Growth Indices and Cost Implications of Three Breeds of Weaner Pigs Fed Rice Husks as Replacement for Maize

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Abstract
The study investigated growth indices and cost implications of three breeds of weaner pigs fed rice husks as replacement for maize. The study adopted completely randomized block design. The study was conducted at the Piggery Unit of the Department of Agricultural Education Teaching and Research Farm, University of Nigeria, Nsukka. Seventy-two weaner pigs of three breeds of Large white, Duroc, and Landrace were used for the study. The treatments for the study were: T1 (the control diet 0%), T2 (a diet containing 10% fermented rice husks), T3 (a diet containing 15% fermented rice husks) and T4 (a diet containing 20% fermented rice husks). Data were collected for feed intake, weight gain, linear body measurements, mortality rate and cost of feeding each group. The data collected were analyzed by using analysis of variance significant of means were compared using Least Significant Difference (LSD) at (P<0.05). The findings of the study revealed that weaner pigs fed with (T1) control treatment performed better in terms of feed intake, weight gain, body length gain, chest girth gain, and height gain across the three breeds followed by T2, T3 and T4. The mortality rate increases as the rate of inclusion of rice husk increases from 10 to 20% while the cost per kg weight gain was lower when fed with T4 treatment followed by T3, T2 and T1. In conclusion, rice husks are not a better alternative for replacement of maize in weaner pigs' diet. It was recommended among others that weaners pig irrespective of the breeds should not be reared with the inclusion of rice husk at 10, 15, and 20% as a replacement for maize in a diet at it decreases the growth parameters and increases the rate of mortality among weaner pigs.
Keywords: *Weaner pigs, Growth indices, Rice husk, Cost, Mortality.*

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Introduction

The inherent scarcity and cost of conventional feeds, cattle rustling in addition to herder-crop farmer clashes and insurgency has hindered the growth of the livestock industry in Nigeria. Moreover, Nigeria is faced with the problem of dietary animal protein shortage for an increasing human population where the daily protein intake per capita is 46 g/kg, which is lower than the minimum recommended intake of 66 g/kg (Chinwe & Chinekwu, 2020). The animal protein shortage threatens protein malnutrition due to insufficiency; thus, the need to increase the production of such domestic animals as poultry and pigs which are conventional sources of animal protein.

Pig production in particular represents one of the fastest ways of increasing animal protein, since pigs grow at a faster rate and are highly more prolific than cattle, sheep and goats (Ikeh, 2009). There are different breeds of pig such as Mulefoot, Duroc, Tamworth, Landrace, Berkshire, Yorkshire, Hereford, Hampshire, Black Local, Brown Local, White Local, and Boars pigs. The most common pig breeds for commercial pig farming in Nigeria are the Yorkshire, Landrace, Hampshire, Duroc breeds and their crosses. These breeds produce lean meat combined with efficient feed conversion. Compared to local pig breeds, these commercial breeds have good resistance to diseases and suffer less from

hot weather and low-quality feed (Verlag et. al., 2005).

Apart from the poultry industry, pig farming has the highest quick returns on investment if fed with cheap and available local feed. Researchers like Sabben et al. (2008), and Fontenot in Ikeh (2009) explained that the high cost of the conventional feedstuff most especially the protein supplement, necessitated the quest for locally available alternatives that can substitute for the conventional feedstuffs by reducing feeding cost, thereby making the pig enterprise a more profitable one. The alternative cheap and available feedstuff considered in this study was rice husk.

Rice husks are residual product of the rice mills which do not attract competition between man and animals. Rice husks are readily available when compared to other alternative sources of feed ingredient. Rice husks have estimated feeding value that can be compared with maize when included in moderate to high quantity in maize-based diets. Rice husk as an alternative feed ingredient has a nutrient content of 12.5% water, 3.1% crude protein, 29.2% nitrogen extract (BETN) material, 35% crude fiber, 2.7% fat and 17.5% ash with low digestibility (Partama, et. al., 2019). The authors noted that rice husk contains anti-nutritional factors such as anthraquinones, phenolics, tannins, saponins, and phytic acid which affects the efficiency of ration use and must be fermented to improve the nutritional value. One of the best inoculants used to digest a ration material high in crude fiber is a solution of Effective Microorganisms-4 (EM-4) (Partama, et. al., 2019). The authors stated that the EM-4 solution contains almost 98% cellulolytic enzymes that hydrolyze cellulose into the simple carbohydrate compound glucose. Yadnya and Trisnadewi in Partama, et. al., (2019) reported that rice husks fermentation with EM-4 solution and urea ammonization improve the nutrient value of rice husks with the following data: a decrease in crude fiber content from 81.91 to 48.40% and an increase in crude protein content from 0.90 to 8.10% and crude fat from 0.32 to 2.30%. Therefore, fermented rice husks with EM-4 solution and urea ammonization to improve the nutrient value and reduce the anti-nutritional factors presence in it was considered. The choice of rice husks for this study is based on relative abundance in all seasons and should be exploited and evaluated for inclusion in livestock diets particularly for feeding three breeds (Landrace, Hereford and Yorkshire) of pig commonly reared in Nigeria by the farmers.

In Nigeria especially in south eastern part (Enugu State), fresh pork has ready market as it is relished by both old and young. However, there are factors militating against increased pig production and consumption such as high cost of feed production, inadequate information on best performing breeds of pig, pork fatty contents and insufficient skills and understanding on how to mix and use available agricultural waste for feed formulation by farmers. Feed cost constitutes over 90% of pig farm recurrent expenditure in Nigeria and this is due to competition between humans and pigs for available feed resources. As a result of this, most pig farmers in Enugu State resort to feeding their stocks with kitchen wastes and seasonal agricultural wastes within their reach. However, the effects of their inclusion on carcass quality and cholesterol concentration of the carcass have not been fully investigated and documented. Due to increasing incidence of cardio vascular related diseases, most elites in the state who consume pork tend to be cautious of the amount of fat in the pork and this is beginning to have effects on pork demand among them. This decrease in acceptability of pork may adversely affect its market and general pig production especially in Nigeria (Omojola et. al. 2009, Akinfala et al.,2017). Farmers in Nigeria have been using agricultural wastes as basal feedstuffs in the diets of growing-finishing pigs with little or no knowledge on the effects of their inclusion on the degree of fattiness on the

final product (pork) and also the effects of their inclusion on hematological traits of pigs. Also, farmers in Enugu state may be unaware of the breeds of pig they should rear for pork as there is no documented evidence of the best performing breeds of pigs fed with agricultural wastes like rice husks which is the most abundant at all seasons.

There have been several studies done be researchers like Ani and Ikeh, (2011); Ekpo, Sam and Okon, (2021) and Olajide et. al, (2019) on the production of pigs in Nigeria. However, available literatures showed paucity of researches on the growth indices and cost implication of three breeds of weaner pigs fed rice husk as a replacement for maize in the study area. It is against this background that the study determined the growth indices and cost implication of three breeds (Large-white, Duroc and Landrace) of weaner pigs fed by replacing maize with rice husks in the study area. Specifically, the study determined the effects of graded level (10, 15, and 20%) of rice husks on:

1. Growth indices of three breeds of weaner pig.
2. Cost implication of three breeds of weaner pig.

Methodology

The study was conducted at the Piggery Unit of the Department of Agricultural Education Teaching and Research Farm, University of Nigeria, Nsukka. Nsukka is situated on gentle slope with hills and valleys and located between latitude 70 211 S and 70 361 East and longitude 60 451 and 70 North (Ezike in Nzeh, Akogwu, Ugwu and Nzeh, 2014). Rice husks and other feed ingredients used for the study were procured from Adani rice mill in Uzo-uwani local government area, and Ogige market in Nsukka, respectively in Enugu state, Nigeria. The weaner pigs were purchased from JB Piggery LTd Nsukka. The fermentation of rice husks was preceded by the preparation of the EM-4 solution comprising one tablespoon of molasses, 1% urea and one spoon of EM-4 solution per liter of water, which was then subjected to a single day treatment. Then, the rice husk was ready for fermentation with the solution for two weeks; the amount of solution mixed with rice husk was determined at the point which when clenched with the hands, solution was not released. The fermented rice husks were put in a vacuum bag under vacuum for one week. Then, the dried, fermented rice husk was ready for use as a feed mixing material. The compositions of the diets for the research include Maize, Groundnut cake, rice husks, Palm Kernel meal, Fish waste (32%CP), Palm oil, Bone meal, Salt, Methionine, Lysine and Vitamin-mineral premix. The study adopted randomized complete block design with four treatments replicated three times. The assumption of the design was that a population of experimental units can be divided into a number of relatively homogenous blocks (Monsi, 2007). The design has three stages. The first stage consisted of grouping the population of experimental units into blocking variables which were breeds of pig (Large white, Duroc and Landrace). In the second stage, each block was divided into equal treatments and replicated thrice. The number of units in each block were equal to the number of treatments. In the third stage, units of each block were assigned the treatments groups (graded levels of rice husks) at random. These identified conditions were present in the study hence, suitable for the research. The treatments for the study were: (T1) the control diet (without rice husk), (T2) a diet containing 10% fermented rice husks, (T3) a diet containing 15% fermented rice husks and (T4) a diet containing 20% fermented rice husks.

Seventy-two weaner pigs consisting of twenty-four pigs per breed were used for this study. The weaner pigs were acclimatized for two weeks. During the acclimatization the weaner pigs were fed commercially formulated feed and dewormed using fenbendazole. Twenty-

four male breeds each of Large white, Duroc and Landrace weaner pigs, about 6 weeks old, weighing 5.92-6.85kg were randomly divided into four groups of six pigs each using a completely randomized design (CRD) per block. Each group was randomly assigned to one of the four diets (T1, T2, T3 and T4) containing 0% (control), 10, 15 and 20% rice husks for 56 days. Each treatment was replicated 3 times with 2 pigs per replicate placed on a concrete-floored pen with windows installed with wire nets to prevent flies from entering into the pens. The diets were formulated to be isocaloric and isonitrogenous supplying 2800kcal ME/kg and 18% crude protein. Water was given ad-libitum. Pigs were fed 4% of their body weight in the first 2 weeks and later increased to 5% of their body weight as ration per replicate. The pigs were injected with Ivomec (0.5ml per pig) subcutaneously against endo and ecto parasites.

Data were collected on feed intake, weight gain, linear body measurements, mortality rate and cost of feeding. Data on the linear body measurements were collected based on the body length, chest girth and height at the withers. The body length was measured weekly by obtaining the length of the weaner pigs from the base of the ear to the base of the tail. The chest girth was determined by obtaining the circumference of the chest region behind the forelegs while the height at the withers was measured by obtaining the distance from the ground to the shoulder when the animal was in a standing position. The mortality was determined by counting the number weaner pigs that dropped died on daily basis from each treatment group and breeds. The prices of a unit of the feedstuffs multiplied by the quantity of each diet consumed per pig was applied in determining the cost of feed per piglet per group. The data collected were analyzed by using analysis of variance following procedure of Gomez and Gomez in Ali et. al., (2020) and significant of means were compared using Least Significant Difference (LSD) ($P< 0.05$).

The **Table 1** showed data on the growth indices of three breeds of weaner pigs fed different graded levels (10, 15, and 20%) of rice husks as replacement for maize. The results showed that initial measurements of all traits were generally similar, hence no significant differences ($P<0.05$) were detected among them on Table 1. The data shows that there was a significant difference ($P>0.05$) in the feed intake, weight gain, body length gain, chest girth gain, height gain and mortality rate. The data reveals that as the quantity of rice husk increases in the diet the growth indices under investigation decreases. The data equally revealed that large white performed better than Duroc and landrace breeds in terms of growth indices under investigation. The data shows that weaner pigs fed with T4 treatment had highest percentage mortality rate whereas landrace breed had the highest mortality followed by Duroc breed.

Results

Table 2 indicated that there was significant difference ($P<0.05$) in the cost of replacing maize with different graded levels of rice husk in diet of weaner pigs. The total cost of feed consumed per pig was significantly different from each other. The data shows that weaners pig fed T1(4,500.65)) control treatment was costlier when compared to T2(2,631.42), T3 (2,466.52), and T4 (2,100.76) which contained rice husks which was a cheaper, available and an agricultural waste with no competition with human and animals when compared with maize in T1 control treatment. However, the reduction in the cost of the feed in the diet containing rice husks did not translate to economic benefit to the farmer because the loss in weight and other growth parameters in weaner pigs may reduce the profitability of the business.

Table 1:
Growth indices of three breeds of weaner pigs fed by replacing maize with rice husk at 15 weeks old

Growth Indices	BREEDS														
	Large white					Duroc					Landrace				
	T1 0%	T2 10%	T3 15%	T4 20%	SEM	T1 0%	T2 10%	T3 15%	T4 20%	SEM	T1 0%	T2 10%	T3 15%	T4 20%	SEM
Initial body weight (kg)	6.20	5.90	6.00	7.10	0.318	6.21	6.0	6.10	5.91	0.338	6.21	6.32	5.99	6.22	0.319
Final body weight (kg)	58.50	53.20	51.10	49.10	0.830	58.12	54.30	51.70	50.15	0.821	57.33	54.00	51.26	48.85	0.803
Weight gain (kg)	52.30*	47.30**	45.1***	42.00****	0.763	51.91*	48.30**	45.60***	44.60***	0.762	51.12*	47.68**	45.27***	42.63****	0.763
Total feed intake (kg/pig)	97.49*	77.33*	51.21*	47.32*	0.687	97.22*	75.31*	57.22*	43.32*	0.699	97.37*	70.11*	51.26*	40.55*	0.687
Average daily feed intake(kg/pig/day)	2.96*	1.96*	1.96*	1.96*	0.005	2.96*	1.97*	1.97*	1.96*	0.003	2.96*	1.97*	1.89*	1.88*	0.004
Initial body length (cm)	50.10	49.61	51.20	50.56	0.488	50.21	50.00	50.51	49.50	0.429	50.20	49.01	49.00	50.23	0.489
Final body length(cm)	95.20	82.55	80.23	79.67	0.898	93.55	81.11	80.33	79.15	0.877	91.55	79.33	78.56	77.11	0.867
Body length gain (cm)	45.1*	32.94**	29.20***	29.11***	0.811	43.34*	31.11**	29.82***	29.65***	0.801	41.35*	30.32**	29.56***	26.88****	0.805
Initial chest girth (cm)	35.44	37.21	36.55	41.56	0.391	35.51	36.10	35.26	37.51	0.385	36.10	36.00	37.22	36.41	0.387
Final chest girth (cm)	71.45	68.22	66.87	61.68	0.873	70.50	67.51	64.00	61.25	0.867	70.33	67.56	63.44	60.61	0.871
Chest girth gain (cm)	36.01*	31.01**	30.32***	20.12****	0.776	34.99*	31.41**	28.74***	23.74****	0.770	34.23*	31.56**	26.22***	24.20****	0.782
Initial height (cm)	33.10	33.00	33.20	33.41	0.515	33.51	33.31	32.10	32.80	0.534	32.55	33.00	32.10	31.55	0.538
Final height (cm)	51.56	47.81	46.12	44.31	0.367	50.11	47.44	45.32	43.55	0.369	50.25	47.15	45.31	42.50	0.361
Height gain (cm)	18.46*	14.81**	12.92***	10.90****	0.688	16.60*	14.13**	13.22***	10.75****	0.644	17.70*	14.15**	13.21***	10.95****	0.658
Mortality rate (%)	15.33	33.23	57.96	68.87		10.00	35.00	48.88	72.00		7.89	42.00	55.55	82.89	

Mean values in a row with different number of (*) are significantly different (P<0.05). SEM: Standard Error of mean

Table 2: *Cost implication of replacing maize with rice husk at 15 weeks old weaner pigs.*

Parameters	T1 (0%)	T2 (10%)	T3 (15%)	T4 (20%)	SEM
Cost per kg (#)	445.45	235.64	224.30	220.55	
Total cost of feed consumed per pig (#)	43,426.92[a]	22,934.84[b]	21,804.20[c]	21,463.93[c]	91.67
Cost of feed per kg weight gain (#)	4,500.65[a]	2,631.42[b]	2,466.52[c]	2,100.76[d]	51.43

[abcd] Mean values in a row with different superscript are significantly different (LSD, 5%). SEM: Standard Error of mean

Discussion of Findings

Table 1 showed that the growth indices of three breeds of weaner pigs fed different graded levels (T2(10%), T3(15%), and T4(20%)) of rice husks as replacement for maize. The findings of the study indicated that the growth indices were greatly affected by different graded levels of rice husk and breeds of weaner pigs. The result showed that large white weaner pigs fed maize based diet (T1) performs better in terms of feed intake, weight gain, body length gain, chest girth gain and height gain followed by (T2(10%), T3(15%), and T4(20%)) respectively. The result indicated that as the amount of rice husk increased in a diet the growth parameters such as feed intake, weight gain, body length gain, chest girth gain and height gain decreased. This is because of high fiber content of diet containing rice husks. The results of the study revealed that the three breeds of the

weaner pigs fed rice husk (T2(10%), T3(15%), and T4(20%) treatments had similar feed intake which implies similar acceptance. The findings are in agreement with Sikka (2007) that the increase in the feed consumption and deterioration in the FCR in paddy containing diets can be attributed to the low energy content of these diets due to higher crude fibre level in these diets as compared to control diet. Moreover, a negative relationship exists between the energy and dietary crude fibre content (Sikka 1990). Bhar et. al. (2001) reported reduction in feed consumption along with deterioration in FCR due to increase in crude fibre as a result of increase in rice bran of the diet. This is also in agreement with Omotoso and Arilekolasi (2019) that due to high fibre content, high silica/ash content and abrasive characteristics of rice husk, it is not easily digested by monogastric like pigs. The study revealed that inclusion of rice husk in diet of weaner pigs irrespective of the breeds do not improve the growth parameter due to their tender age but could be used on finishing pigs to reduce weight and back fat thickness. This agrees with Izquierdo et. al. (2018) that supplementation with rice husk (a fibrous, abundant and inexpensive byproduct) before finishing may increase satiety, decrease stress and competition, increase animal welfare and might reduce weight gain variability and improve carcass uniformity. Rice Husk is a high fibre feed ingredient which affects feed intake and energy utilization (Bassey et. al. 2022).

The result of the study further revealed that the percentage mortality rate increases as the percentage rice husk increases in the diet among the three breeds of weaner pigs under investigation. This agrees with Izquierdo et. al. (2018) that the inclusion of rice husk in weaner pigs diet inhibit weight gain and probably increase the mortality rate due to high fibre content.

Table 2 indicated that there was significant difference ($P<0.05$) in the cost of replacing maize with different graded levels of rice husk in diet of weaner pigs. Weaner pigs fed with T2(10%), T3(15%), and T4(20%) cost less when compared with control treatment (T1) due to the availability and affordability of rice husks which is an agricultural waste. Weaner pigs fed with 20% rice husk had lower cost per weight gain when compared with other treatments. The findings agree with Ikehi et. al. (2022) that weaner pigs fed AYB at 20% had significantly lower cost per weight gain.

Conclusion and Recommendations

Rice husk replaced with maize at 10, 15, and 20% in a diet had significant effect on the feed intake, weight gain, body length gain, chest girth gain, height gain and mortality rate of three breeds (large white, Duroc and Landrace) weaner pigs with serious cost implications. The feed intake, weight gain, body length gain, chest girth gain and height gain decreases as the rice husk increases in a diet whereas mortality rate among the three breeds increases as the rice husk increases from 10 to 20% in a diet. Large white breed performed better in terms of weight gain, body length gain, chest girth gain, height gain and had the lowest rate of mortality followed by Duroc and Landrace breeds when fed with control treatment.

Based on the findings of the study it was recommended among others that weaners pig irrespective of the breeds should not be reared with the inclusion of rice husk at 10, 15, and 20% as a replacement for maize in a diet as it decreases the growth parameters and increases the rate of mortality among weaner pigs in the study area. Rice husk should only be included in diet of fishing pigs with the intention to reduce weight gain and back fat thickness.

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