Productive Performance of Piglets Fed with Different Sources of Lactose

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Abstract

Lactose is important to potentiate the health and growth of piglets before and after weaning. The aim of this study was to evaluate the effect of three sources of lactose on performance: 24 piglets from 7 days of age were divided into three groups (n = 8), 2 dietary phases were used: pre-weaning (7-35 days) and weaning (36-56 days). The source of lactose was the variable under study: Crystallized lactose, lacto-whey and permeate. Body weight (BW), Average Daily Gain (ADG) and Feed Conversion Rate (FCR) were the parameters evaluated. The results were analyzed by ANADEVA and DUNCAN. Piglets receiving the permeate had a higher final weight 23.98 kg (P> 0.05) and higher ADG 0.42 kg / d (P> 0.05). This experiment determined that any source of lactose can be included in feed processing for piglets however the inclusion of permeate cheaper production costs..

Keywords: piglet, feed, lactose, whey, permeate

1. Introduction

There is great interest in developing management and feeding strategies that stimulate the development and digestive health of piglets in order to enhance its growth and minimize the use of antibiotics (de Lange et al., 2010). The use of dairy products for feeding piglets early in life has shown remarkable benefits thanks to the contribution of highly digestible nutrients such as the lactose (Cromwell et al., 2007).

The piglet at weaning (21-35 days old) suffers damage at the level of the villi of the intestinal mucosa which decreases the digestive capacity (Lallès et al. 2007) and it is essential to avoid incorporating large amounts of plant nutrients which would aggravate the damage (Pluske 2013). The inclusion of sources of lactose in the diet of pigs has shown an increase in daily weight gain in pigs in the weaning stage in approximately 17% (Cera et al. 1988). The effect is associated with increased feed intake (Gahan et al. 2009) and most nutrient digestibility (Tokach et al. 1989) thus decreasing the atrophy of the villi and pig productive performance is improved (Dong and Pluske, 2007)**.** It has also been observed that diets that include lactose improve the digestibility of dry matter (DM) and crude protein (CP) thereby reducing the excretion of these nutrients (Jin et al. 1998).

Whey, deproteinized whey (permeate) and lactose purified among others are used as source of lactose in feeding piglets. These vary greatly in their nutritional composition, lactose, protein, ash and its solubility properties and pH (Nessmith et al. 1997)**.** Whey is the liquid fraction obtained after the coagulation of milk during cheese manufacture, it contains about 70% lactose but may vary depending the cheesemaking process (Zadow, 2012)**.** The crystallized lactose is obtained after evaporation and dehydration of serum (mainly composed of α-lactose) and pure lactose is obtained by centrifugation and purification of the crystallized whey: it contains more than 99% lactose. The permeate is the whey fraction deproteinized resulting from ultrafiltration process for the separation of whey protein concentrate and contains about 83% lactose (Nessmith et al. 1997)**.** The objective of this study was to evaluate the effect of dietary inclusion of three sources of lactose on the productive performance of piglets.

2. Materials and Methods

The experiment was conducted at the pig farm "San Francisco" located in Alangasí, Pichincha-Ecuador. 24 piglets from 7 days old Landrace-york F1 were selected; 12 females and 12 males, weaning was performed at 21 days old. Individuals were randomized into three groups of 8 animals each with an equal number of females and males (T1, T2 and T3). The study lasted 49 days and was evaluated in two diets: pre-weaning phase (7-35 d) and post-weaning phase (36-56 d) formulated based on the recommendations made by NRC 2012. The T1 group received pure lactose, T2 whey and T3 permeate. The nutritional composition of the diet study is detailed in Table 1.
Production parameters: BW, ADG and FCR were recorded from day 7 to day 56 of age. In addition a cost-based economic analysis was carried out.

2.1. Statistic analysis

ANADEVA and DUNCAN test was used for variables, the analysis was performed using SPSS version 22.0 (SPSS Inc., Chicago, IL). An α level of $P < 0.05$ was considered statistically significant.

3. Results and Discussion

The values obtained for the evaluated parameters are presented in Table 2. The final body weight at 56 days of age was similar in all three treatments and there was no significant difference ($P > 0.05$). Pigs receiving permeate had a slightly higher average in ADG (0.42 ± 0.030 kg / d) but no significant difference ($P > 0.05$). Although there was no significant difference between treatments FCR was better in the T3 group (0.899 ± 0.06). In the economic analysis conducted for this study it was obtained as a result that the T3 group (permeate) the cost per kilogram of feed produced was lower which led to a higher net profit per kilo body weight produced (2.1 USD) when compared to T1 (1.99 USD) and T2 (2.04 USD).

It is well established that the inclusion of lactose in the diet of piglets improves the yield of animals by stimulating the feed intake and palatability (Mascarenhas et al. 1999), in the study is evidence that all animals showed uniformity in the weight at the end of the experiment and reached a greater weight than those estimated in the tables weight goals.

In studies where higher percentages of lactose (25%) were included in the preference of animals by diet and overall higher consumption in the weaning it was evident, even at the stage of pre-weaning inclusion levels of lactose generated differences in consumption (de Souza and Landín., 2004). The ADG was statistically similar in the 3 groups similar data were found in the work of Jin et al. (1998) in which there were no differences in the ADG in piglets receiving crystallized lactose (555.52 g/d) and those receiving whey (555.91 g/d) 0 to 21 days of age, as in the study Nessmith et al. (1997) in which there were no differences in ADG by comparing the same three sources of lactose in the period 0 to 35 days old.

As for FCR was no difference between similar to what happened in the study by Nessmith et al groups. (1997). However, in the study by Jin et al. (1998) significant difference (P0.05) was found in both pure lactose CA between treatments (1.33) vs. dried whey (1.35).

4. Summary and Conclusion

Replacing pure lactose whey or permeate in piglet diets phased pre-weaning and weaning not reflect significant differences on productive parameters evaluated in this study and represent suitable for supplying the nutrient sources, however whey can be very variable in composition and quality and is an important factor to consider for use in animal feeding.

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Table 1. Calculated composition of the diets (as-fed basis)		
	7-35 d	36-56 d
DM, %	91.3	89.6
Lactose, %	15	7.5
CP, %	22.7	22.9
Lys, %	1.60	1.56
Thr, %	1.03	1.04
Trp, %	0.27	0.27
Met + Cys, %	0.93	0.93
Ca, %	0.78	0.80
P, %	0.71	0.69
Bioavailable P, %	0.43	0.40
ME, Mcal/kg	3.42	3.43
Fat, %	5.6	5.9
Crude fiber, %	2.3	2.7
Ash, %	7.6	7.3

Provided per kilogram of diet: vitamin A, 11,600 IU; vitamin D3, 1,100 IU; vitamin E, 22 IU; vitamin K, 4 mg; riboflavin, 8.25 mg; D-pantothenic acid, 28 mg; niacin, 33 mg; and vitamin B12, 0.03 mg. Provided per kilogram of diet: Zn, 165 mg; Fe, 165 mg; Mn, 33 mg; Cu, 16.5 mg; I, 0.3 mg; and Se, 0.3 mg.

Table 2: Performance parameters			
	T1	T2	T3
	Pure lactose	Whey	Permeate
Piglets (n)	8	8	8
Inicial body weight (kg)	3.51±0.32[a]	3.43±0.14[a]	3.26±0.30[a]
Final body weight (kg)	23.13±1.81[a]	23.24±2.59[a]	23.98±1.77[a]
ADG (kg/d)	0.40±0.036[a]	0,41±0.049[a]	0,42±0.030[a]
FCR	0.941±0.08[a]	0.948±0.14[a]	0.899±0.06[a]
Average cost (USD/kg feed)	1.51	1.46	1.40
Profit (USD/kg de PV)	1.99	2.04	2.1

Same letters in the same row indicate no significant difference (P> 0.05)