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THE UTILISATION OF RICE BY GROWING PIGS IN MALAYSIA

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Ringkasan

Tiga puluh enam ekor babi baka Landrace dan kacukan Landrace x Cina tempatan telah digunakan di dalam percubaan untuk mengetahui nilai mutu permakanan beras yang dicampuri di dalam makanan babi yang sedang membesar. Satu makanan ration mengandungi 50% jagung dan tiga lagi ration yang sama protin mengandungi 30%, 40% dan 50% beras telah diberi kepada babi yang mula beratnya 13.7 kg. sampai meningkat 71.5 kg. berat badan ditimbang hidup. Didapati tidak ada beza di dalam kenaikan berat badan, penggunaan makanan dan mutu daging selepas disembelih bagi semua kumpulan yang memakan ration-ration percubaan yang berlainan. Ini menunjukan bahawa beras boleh diguna menggantikan jagung di dalam makanan babi yang sedang membesar. Ini adalah tertakluk kepada kedudukan harga dan ekonomi.

INTRODUCTION

Rice is the principle food crop for humans in Asia. The heavy demand for rice for human consumption has made it uneconomical to feed it to livestock. Broken rice has, however, been used (Moromoto *et al.*, 1963) and more particularly, rice by-products such as straw and bran have been extensively utilised in several parts of the world (White, 1965; Balderma *et al.*, 1968) for feeding animals.

With the growth towards self-sufficiency in rice in many countries in South East Asia, the possibility exists that surplus may well arise. In Malaysia, there is also the need to find substitutes for maize in livestock feeds on account of the high cost of its importation. The utilization of whole grain rice as an animal feed presents an area of investigation which could affect livestock feeding and also rice and feed grain production.

In order to investigate the value of rice in livestock feeding a research programme was initiated. Live weight gains, efficiency of feed conversion, and carcass characteristics of pigs fed rice-based rations were compared to pigs fed a maize-based control ration. These parameters were selected as important for determining the cost of production and the market value of carcasses produced. As far as the authors are aware, this is the first study of its kind in pigs; this paper reports the initial findings.

Methods and Materials

Thirty two Landrace and four Landrace x Local Chinese pigs from six litters were allocated to twelve pens of three pigs each on the basis of live weight, sex and genetic relationships. The pigs were weaned at three weeks of age and fed a commercial pre-starter diet *ad libitum* until they were eight weeks old. They were dewormed, ear notched for identification, given supplementary iron and the males castrated prior to starting the experiment at eight weeks of age. The animals were housed in 3 x 3.5 meter cement floored pens. Feed and water were available *ad libitum*.

The control ration was similar to a local proprietary mash and contained 50 percent maize. Rice replaced maize to make up 30 to 50 percent of the treatment diets. (Table 1). The diets were kept iso-nitrogenous and the formulations were based on the proximate analysis of the feedstuffs used in this trial. The ingredients for the diets were all ground in a hammer mill through a 2mm screen. The feedstuffs were mixed in a vertical mixer

*(Veterinary Livestock Station, Serdang)

Table 1: Composition of the Rations

Ingredients	Ration 1	2	3	4
Maize (%)	50	20	10	0
Soya bean meal (%)	8	6	6	6
Fish meal (%)	6	6	7	8
Copra cake (%)	8	18	18	16
Wheat Bran (%)	10	9	7	7
Rice Bran (%)	14	10	11	12
Whole grain Rice (%)	0	30	40	50
Alfalfa Meal (%)	2	0	0	0
Tapioca Chips (%)	2	0	0	0
Mineral mix*(%)	0	1	1	1
Total:	100	100	100	100
Calculated Crude Protein (%)	16.7	16.4	16.6	16.8
Calculated Crude Fiber (%)	9.0	7.9	8.0	8.0

Animals were weighed weekly and animals weighing more than 70 kg. were selected for slaughter the following week. At the end of 15 weeks of feeding the five remaining pigs were slaughtered regardless of their weight. The pigs were fasted 18 hours before slaughter, immediately before which the body weight was recorded.

After slaughter the pigs were bled, dehaired, eviscerated, split, and the carcass sides, with head, leaf fat and kidneys included, were weighed. The sides were chilled at 0 – 4°C for two days. After chilling the weight and length of the carcass from the anterior edge of the first rib to the anterior edge of the aitch bone was measured. The thickness of backfat was measured at the point of greatest thickness over the shoulders, directly opposite the mid point of the kidney and at the point of greatest thickness over the sacral area.

The chilled carcasses were cut as shown in figure 1. The head was removed at the alanto-occipital joint. The front and rear legs were removed. The fore quarter was removed between the 4th. and 5th. rib. The rear quarter was removed between the 4th. and 5th. lumbar vertebrae. The outlines of the *longissimus dorsi* was traced from the surface exposed by removing the rear quarter. The area of the tracing was determined using a planimeter. The weight of all the cuts was recorded.

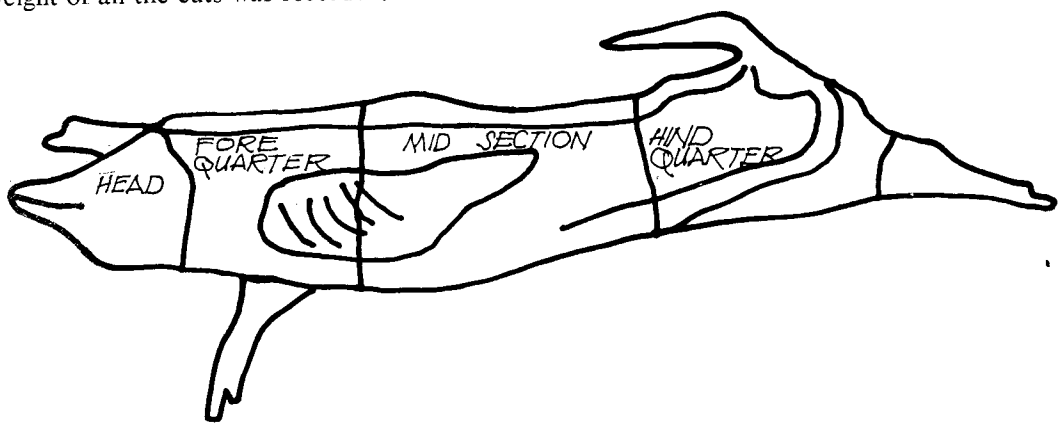

FIGURE NO.1. METHOD OF CUTTING CARCASSES

Data were analyzed statistically by analysis of variance using a computer program. Values which were expressed as percentages were converted by the method of arcsine transformation, before they were analyzed.

Results

Of the 36 pigs which entered the trial, one from Treatment (4) failed to gain weight and was sacrificed after the fifth week. One pig from Treatment (3) died as the result of a gastric ulcer and of enteritis. One animal from Treatment (2) reached a weight of only 50 kg. at the final slaughter date. The live weight gains and feed consumption by these three animals were included in calculating the feed conversion data but not in any of the other statistics.

The pigs receiving the control diet reached a weight of 72 kg. after 117 days of feeding. The pigs receiving the 30 percent rice, 40 percent rice and 50 percent rice diets reached 72 kg. at 113, 108 and 112 days respectively. Conversion of this data into daily live weight gains and subsequent statistical analysis indicated no differences in response to the different rations 2 illustrates this response. The mean feed conversion ratios for the control, 30 percent rice, 40 percent rice and 50 percent rice diets were respectively 3.80, 3.83, 3.57 and 3.73 kg. of feed consumed per kilogram of live weight gain (Table 2). Differences among these means were not significant.

Table 2: The performance of pigs slaughtered at approximately 72 kg. live weight

Treatments	(1) 50% Maize 0% rice	(2) 20% Maize 30% rice	(3) 10% Maize 40% rice	(4) 0% Maize 50% rice
Initial live weight (kg)	13.8	13.5	14.1	13.7
Final live weight (kg)	71.6	71.4	71.0	72.1
Live weight increase/day (kg)	.49	.51	.52	.52
Mean daily feed intake (kg)	1.88	1.95	1.85	1.91
Duration to slaughter (days)	117	113	108	112
Kg of Feed/Kg of gain	3.80	3.83	3.57	3.73

The quantitative measures of the whole carcasses are given in Table 3. There was no significant effect of diets on the dressing percentage, carcass length, back fat thickness, carcass shrink or loin eye areas. (Table 4). Nevertheless there appeared to be a slight tendency for the pigs on the higher rice diets to be fatter.

Table 3: Measurement of the whole Carcasses

Treatment	(1) 50% Maize 0% rice	(2) 20% Maize 30% rice	(3) 10% Maize 40% rice	(4) 0% Maize 50% rice
Live weight at slaughter (kg)	71.6	71.4	71.0	72.1
Hot dressed weight (kg)	57.4	58.0	58.1	57.7
Dressing percentage (%)	79.8	81.2	81.7	80.1
Cold carcass weight (kg)	54.9	55.6	55.9	55.7
Carcass shrink (%)	4.07	4.16	3.70	3.12
Loin Eye Area $(cm)^2$	34.2	34.6	33.7	35.1
Carcass Lenth (cm)	71.4	71.8	71.3	70.9
Back Fat thickness (cm)	3.29	3.49	3.54	3.51

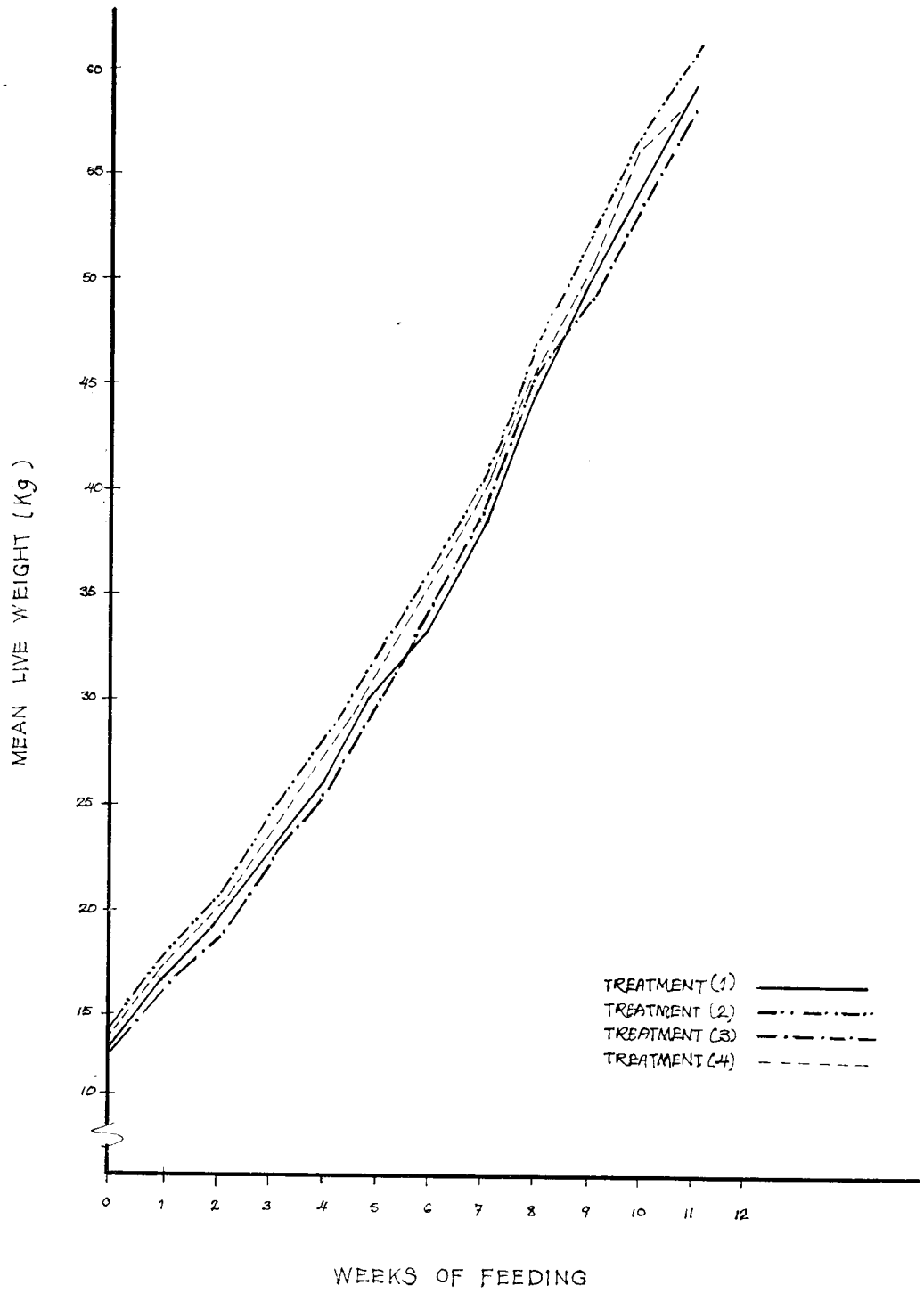

Fig 2 LIVE WEIGHT RESPONSE BY TREATMENT

Carcass shrink was slightly lower in the groups which were fed the higher levels of rice. This may be explained by these pigs having a slightly thicker fat cover (Table 2). Measurement of the loin eye area indicated that carcass muscling was not affected by the replacement of maize by rice.

The diets did not affect the proportion of the carcass cuts (Table 4).

Table 4: Weight of Carcass Parts

Treatment	(1) 50% Maize 0% rice	(2) 20% Maize 30% rice	(3) 10% Maize 40% rice	(4) 0% Maize 50% rice
Head weight (kg)	4.04	4.16	4.28	4.16
(%)*	7.34	7.58	7.59	7.73
Forequarter weight (kg)	6.65	6.60	6.66	6.85
(%)**	12.1	11.8	11.9	12.26
Middle weight (kg)	6.66	9.01	8.63	8.66
(%)**	15.8	16.1	15.5	15.6
Hindquarter weight (kg)	7.75	7.79	7.80	7.80
(%)**	13.8	13.8	14.1	14.1
Leaf fat weight (kg)*	.9	1.3	1.3	1.1
(%)*	1.7	2.3	2.4	1.9
Trotters & Hacks (kg)	3.28	3.20	3.18	3.38
(%)*	5.9	5.9	5.7	5.9

*as a % of chilled carcass weight

**as a % of chilled side weight

Discussion

Rice was considered as a potential substitute for maize in pig feeding to offset the heavy dependence on imports. At present 90 percent of the maize and sorghum used in Malaysia for animal feeds is imported (Rahman and Ani, 1971). The supply of feedstuffs is dependent on the surplus available from other countries. With the introduction of double cropping in many of the rice growing areas in Malaysia, the production of rice will increase. It is predicted that Malaysia will produce sufficient rice to meet the demand for domestic consumption by 1975 (Lai, 1971). It is also predicted that rice production would be profitable in double cropped areas at a price which is lower than the current government support price (Rahman and Ani, 1971). This trial was carried out as the first in a series designed to determine the relative feeding value of rice in comparison to maize in order that it will be possible to recommend when it is economical to replace maize by rice in pig rations. The relative performance of the pigs fed the rice diets indicated that rice is a suitable substitute for maize in the diet of the growing pig.

The crude protein content of rice used in this trial of 7.9 per cent is lower than the mean value of 8.4 per cent reported by Quah and Rao (1972). This value is also lower than the crude protein content of maize of 8.4 per cent which is comparable to those reported by Lim (1962) and the National Research Council (1967). The need to supplement the rice-based diets with the protein from other sources will tend to increase the cost of these diets. The choice of 17 percent crude protein in the diets was made in accordance with the Agricultural Research Council (1967) and the National Research Council (1968) recommendations for temperate conditions. Also this level has been shown to be adequate for growing pigs in a tropical environment (Devendra and Clyde Parris, 1970). The value of 17 percent was selected with the realization that it is lower than recommended for pigs at the weight of those starting

the trial and higher than recommendation for finishing pigs, but should best meet the average requirements. However, it should be noted that there are no current recommendations for protein levels based on Malaysian feedstuffs and conditions.

From a nutritional standpoint, the digestible energy values for rice and maize are 4321 and 4056 Kcal/Kg (National Research Council, 1968). This higher energy content of rice favours its more intensive use. It was noted in the present trial that there was a tendency for undigested rice to appear in the faeces of pigs fed the rice diets. The amount of rice present in the faeces appeared to decrease with age. This suggests that it may be necessary to render the rice more digestible, for example by wetting or cooking prior to feeding.

The efficiency of feed conversion (E.F.C.) and also duration to slaughter figures for the four treatments indicated that treatment (3) with 40 per cent rice inclusion was the best; regarding rate of gain and E.F.C. but it should be noted that this treatment also produced the fattest carcasses with the smallest loin eye areas. Although there were no statistically significant differences, this suggests that 40 per cent rice may be an optimum level of inclusion; this point needs further study. However, it is of interest to note that the E.F.C. of 3.57 kg. feed per kg. live weight gain compares favourably with those reported for approximately the same level of crude protein in the diet (Braude *et al.*, 1947; Glover, Goodwin and Morton, 1947; McMillan, Lueke and Thorp, 1949; Anderson and Hogan, 1950; Devendra, Clyde and Parris, 1970).

It may be concluded that the utilization of whole grain rice will be determined by economic considerations. The published analysis and the additional protein required to make the rice diets iso-nitrogenous indicate that the relative feeding value of rice in comparison to maize is influenced by the lower protein value to rice. To be of equal value rice would require 1 per cent additional protein supplementation. As whole grain rice is not currently used as a feedstuff for livestock it is difficult to predict its cost to the livestock feeder. It is expected there will be a cost saving by utilizing grades which are not preferred for human consumption, volume purchases from producers, and the possible integration of rice mills with livestock feed mills. It may be that when the cost of whole grain rice plus M$0.02/Kg., for protein supplemention, falls below the cost of maize it will be economical to substitute rice for maize.

The utilisation of rice by pigs represents a new dimension in animal feeding, especially in countries like Malaysia, where rice is an important crop and the pig industry is an advanced one. As an outlet for surpluses, it is clear than rice can be used and can also substitute for maize. However, the extent to which it will be widely utilised will depend on its relative cost and also availability.

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Summary

Thirty six Landrace or Landrace x Local Chinese pigs used to determine the feeding value of whole grain rice in pig grower rations. A control ration containing 50% maize and three isonitrogenous diets containing respectively 30%, 40% and 50% whole grain rice were fed to pigs from 13.7 to 71.5 kg live weight. There was no difference in rate of gain, efficiency of feed conversion or carcass characteristics between the groups fed the different rations, indicate a possibility that grain rice may be used to replace maize in pigs grower rations; the extent of substitution is dependent on economic considerations.

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