EVALUATION OF RAW SUGAR AS AN ENERGY SOURCE FOR GROWING/FATTENING PIGS

ELIZABETH SCHUMACHER*, R. ELLIOTT*, N.P. McMENIMAN* and I. GRIFFITHS**

SUMMARY

Ten Large White x Landrace pigs (25 kg initial weight) were fed either a conventional cereal-based diet or a diet based on raw sugar until they reached 80 kg slaughter weight. Live weight gains, dressing percentages and feed conversion efficiencies were superior in the pigs fed the sugar-based diet, while backfat thickness was significantly less in these pigs. Analysis of the fat samples revealed significantly less linoleic acid in pigs which had been fed sugar. Eye muscle area and carcase pH values were similar in both groups of pigs. Taste panel evaluation revealed no significant differences in aroma, flavour or overall acceptability of meat from pigs fed the sugar or cereal based diet.

(Key words: Sugar, pigs, growth, composition, acceptance)

INTRODUCTION

Total substitution of cereal grain with fresh sugar cane juice in diets for both growing and fattening pigs has been reported previously (Mena et al. 1981, 1982 ; Fermin et al. 1984). There are also reports on the use of final molasses and integral molasses (concentrated sugar cane juice) in pig diets (Marrero and Ly, 1976; Diaz and Marrero, 1978).

The inclusion of raw mill sugar instead of sugar cane juice or molasses could be more practical under some management conditions. There is however, little information on the use of raw mill sugar as the main energy source in diets for growing/fattening pigs.

This paper reports an experiment which compared the effects of total substitution of sorghum in pig diets with raw mill sugar on growth and carcase characteristics of growing/fattening pigs. Acceptability of pig meat was subsequently evaluated by taste panel.

MATERIALS AND METHODS

Twenty Large White x Landrace pigs of approximately 25 kg liveweight were divided into two experimental groups, each contained five males and five females. The pigs were individually housed. Fresh water was available at all times. One group was offered a commercial cereal-based grower/finisher ration containing 13.4 MJ Digestible Energy/kg, 0.85% available lysine, 0.52% methionine plus cystine and 0.51% threonine.

The other group of pigs received an experimental sugar-based diet containing raw mill sugar (70%), soybean meal (15%), meat and bone meal (9.6%), blood-meal (7%) and a vitamin/mineral premix (0.4%). This diet was formulated using previously published values of amino acid composition and energy values for standard protein supplements (McIntosh and Williams, 1984) and assuming the digestible energy value of the raw sugar (as fed basis) to be equal to its gross energy value determined by bomb calorimetry (14.6 MJ DE/kg). This resulted in the following dietary specifications: 13.9 MJ DE/kg, 0.87% available lysine, 0.37% methionine plus cystine and 0.58% threonine.

* Departments of Agriculture and Animal Production, University of Queensland.
**CSIRO Division of Food Research, Meat Research Laboratory, Cannon Hill Q. 4170.

Both diets were offered to the animals on an ad lib basis and the change from a cereal-based diet to the experimental sugar diet was effected within one day.

The pigs were weighed at fortnightly intervals until they reached a target slaughter weight of 80 kg. At slaughter, liver weights were recorded and samples removed and immediately frozen for glycogen analysis.

Twenty-four hours after slaughter the pH of the carcase musculature was recorded and a section of the loin from each carcase was removed for subsequent evaluation of meat acceptability. Section of the eye muscle were removed for glycogen analysis as were back fat samples for fatty acid analysis. Carcase fat thickness was determined with an optical probe and eye muscle area was measured by planimeter.

Acceptability of the pigmeat was evaluated by a taste panel using standard procedures described by Takken et al. (1986).

RESULTS

The pigs avidly accepted the sugar-based diet. While diarrhoea was evident in most of these animals during the first week of the experiment, it did not persist. The pigs fed the sugar-based diet gained weight at a faster rate than the cereal fed pigs but the difference was not significant (Table 1). Feed intakes were similar, but pigs fed the diet based on raw sugar had significantly greater dressing percentages and this resulted in a significantly better feed conversion ratio.

Table 1 Production parameters of pigs fed either raw sugar or sorghum as the dietary energy source

Parameter	Cereal diet		Sugar diet		Level of significance
		SE(±)		SE(±)	
Mean L.W.G.(g/d)	612	48	702	50	N.S.
Mean feed intake (kg/d)	2.30	0.09	2.36	0.09	N.S.
Dressing percentage	74.7	1.1	80.1	0.8	$P < 0.05$
Feed conversion ratio (kg feed/kg dressed weight)	6.76	0.90	4.47	0.23	$P < 0.05$

There was a significant reduction in backfat thickness in the sugar fed pigs (Table 2). Other carcase characteristics were similar. Liver weights and muscle and liver glycogen levels were also similar in both groups.

There was significantly more oleic and palmitoleic acid in the backfat from the pigs fed the sugar-based diet whereas there was more linoleic acid present in the fat from the pigs fed the cereal-based diet (Table 2). Traces of lauric and myristic acid were present in the backfat from both groups (approx. 1%)

Table 2 Carcase characteristics (± standard error) and percentages of the various fatty acids in the backfat of pigs fed diets containing raw sugar or sorghum as the dietary energy source

Parameter	Cereal diet		Sugar diet		Level of significance
		SE(±)		SE(±)	
Eye muscle area (cm^2)	41.0	4.3	45.1	2.0	N.S.
Ultimate pH	5.63	0.01	5.61	0.01	N.S.
Backfat thickness (mm)	22.8	1.4	19.8	1.4	P < 0.05
Percentage of fatty acids in backfat					
Palmitic	22.1	1.29	23.9	0.92	N.S.
Palmitoleic	3.4	0.91	6.6	0.31	P < 0.05
Stearic	9.0	0.44	9.2	0.29	N.S.
Oleic	46.2	1.87	57.9	0.94	P < 0.01
Linoleic	17.7	2.78	1.6	1.43	P < 0.001

The taste panel could not detect any differences (Table 3) in aromas, flavours or overall acceptability of the meat samples obtained from the two groups of pigs.

Table 3 Mean values of taste panel scores for pigmeat from animals fed either raw sugar or sorghum as the dietary energy source

	Meat aroma	Other aroma	Meat flavour	Other flavour	Overall acceptability
Cereal diet	3.42	1.58	3.54	1.81	4.11
Sugar diet	3.38	1.40	3.53	1.81	4.07
Level of significance	N.S.	N.S.	N.S.	N.S.	N.S.
Standard error of a mean	0.06	0.12	0.10	0.15	0.16

DISCUSSION

The most significant findings in this study were that the pigs fed the sugar-based diet had slightly higher rates of liveweight gain, higher dressing percentages and lower feed conversion ratios than those fed the cereal-based diet. Superior liveweight gains in pigs fed sugar cane juice diets have been reported by Mena et al. (1981) and Fermin et al. (1984). These workers also found increased dressing percentages in pigs fed sugar diets, a feature clearly evident in this study. That these results were due to the lower fibre content of the sugar-based diet is suggested by the report of Cole et al. (1968) which showed that increasing dietary fibre levels decreased dressing percentage. Similarly, Batterham (1979) and King (1981) concluded that increasing the fibre content of pig diets by including lupin meal decreased dressing percentage. It is possible that sugar could be used to dilute the fibre content of a ration and so make it possible to use more of the lower priced vegetable proteins that, because of their high fibre content, cannot currently be included in high concentrations in pig rations. Work along these lines is continuing at our laboratory.

The higher dressing percentage and lower backfat thickness recorded in pigs fed the sugar-based diet suggest that they produced more lean muscle tissue per unit food intake than did the control group. Reasons for this possible difference in nutrient partitioning are not evident and further work is warranted. Superior dressing percentages without excessive fat cover were also noted in the reports of Mena et al. (1981) and Fermin et al. (1984).

The higher proportion of the polyunsaturated linoleic acid in the fat from the pigs fed the cereal based diet was expected due to the high concentration of this fatty acid in sorghum grain which was the cereal component in the control diet. However, the difference in fatty acid composition of the fat from the two groups of animals did not affect the flavour or taste of the pigmeat.

The sugar based diet did not influence post slaughter muscle glycogen levels or muscle pH values which were in the range considered adequate for good meat quality (5.4 – 5.8). Liver weights and glycogen concentrations were not affected by feeding the sugar-based diet. This is in contrast to the findings of Babatunde et al. (1975) and Mena et al. (1981) who reported increased liver weights in pigs fed molasses and diets based on sugar cane juice.

In conclusion, raw sugar can be efficiently used as an energy source for growing/fattening pigs resulting in excellent liveweight gain and significantly increased dressing percentages without adversely affecting backfat thickness, health of the animal or product acceptability.

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