

Fermented rice rinse field trial in backyard pig raising

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ABSTRACT

Barangay Caticugan, Sta. Rita Samar is an area chosen by the Philippine Higher Research Network Visayas State University luminaries as the beneficiaries of this research, aiming to improve marginal upland pig farmers and concurrently helping climatic change in marginal upland areas. Six mixed breed island born piglets (MBIBP) were randomly blocked into 2 treatments, with 3 replications each. Treatment 0 (T_0) is feeding with commercial feeds without supplementation (Control treatment). Treatment 1 (T_1) is feeding with control treatment with 20mL/head/day fermented rice rinse (FRR) supplementation. The research trials were applied to growing-finishing mixed breed island born piglets from weaning age (approximately 30 days old) to growing-finishing age (at 150 days old). The amount of feed was equal in all treatments at nearly *ad libitum* feeding. Moreover, weekly monitoring of weights was done and monthly data were subjected to *T* test from 30 to 150 days period. Results revealed that treatment with supplementation of FRR has produced significant average body weights (ABW) at 0.002 *p-value*. Average daily gain (ADG) is greater in T_1 than T_0 and the former has lower feed conversion ratio (FCR) at 1.97kg than the latter at 3.08kg. Therefore, FRR supplementation to MBIBP produced better growth performance among treated pigs than those without FRR supplementation.

Keywords: cumulative weight gain, fermented rice rinse, mortality, island born piglets

INTRODUCTION

Mixing fermented rice rinse with feed is a conventional way to conserve water and at the same time, serves as feed additive to lessen feed costs. This research commenced last January 2013 at Visayas State University (VSU), Baybay City, Leyte, with the Department of Animal Science as the proponent. A series of feeding trials using FRR was conducted in different selected barangays in Inopacan, Leyte.

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Supplementation with FRR to gestating and lactating sows resulted to a highly significant improvement in litter size. The significant research findings propelled the researchers to further conduct the study on the hog fattening by the marginal upland farmers at Barangay Caticugan, Sta. Rita, Western Samar. The most common farm animals raised in the area of the study include native chickens, goats, cattle, carabaos and majority were pigs. Pig production in the marginal upland farmers is a big help in terms of income, following the appropriate technology of the natural farming system of management. However, the traditional ways of feeding management resulted to a lower farm productivity hence, this research study was conducted to determine the performance of fattening hogs supplemented with FRR using weanling to growing-finishing pigs.

Researchers' efforts of several established fermentation studies were searched from historical evidence for cultural production and consumption of fermented beverages dating back to over 9,000 years ago in ancient China (Prajapati & Nair 2003). McGovern et al (2004) have chemically confirmed that the earliest known fermented beverage produced was wine-like, made from a mixture of rice, honey and fruit. From a biochemical point of view, fermentation is a metabolic process of deriving energy from organic compounds without the involvement of an exogenous oxidizing agent. One major role attributed to fermentation is the preservation of food through formation of inhibitory metabolites such as organic acid (lactic acid, acetic acid, formic acid & propionic acid) (Gaggia et al 2011). Rice is one of the substrates for yeast fermenters in the Philippines which occurs in many food sources and are important glucose fermenters such as *Debaromyces*, *Pichia*, *Saccharomyces*, *Williopsis*, etc. (Nout et al 2005). A characteristic of fermented liquid feed is a high concentration of lactic acid bacteria, yeasts, lactic acid, low pH and low enterobacteria counts. The benefits of liquid feed have been shown by many researchers (Cumby 1986, Canibe & Jensen 2003). Yeasts are sometimes considered undesirable in liquid diets because they may confer off-flavors and taints that would affect the palatability of the feed. Yeasts may, on the other hand, inhibit mold growth and may induce positive effects in the gastrointestinal tract (Nout et al 2005). One concern is that yeast metabolism can convert starch into alcohol and carbon dioxide, which may result in high ethanol contents and losses of energy due to carbon dioxide production. However, in spite of high yeast colony forming units (CFU) numbers during fermentation, the authors of this study have previously found only low levels of ethanol and small losses of weight in the feed. With the exception of pathogens, the microbial community in fermented feed has been characterized only by the quantification of certain groups of fermenting microorganisms (eg, LAB and yeasts). Feed fermentation is a spontaneous process caused by the microbial population present in the feed components, although the effects of fermented feed on the animals' health and nutrition are generally positive (Olstorp et al 2008). FRR has limited resources on laboratory analysis but previous livestock application on gestating and lactating sows showed significant results (Abela et al 2014). Moreover, the results for weight gain, feed intake and conversion and carcass value prove that sugar cane juice and molasses can substitute totally for cereals in the diets of local Baxuyen pigs, from weaning up to slaughter (Van & Men 1992).

Pork production using island born pig for fattening can be increased by supplementing FRR with the very high price of commercial swine feeds today. In

addition, crossbred island born pigs are the most popular resources of local breeds, hence it is pompous to conserve and preserve this local breed of pigs. In order to uplift local farmers to compete in borderless ASEAN competition, locally crossbred island born pigs must be continuously produced by the marginal upland farmers. Since countryside challenges on yearly increasing and continuous importation of pork must be taken into consideration, joint research collaboration of Phernet and VSU was forged to increase the marginal upland farmers' income through fermented rice rinse supplementation on fattening pigs, hence this study.

MATERIALS AND METHODS

Production of Fermented Rice Rinse

Rice rinse was collected, measured per liter then allowed to settle in the container for 24h. Thereafter, the bubbles were scraped and 250g of brown sugar was added for every one (1) liter of rice rinse collected. The container with rice rinse was covered with nylon net and was placed under the tree by hanging that is more or less 7 feet high from the ground. Temporary plastic cover was placed at 1ft distance apart from the rice rinse container for protection of the possible droplets. The rice rinse was then allowed to stay for 21 days to undergo the fermentation process. After 21 days, Fermented Rice Rinse (FRR) was collected and was mixed in feed ration used for livestock supplementation. The production of FRR was done one month earlier before the supplementation of weaning pigs.

Field Initiation

Courtesy meeting was conducted by the core group of VSU researchers to the officials of the Local Government Unit (LGU) of Sta. Rita, Western Samar, together with the officials of Barangay Caticugan, Sta. Rita, Western Samar. The farmer chairmen and their farmer representatives were also invited and the goals and objectives of the research study were fully introduced to the marginal upland farmers. Likewise, the purpose and duration of the research project were also presented.

Animals, Diets and Experimental Design

A total of 54 mixed breed island born piglets, approximately 1 month old and reared in the backyards of the farmer co-operators, were used and fed with commercial available feeds which were given at nearly *ad libitum* and wet feeding (with 1:3 ratio of feed and water). The average initial body weight of the piglets was approximately 4.9kg. Six out of 54 piglets were used in this research. Six piglets were randomly blocked (with consideration on geographic location of farmer backyard pig location distance): three piglets were designated as T₀ feeding (with locally available commercial feeds without FRR); and another three piglets designated as T₁ feeding (with locally available commercial feeds with FRR supplementation of 20mL/head/day). The research study was carried out from weaning to growing finishing stage (30-day old to 150-day old). The average data were plotted monthly at 60th, 90th, 120th and 150th day. The supplementation of FRR in feeding was done twice daily, every morning and afternoon.

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Data Gathered and Formula Used

Body Length (BL) and Heart Girth (HG) measurement were gathered from each pig once in every week, using weighing scale or tape measure. In computing the actual body weight in kilogram, (BL) and (HG) using Zavoral method were used. Body weight in kilogram equals the $(HG)^2 \times (BL) / 400/2.2\text{lbs}$. Other parameters in Cumulative Weight Gain (CWG), Daily Feed Intake (DFI), Average Daily Gain (ADG) and Feed Conversion Ratio (FCR) were analyzed. Percent mortality and morbidity were observed. FCR feed kilogram per body weight was computed by DFI over ADG. Return on investment (ROI) was also computed to determine the expected profit of the farmer cooperators.

Data Analysis

The data on actual body weight of pigs, with or without supplementation, were compared using *T* test at 5% level of significance. Economic value defining the farmers' income every monthly period is presented in Table 5.

RESULTS AND DISCUSSION

Performance Parameters

The simple method in fermenting rice rinse was successfully carried out. Nout et al (2005) inferred that manifestation of fermenting rice, honey and fruit fed to pigs resulted to a good performance. Rice rinse is starchy in form and is seemingly similar to the broken rice used in the study of Dung et al (2005), where broken rice is a starchy feed source fermented. When checked at pH4 or less it was used as inocula and increased growth performances when fed to pigs. Anaerobic fermentation using the lactic acid bacteria improves storability, palatability and nutrient values of feedstuffs (Gao et al 2008). No increase in feed intake was observed in both treatment groups of pigs, although a dietary fermented diet decreased growth performance and feed efficiency but improved the carcass grade in pigs which might have varied on commercial feeds formulation and breed type of pigs (Chu et al 2011). Actual body weights were used in the statistical analyses due to homogeneity of initial body weights of treatment groups. Neither morbidity nor mortality arised in the whole research period. The average body weight changes were the same in both treatments on the first month, while on the 60th day from commencement of the trial, the pigs were gaining and developing antibodies aside from the fact that initial body weights were too small (with the average body weight of 4.9kg). Positive body weight changes were observed at 120th and 150th day period with same *p-value* at 0.002 (Table 1). Viability of results fall within the limit at 10 % cv, from 90th day onwards till 150th day. FRR has its sugar content which gives the sour and sweet taste, of which the results of this study may be attributed as seemingly similar to the results of Dung et al (2010). The increasing live weight gain in pigs supplemented with sugar cane syrup can be explained by the associative effects of high total dry matter intake and improved digestibility of the sugar cane syrup diets. Dung et al (2010), also found that the pigs grew faster with sugar cane supplements. ADG of both treatments were the same at the first month and on the 60th, then started to vary on the 90th day of treatment. There were higher ADG on

treatments without FRR Supplementation. The heavier ADG results were found on the 120th and 150th day on pigs treated with FRR, which can be strongly pointed out that farmer co-operators have different overall management practices, as well as protein solubility is very dependent upon pH thus, at pH4, fermented feed protein is easily broken down and becomes more soluble, as confirmed by Longland (1991). The subsequent period was shifting improvement in growth, where treatment without FRR has lower ADG than treatment with FRR (Table 2). Interestingly, the highest ADG of all periods is the latter mentioned treatment. This can be inferred from the study of Dung et al (2005), where fermented broken rice feed increases ADG than non-fermented usual feed mixed with water. Right after the 150th day, ADG were declining in both treatments due to the fact that pigs become slow growers during finishing stage. The average CWG greatly varies in both treatments starting on the 60th day until 150th day in pigs treated with FRR (Table 3).

FCR, in treatment with FRR supplementation, were lower than treatments without supplementation, so the former treatment was better feed conversion (Table 4). This result was similar to Dung et al (2005), where pigs offered with fermented liquid feeds improved growth performance and feed conversion ratios.

In addition, Boesen et al (2004) claimed that fermented diets improve gastrointestinal health and prevent clinical diseases by decreasing gastric pH and a number of enteric pathogens and increasing gastric lactic acid concentration in pigs. Likewise, at level 2 to 4%, sugarcane in the pig diet improved the live weight gain (Yamasaki et al 2005).

Table 1. Average body weight changes of mixed breed island born pigs fed with or without FRR supplementation using 20mL/head/day (day 30th - 150th)

TRT	(Initial weight) 30 th day	(Average body weight (kg.))			
		60 th day	90 th day	120 th day	150 th day
Without FRR	5.00	15.33	28.67 ^a	41.67 ^a	53.33 ^a
With FRR	4.83	15.33	24.67 ^b	59.33 ^b	77.67 ^b
<i>T</i>	<i>0.28</i>	<i>0.00</i>	<i>3.62</i>	<i>7.50</i>	<i>7.46</i>
<i>p-value</i>	<i>0.795</i>	<i>1.000</i>	<i>0.022</i>	<i>0.002</i>	<i>0.002</i>
<i>CV</i>	<i>14.97%</i>	<i>11.91%</i>	<i>5.08%</i>	<i>5.72%</i>	<i>6.10%</i>

NOTE: Treatment means with at least one common letter are not significantly different using Tukey's HSD test at 5% level
NOTE: Actual body weights were analyzed because of homogeneity of initial weights

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Table 2. ADG of mixed breed island born pigs fed with or without FRR supplementation using 20mL/head/day (day 60th - 150th)

Treatment	ADG (Kg)			
	60 th day	90 th day	120 th day	150 th day
Without FRR	0.34	0.44	0.43	0.39
With FRR	0.35	0.31	1.16m	0.61

Table 3. Monthly average cumulative weight gain changes of mixed breed island born pigs fed with or without FRR supplementation using 20mL/head/day (day 30th - 150th)

Treatment	Ave. CWG (Kg)			
	60 th day	90 th day	120 th day	150 th day
Without FRR	10.33	23.67	36.67	48.33
With FRR	10.50	19.83	54.50	72.83

Table 4. FCR (per kilogram body weight) of mixed breed island born pigs fed with or without FRR supplementation using 20mL/head/day (day 30th - 150th)

Treatment	FCR (kg/kg)			
	60 th day	90 th day	120 th day	150 th day
Without FRR	1.1	1.36	2.09	3.08
With FRR	1.07	1.94	0.78	1.97

Economic revenue was computed based on final body weights acquired every monthly period due to the fact that farmers tend to sell the pigs at anytime depending on financial need as per conversation with other farmers with this, farmers have a cogent visualization on how the selling process goes, especially on middlemen in the area who constitute the most number of buyers of pigs and gain more profit than the farmers. The overall average expected revenue in treatment with FRR supplementation was higher enough (PHP4,536) than without FRR supplementation (PHP2,210). There is little difference in the total feed cost, since rice rinse mixture cost is at nugatory amount (Table 5).

Table 5. Average economic value of mixed breed island born pigs fed with or without FRR supplementation of 20mL/head/day (day 60th-150th)

Items	60 th day	90th day	120 th day	150 th day
Without FRR supplementation				
Total feed cost, Php	288	630	945	1260
Total feed intake, kg.	9	18	27	36
Live body weight	15.33	28.67	41.67	53.33
Expected revenue, Php	1,245	1,949	2,304	2,210
With FRR supplementation				
Total feed cost, Php	315	672	945	1,287
Total feed intake, kg	9	18	27	36
Live body weight, kg	15.33	24.67	59.33	77.67
Expected revenue, Php	1,218	1,495	3,989	4,536

CONCLUSION

The results showed that the most improved growth performances of the pigs were due to the supplementation of 20mL/head/day of fermented rice rinse. Likewise, supplementing 20mL/head/day FRR (from weaning stage to growing stage) were safe and sound to be mixed in feeding pigs. The differences in pigs' growth performances during the first two months of supplementation was a strong evidence that the farmer cooperators have different overall management practices of raising their pigs. Furthermore, this research helped conserve water in the locality where rice rinse will be utilized, yet there is a need to continue to evaluate nutritional strategies that maximize animal performance, while minimizing environmental concerns. On the other hand, research study on the microbial analysis of fermented rice rinse is recommended to have a clear idea on the bacterial species that are initiating and dominating the whole fermentation process.

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