

New calcium sources used in pig feeding

Veronica Hebean, Ioan Moldovan, Dumitru Preoteasa, Mihaela Hăbeanu, Alexandru Lionide, Claudia Mihăilă
Institute of Biology and Animal Nutrition, 8113 Balotești

Abstract

Three types of marble waste (Vărănic, Sohodol and type "M dry") as well as Borsec travertin waste were tested as dietary calcium sources for growing pigs compared to the feed grade limestone from Basarabi – Constanța. 86 hybrid (Large White × Periș Synthetic Line 345) piglets with 9.55 kg average initial weight were assigned to five groups differentiated by the calcium source. The calcium content of the marble and travertin waste supplied by S.C. Marmura SA Bucharest ranged between 35.37-38.27%, compared to 38% calcium in feed grade limestone. The same calcium level was supplied to all five groups, irrespective of the source. Slightly lower average daily weight gains were obtained in the treated groups compared to the limestone group, but the differences were not significant. Feed conversion ratio was similar. Serum and bone calcium levels were similar with the control group, particularly when waste from Vărănic marble and Borsec travertin were used.

Keywords: *pigs, nutrition, calcium, new sources, marble waste*

Introduction

Calcium is the mineral with the highest proportion in the organism. Calcium and phosphorus amount to 70% of the mineral content of the body. About 90% of the calcium is found in bones and teeth. Among forages, alfalfa has large amounts of calcium, as well as the legumes, fishmeal, bone meal, meat waste, milk and dairy products. These calcium rich forages are little represented in pig feeding. Therefore, the requirements for this mineral are not met and the diets have to be treated with mineral supplements rich in calcium.

Worldwide, many researchers considered the macroelement requirement for pigs (Ensminger, 1990; Henry and Perez, 1987; Jongbloed *et al.*, 1996; Manhan, 1982; Miloș and Drînceanu, 1980; Pallauf, 1996).

The most usual calcium sources used in animal feeding are the bone meal, calcium gluconate, lactate calcium, dicalcium phosphate, limestone, shell meal.

S.C. Marmura SA Bucharest, dealing in marble and travertin extraction and processing for construction and other fields, has four types of marble and travertin wastes differing by the place of

extraction and by the calcium level (35.37-38.27%). The purpose of this paper is to present the use of these wastes in piglet feeding.

Material and methods

Four types of marble and travertin were used by the biological test in comparison with the feed grade limestone from Basabi – Constanța. The calcium content was assayed by emission spectrophotometry and it was as follows:

- feed grade limestone from Basarabi Constanța – 38.0%
- Vărănic marble, Gura Văii – Mehedinți quarry – 38.07%
- Sohodol marble, Sohodol – Alba quarry – 36.27%
- Type “M dry” marble, resulting from marble processing – 35.37%
- Borsec travertin, Borsec – Harghita quarry, 38.27%

The experiment on animals was conducted in the experimental farm of IBNA for a period of 36 days. We used 86 hybrid (Large White × Periș Synthetic Line 345) piglets, weaned at 40 days, average weight 9.55 kg, assigned to five groups (C, C1, C2, C3, C4). All groups received a compound feed formulation for the period from weaning to 16 days and thereafter another formulation for the period 17-36 days, with quality indices proper for the two age categories (Table 1).

Table 1 *Compound feed formulations and quality indices*

Ingredients	Weaning to 16 days	17-36 days
Corn	50.78	61.86
Soybean meal	15.00	17.00
Sunflower meal	-	8.00
Milk replacer	20.00	5.00
Fishmeal	4.00	2.00
Soy oil	5.00	1.00
Choline premix	0.22	0.22
Lysine	0.60	0.40
Methionine	0.40	0.12
Dicalcium phosphate	2.00	1.80
Salt	0.50	0.50
Calcium carbonate*	0.50	1.10
Mineral-vitamin premix P1+2	1.00	1.00
Analyzed		
Gross protein, %	21.32	18.61
Lysine, %	1.51	1.10
Methionine cysteine, %	+ 1.06	0.68

Calcium, %	1.16	0.95
Phosphorus, %	0.98	0.85
Metabolisable energy, MJ/kg CF	14.71	12.85

The calcium source was ground and added to the CF as follows:

- Group C (control) received feed grade limestone
- Group C1 – Vărănic marble powder
- Group C2 – Sohodol marble powder
- Group C3 – “M dry” type marble powder
- Group C4 – Borsec travertin

The proportion of inclusion of the four marble and travertin sources of calcium for groups C1 to C4 was calculated according to the calcium content compared to the feed grade limestone from group C.

The piglets were housed in stalls of 5-6 animals. The animals had free access to the feed and water. Feed intake was measured daily. The piglets were tagged at farrowing and were weighed in the beginning of the experiment (weaning), at 16 days from weaning and in the end of the experiment.

At the end of the experiment blood samples were collected from 30% of the animal stock and 3 piglets from each group were slaughtered, the tibia was harvested and serum and bone calcium levels were determined.

Results and discussion

Piglet body weight throughout the 36 experimental days (Table 2) was similar in the five groups, ranging between 15.70-16.0 kg after the first 16 days and between 25.32-25.80 kg at the end of the experiment. In both periods the body weight of group C1 (treated with marble waste from Gura Văii) was very close to the body weight of group C, 99.56% and 100.66% respectively. The other groups had lower similarity with group C, as follows: group C2 (Sohodol marble) 98.56% and 99.19% during the first and second period, respectively, group C4 (Borsec travertin) 98.50% and 98.53% respectively, group C3 (“M dry” marble) 98.13% and 98.14% respectively. The weight difference between the experimental groups and the control group are not significant ($P > 0.05$).

Table 2 *Body weight evolution*

	C	C1	C2	C3	C4
Average initial weight, kg	9.55	9.55	9.55	9.55	9.55
Average weight 0-16 days kg*	16.00 ^a	15.93 ^a	15.77 ^a	15.70 ^a	15.76 ^a

% compared to C	100.00	99.56	98.56	98.13	98.50
Average final weight					
kg*	25.80 ^a	25.97 ^a	25.59 ^a	25.32 ^a	25.42 ^a
% compared to C	100.00	100.66	99.19	98.14	98.53

* values in rows with the same superscript do not significantly for $p>0.05$

The average daily gain (Table 3) in groups C1-C4 during the first 16 days was lower than in the control group ranging from 95.29 to 99.00%. During the second period groups C1 and C2 gained more than group C (102.45%-100.20%), while groups C3 and C4 gained less (98.16% and 98.57%). The differences are not significant.

Table 3 Average daily gain

	C	C1	C2	C3	C4
0-16 days					
kg*	0.403 ^a	0.399 ^a	0.390 ^a	0.384 ^a	0.388 ^a
% compared to C	100.00	99.00	96.77	95.29	96.28
17-36 days					
kg*	0.490 ^a	0.502 ^a	0.491 ^a	0.481 ^a	0.483 ^a
% compared to C	100.00	102.45	100.20	98.16	98.57
0-36 days					
kg*	0.451 ^a	0.456 ^a	0.446 ^a	0.438 ^a	0.441 ^a
% compared to C	100.00	101.11	98.89	97.12	97.78

* values in rows with the same superscript do not significantly for $p>0.05$

Feed intake (Table 4) was higher in both periods in C1 than in C and lower in the other groups, however, the difference is very small. During the first period the average feed intake ranged from 0.718 kg in group C3 and 0.742 kg in group C1, while during the second period it ranged between 0.962 kg in group C4 and 0.998 in group C1.

Table 4 Feed intake

	C	C1	C2	C3	C4
Average feed intake 0-16 days					
kg	0.736	0.742	0.728	0.718	0.720
% compared to C	100.00	100.82	98.91	97.55	97.83
Feed conversion ratio					
kg CF/kg gain	1.83	1.86	1.86	1.87	1.86
% compared to C	100.00	101.64	101.64	102.18	101.64
Average feed intake 17-36 days					
kg	0.969	0.998	0.986	0.966	0.962

% compared to C	100.00	102.99	101.75	99.69	99.28
Feed conversion ratio					
kg CF/kg gain	1.98	1.99	2.00	2.00	1.99
% compared to C	100.00	100.50	101.01	101.01	100.50

Serum calcium (Table 5) was generally lower in the experimental groups: 97.83% in C1, 96.04% in C2, 97.74% in C3 and 95.57% in C4. The evidence shows that it is more difficult to absorb serum calcium from Borsec travertin (C4) and Sohodol marble (C2). Tibia calcium was also lower in groups C4 and C2, 96.51 and 98.47% respectively, compared to C. In all groups the blood and tibia calcium levels are within the normal biological range.

Table 5 *Calcium level*

Group	Serum calcium		Tibia calcium	
	mg%	% compared to C	mg%	% compared to C
C	10.60	100.00	34.09	100.00
C1	10.37	97.83	33.90	99.44
C2	10.18	96.04	33.57	98.47
C3	10.36	97.74	33.98	99.68
C4	10.13	95.57	32.90	96.51

Conclusions

The use of marble and travertin waste (Gura Văii, Sohodol, "M dry" marble and Borsec travertin) as calcium source for weaned piglets yielded the following results:

1. Slightly lower weight gains than when feed grade limestone was used, but the difference is not significant.
2. Similar feed conversion ratio
3. Similar serum and bone calcium levels with group C (feed grade limestone), particularly when Gura Văii marble waste and Borsec travertin waste were used.

The performance achieved by weaned piglets treated with wastes from Gura Văii, Sohodol, "M dry" marble and Borsec travertin recommend them to be used as calcium source for pigs.

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