FAECAL OUTPUT AND CHARACTERISTICS IN PIGS FED DIETS BASED ON SUGAR CANE MOLASSES AND GRADED LEVELS OF BIOTRANFORMED FILTER CAKE MUD (GARANVER)

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SUMMARY

A double 3x3 Latin square design was employed to study the faecal response in 30 kg Yorkshire castrate male pigs of the introduction of either none, 11.5 or 22.5% of treated, biotransformed filter cake mud (garanver) in diets based on sugar cane molasses type B and soybean meal.

A sharp, highly significant (P<0.001) decrease in faecal DM concentration and increase in faecal pH was encountered as a consequence of increasing garanver in the diet. Faecal output of fresh material, water and dry material were significantly (P<0.01) doubled when 11.5% of garanver was present in the feed, but no further differences were found when garanver constituted 22.5% of diet. Fresh faecal output was 227, 477 and 581 g/kg DM intake, and faecal DM concentration, 34.3, 29.5 and 26.3% with none, 11.5 and 22.5% garanver in the diet, respectively. Total SCFA and ammonia faecal output significantly (P<0.05) augmented from 21.8 to 52.6, and from 12.9 to 20.6 mmol/kg DM intake, respectively, with increasing levels of garanver in feed.

Data obtained in the herein described evaluation will contribute to information considering pig faeces as starting material for either production of compost or biogas as methods to neutralize environmental aggression of pig excreta, among other possible alternatives.

Key words: pigs, faecal output, biotransformed filter cake mud, garanver

INTRODUCTION

The use of filter cake mud (FCM) or filter press mud (Göhl 1998) for feeding pigs has been assayed in different moments (Bautista 1987; Pérez and Patterson 1983; González and Mederos 1996; Ly 1998; Ly and García 2002), since a considerable amount of this material is originated at the sugar cane factory as a result of alkaline treatment of sugar cane juice (see Figueroa and Ly 1990). According to Cuban experiments, it has generally been found that FCM in natura
neither determine an improvement in digestive utilization of nutrients of the diet (Ly and García 2002), nor is in favour of good performance traits of growing pigs (Pérez and Patterson 1983), even in conditions of use of treated FCM such as that named luvagar (González and Mederos 1996), gicabú (Ly 1998), or garanver (Ly and García 2002; Almaguel et al 2008). Since Cuban efforts for improving the nutritive value of FCM are in current progress (see Almaguel et al 2008), the main objective of the present investigation was to determine faecal parameters in order to provide engineering studies of characteristics of pig faeces fed with graded level of the biotransformed FCM, named garanver.

MATERIALES Y METODOS

A double 3x3 Latin square design was employed to study the faecal response in 30 kg Yorkshire pigs of the introduction of none, 11.5 or 22.5% of biotransformed filter cake mud (garanver) in diets based on sugar cane molasses type B and soybean meal. Further information concerning housing, managing of animals and characteristics of the assayed diets are available elsewhere (Almaguel et al 2008). As a result of the chemical analyses conducted in the garanver (AOAC 1995), it was noted that ash, crude fibre and crude protein (Nx6.25) content were 19.2, 27.6 and 13.4% in dry basis, respectively. In consequence, ash and crude fibre of the diets containing garanver were increased considerably (table 1). The rations were prepared in the moment to be supplied to the pigs at 9:00 am and 3:00 pm. Water was added to the molasses, dry components and garanver in the proportion of 2:1 in dry weight to facilitate feed handling and intake by the pigs.

Table 1. Details of the diets

<table>
<thead>
<tr>
<th>Garanver, % DM</th>
<th>11.5</th>
<th>22.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry matter</td>
<td>53.76</td>
<td>53.93</td>
</tr>
<tr>
<td>Ash</td>
<td>6.66</td>
<td>8.26</td>
</tr>
<tr>
<td>Crude fibre</td>
<td>2.02</td>
<td>4.81</td>
</tr>
</tbody>
</table>

The basal diet (control) contained sugar cane molasses type B and soybean meal 65.8 and 31.4% respectively. For details, see Almaguel et al (2008)

A faeces sample from every pig in every experimental period was obtained from a five-day pool, and analyzed by duplicate for dry matter content, following the AOAC (1995) gravimetric procedure. Fresh material of daily faeces output was recorded by direct weighing of the collected material, and from this, faecal water output was a result of subtration from the dry material. The pH value of fresh faeces was determined daily in the moment of sample collection by the aid of a glass electrode, then pooling the values of five successive days to achieve an average data per pig and per experimental period. A representative sample of the five-day period was stored frozen at -5°C until analysis. Thawed faeces were thoroughly homogenized, then suspended in a solution of NaCl, 9 g/L, in the proportion of 1:4 by weight. The suspended slurry was homogenized carefully and filtered through four layers of cheese cloth to obtain a faecal liquor which was assayed for total SCFA and ammonia, according to the methodology described by Phinmasan et al (2004), consisting essentially in a distillation procedure by using a tecator distilling unit, with the aid of either a strongly acid solution of MgSO₄ to distill the SCFA, or other solution consisting of NaOH 40% to recover ammonia in a boric acid solution.

The Harvey (1990) software was employed to manage the results in order to determine statistical significant differences if any (P<0.05), following Steel et al (1997) recommendations. In the proper cases means were separate by the Duncan multiple range and multiple F test.

RESULTS AND DISCUSSION

The chemical composition of the FCM named garanver was very high in crude fibre and ash, and relatively low crude protein (Nx6.25) content. In this case, these characteristics of garanver are not so different from other types of FCM, such as the liquid product assayed by Bautista (1987) in Venezuela (table 2) or another, the common Cuban material evaluated by Serrano and Iglesias (1988).

Table 2. Chemical composition of filter cake mud (FCM) products

<table>
<thead>
<tr>
<th>Source</th>
<th>Ash</th>
<th>Crude fibre</th>
<th>Nx6.25</th>
</tr>
</thead>
<tbody>
<tr>
<td>In natura</td>
<td>23.9</td>
<td>12.9</td>
<td>10.4</td>
</tr>
<tr>
<td></td>
<td>24.7</td>
<td>5.4</td>
<td>5.6</td>
</tr>
<tr>
<td></td>
<td>27.9</td>
<td>19.8</td>
<td>9.4</td>
</tr>
<tr>
<td></td>
<td>14.2</td>
<td>21.4</td>
<td>15.1</td>
</tr>
<tr>
<td></td>
<td>32.3</td>
<td>24.4</td>
<td>12.8</td>
</tr>
<tr>
<td>Treated</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Garanver (2002)</td>
<td>26.8</td>
<td>26.9</td>
<td>18.3</td>
</tr>
<tr>
<td></td>
<td>19.2</td>
<td>27.6</td>
<td>13.4</td>
</tr>
<tr>
<td></td>
<td>24.0</td>
<td>23.3</td>
<td>10.0</td>
</tr>
<tr>
<td></td>
<td>28.0</td>
<td>30.4</td>
<td>18.5</td>
</tr>
<tr>
<td>Liquid (2002)</td>
<td>17.5</td>
<td>10.7</td>
<td>13.9</td>
</tr>
</tbody>
</table>

For details, see Almaguel et al (2008)

The SCFA and ammonia concentration in faeces, as well as faecal pH values, are listed in table 3. The garanver product...
determined an alkaline reaction in the faeces of pig, and this effect was significant (P<0.05) when compared to faecal samples from pigs fed no garanver. On the other hand, faecal concentration of SCFA increased, and ammonia decreased, as increasing levels of garanver occurred in the diet. Nonetheless, the analysis of variance did not reveal other influence than a trend (P<0.10) in the status of faecal microbial metabolites.

<table>
<thead>
<tr>
<th>Faecal metabolites, mmol/100 g DM</th>
<th>Garanver, %</th>
<th>n</th>
<th>11.5</th>
<th>22.5</th>
<th>SE ±</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCFA</td>
<td>26.71</td>
<td>6</td>
<td>28.28</td>
<td>33.51</td>
<td>6.08</td>
</tr>
<tr>
<td>Ammonia</td>
<td>16.15</td>
<td>6</td>
<td>15.87</td>
<td>13.68</td>
<td>0.73</td>
</tr>
</tbody>
</table>

Table 3. Faecal microbial metabolites in pigs fed biotransformed filter cake mud (garanver)

As it was observed in the current investigation, Varel et al (1984) found a lower ammonia concentration in caecum, colon and faeces of pigs fed a high amount of crude fibre in the diet. On the other hand, the reverse appeared to be true for the status of organic acid concentration (Varel et al 1984). In this particular case, Varel et al (1984) suggested that these findings could be associated to either a higher ammonia utilization by microbial population or less protein catabolism which could be taking place there. Schneider and Bolduan (1985) and Bolduan et al (1986) claimed that ammonia arising from bacterial activity in the digestive tract of pigs is a negative factor in pig production, and should be kept as low as possible in animals and environment too.

Münchow and Häger (1988) suggested that SCFA production, excretion and absorption in the large intestine of pigs should be greatly influenced by the type of substrate to be arriving to caecum and colon of animals. In the experiment of Münchow and Häger (1988), partly hydrolyzed straw, as compared to the same untreated material, strongly favoured SCFA production and absorption in caecum and colon of the animals, and faecal excretion of these acids then evidently decreased. Accordingly, in the current study it could not be known if garanver, as a modified FCM which was introduced in the diet, determined an increase in SCFA production and absorption, and at the same time a major faecal output of acetate and similar organic acids could be taking place there.

Faecal output of materials

A sharp, highly significant (P<0.001) decrease in faecal DM concentration was observed as a consequence of the introduction of garanver in the diet (table 4).

The increased faecal output of fresh and dry faeces has been observed in previous experiments where other type of FCM was supplied to pigs (Ly 1998), and the hypothesis has been put forward that the high content of cell wall in FCM would be one of the main factors determining a high faecal output of materials. In addition, since faecal DM concentration tends to be lowered as determined by the presence of FCM in the feed, this second factor should be suggesting that either an increase in rate of passage through the large intestine, or certain impairment in the rate of water absorption in the colon of pigs could contribute to this phenomenon to occur too.

Data obtained in the herein described evaluation will contribute to information considering pig faeces as starting material for either production of compost or biogas as methods to neutralize environmental aggression of pig excreta, among other possible alternatives (Preston 2000; San Thy 2003).

ACKNOWLEDGMENTS

Thanks are given to the personnel pertaining to the Laboratory of Biochemistry for their skill assistance in the conduction of the chemical analysis. Particular gratitude is expressed to the late Mrs. Hilda Salas for her technical assistance in the care and managing of the animals.
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