Summary

Sixty-four pigs with initial average live weight of 1.8 kg and 7 d of age were fed dry pelleted diets for a 19 d period. A 2 x 2 x 2 factorial experiment was conducted with diets containing two levels of milk protein (25 and 14%), two levels of fat (tallow, 25 and 4%) and two carbohydrate sources (lactose and corn starch).

The average daily gain (ADG) and feed conversion ratio (FCR) of the pigs were 158.9 g/d, 0.94 and 90.8 g/d, 1.33 for the treatments containing 25 and 14% protein respectively and 88.3 g/d, 1.27 and 161.4 g/d, 1.00 for 25 and 4% fat respectively. There were no differences due to carbohydrate source of ADG or FCR.

The apparent digestibility of dry matter (DM), fat and protein was lower for the 14% protein diets than the 25% protein diets and also for the 25% fat diets as compared with the 4% fat diets. Nitrogen (N) retention was 9.19 g/d and 4.20 g/d for the pigs fed the 25 and 14% protein diets and 5.08 g/d and 8.32 g/d for the pigs fed the 25 and 4% fat diets respectively. There was no difference in the apparent digestibility of DM, fat or protein or in N retention due to the carbohydrate source.

I. INTRODUCTION

Early weaning of pigs should reduce the cost of production for various reasons and for successful early weaning on a commercial scale it may be essential to develop a dry diet which satisfies the nutrient requirements of pigs within one week of birth.

The major energy source of the suckling pig is fat. The activity of lipase in the intestine of the pig at birth is high and is maintained at this level as growth proceeds (Kitts et al. 1956; Pond et al. 1971). For the routine rearing of piglets a diet of low fat content is preferable to one of a high fat content because of ease of preparation and reduced risk of deterioration.

Kitts et al. (1956) and Walker (1959) have observed an almost total absence of pancreatic amylase in piglets at birth, but the amount increases to 4–5 weeks of age. Lactose activity in the intestine is high in the newborn pig and its activity decreases between birth and eight weeks of age (Bailey et al. 1956; Walker 1959; Manners and Stevens 1972).

This experiment was designed as a preliminary trial to determine if satisfactory growth rates could be achieved with pigs between 7 and 26 d of age fed dry diets, to indicate the level of fat that should be included in the diet and to determine if starch could replace lactose in the diet.

II. MATERIALS AND METHODS

Sixty-four male pigs of average initial live weight at 7 d of 1.8 kg

*M.C. Franklin Laboratory, Department of Animal Husbandry, University of Sydney, Camden, N.S.W. 2570.
were housed in pairs in *three-tiered* cages designed for separate collection of urine and faeces. The pigs were housed in a controlled environment room maintained at 32°C for the first week and 30°C thereafter.

The duration of the experiment was 19 d with two collection periods when faeces and urine were collected daily, pooled and stored for subsequent analysis. The two collection periods were from 10-14 and 17-21 d of age respectively.

The experiment was a 2 x 2 x 2 factorial design with two levels of protein (25 and 14%), two fat levels (25 and 4%) and two carbohydrate sources (lactose and corn starch). The composition of the diets is shown in table 1.

Two milk powders were manufactured using tallow as the fat source to give powders containing 8 and 50% fat respectively. These powders were spray-dried at low temperatures.

### TABLE 1

**Ingredient and chemical composition of diets**

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>1 &amp; 2</th>
<th>3 &amp; 4</th>
<th>5 &amp; 6</th>
<th>7 &amp; 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk powder (8% fat)</td>
<td>-</td>
<td>50.0</td>
<td>-</td>
<td>44.0</td>
</tr>
<tr>
<td>Milk powder (50% fat)</td>
<td>50.0</td>
<td>-</td>
<td>50.0</td>
<td>-</td>
</tr>
<tr>
<td>Casein</td>
<td>18.5</td>
<td>10.0</td>
<td>6.0</td>
<td>-</td>
</tr>
<tr>
<td>Lactose/corn starch</td>
<td>27.0</td>
<td>36.5</td>
<td>39.0</td>
<td>51.5</td>
</tr>
<tr>
<td>Dicalcium phosphate</td>
<td>2.0</td>
<td>1.0</td>
<td>2.5</td>
<td>2.0</td>
</tr>
<tr>
<td>Calcium stearate</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Premix*</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
</tbody>
</table>

*Premix contains vitamins and trace minerals to requirements and 50 mg/kg oxytetracycline HCl and neomycin sulphate (Pfizer Agricare Pty. Ltd.)*

The pigs were fed ad lib., fresh feed being offered daily; water was available ad lib. Pigs were weighed weekly and feed, faeces and urine samples were analysed for DM, N and fat content by AOAC Methods (1970). The results were analysed by analysis of variance.

### III. RESULTS

Maximum ADG and FCR for the pigs on the high protein, low fat diet over the period 7-26 d of age were 210 g/d and 0.83. The mean final live weight of these pigs at 26 d was 6 kg.

During the period 7-26 d of age, the ADG and FCR were significantly greater (P<0.005) for pigs fed the diets containing 25% protein or 4% fat than those containing 14% protein or 25% fat (table 2). A significant (P<0.01) protein x fat interaction for ADG indicated an increase of nearly 100% in growth rates of the high protein fed pigs as the fat level decreased and only a 40% increase in the low protein fed pigs.
There was a significantly greater retention of N and apparent digestibility of protein (P<0.005) for the pigs fed the 25% protein diets than the 14% protein diets and a significantly greater N retention and apparent digestibility of DM, protein and fat (P<0.005) for pigs fed the 4% fat diets than those fed the 25% fat diets.

### TABLE 2

<table>
<thead>
<tr>
<th>Protein (%)</th>
<th>Fat (%)</th>
<th>Lactose</th>
<th>Corn starch</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>14</td>
<td>25</td>
<td>4</td>
</tr>
<tr>
<td>ADG (g/d)</td>
<td>158.9</td>
<td>90.9</td>
<td>88.3</td>
</tr>
<tr>
<td>FCR</td>
<td>0.94</td>
<td>1.33</td>
<td>1.27</td>
</tr>
<tr>
<td>DM digest. (%)</td>
<td>94.5</td>
<td>93.8</td>
<td>91.6</td>
</tr>
<tr>
<td>Protein digest. (%)</td>
<td>97.0</td>
<td>94.7</td>
<td>94.8</td>
</tr>
<tr>
<td>Fat digest. (%)</td>
<td>94.9</td>
<td>93.8</td>
<td>93.1</td>
</tr>
<tr>
<td>N balance (g/d)</td>
<td>9.19</td>
<td>4.20</td>
<td>5.08</td>
</tr>
</tbody>
</table>

A significant increase in the N retention and apparent digestibility of fat (P<0.005) and apparent digestibility of protein (P<0.05) occurred between the first and second collection periods.

There was no significant difference due to the carbohydrate source in any of the parameters studied.

### IV. DISCUSSION

The results of this trial indicated that satisfactory performance could be achieved by rearing piglets weaned at 7 d of age with dry pelleted diets as growth rates were similar to those reported by Lucas and Lodge (1961) for pigs suckling the sow. It has been previously well established that milk protein is efficiently digested by the baby pig and the values reported in this trial agree with numerous workers (Lucas and Lodge 1961).

The pigs in this experiment performed equally fed either lactose or corn starch as the carbohydrate source in the diet. Becker, Ullrey and Terrill (1954) and Yeh and Tseng (1973) fed pigs from 7 d of age on diets containing various carbohydrates and they also found that piglets fed diets containing corn starch gave similar or improved performance compared with those pigs fed other sources of carbohydrate. This indicates that the pancreatic amylase activity in the pig at one week of age is sufficient to digest corn starch as a carbohydrate source although Kitts et al. (1956) and Walker (1959) observed increasing concentrations of pancreatic amylase in pigs up to five weeks of age.

The feed intakes of the pigs fed the 25% fat diets were 70% of those of the pigs fed the 4% fat diets while their digestible energy intake was reduced by 13%. Carlson and Bayley (1968, 1972) found that inclusion of 10% tallow resulted in reduced feed intakes, weight gains and apparent digestibilities compared to diets not supplemented with tallow in pigs between 13 and 23 d of age. They suggested that the reduced feed intake may have been due to a delay in gastric emptying caused by a separation of fat from the rest of the feed in the stomach. There is evidence that the pig consumes a constant daily digestible energy intake and within limits
is able to compensate for changes in energy level of the diet by changes in feed intake (Cole et al. 1967).

The mean apparent digestibility of fat in this trial was 94% which is considerably higher than values reported by Carlson and Bayley (1968) of 47% but are similar to values reported by Braude and Newport (1973) of 93.8% obtained from pigs given liquid skim milk plus tallow diets.

In conclusion, a diet in which tallow at a low level replaced butter-fat and corn starch substituted for lactose in milk gave satisfactory performance when fed to pigs from 7-26 d of age in a dry form.

V. ACKNOWLEDGMENTS

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VI. REFERENCES


