

It is concluded that among the treatment groups, 10% wet brewer's spent grains was considered more suitable, economical alternative protein source which can be included in finisher pig ration to lower the cost of production.

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