Global Veterinaria 16 (1): 52-56, 2016
ISSN 1992-6197

DOI: 10.5829/idosi.gv.2016.16.01.101203

The Use of Sweet Whey for Weaning Pigs

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Abstract: Sweet whey is a product that could be used in different farm systems for its high nutritional content, food quality, its deliciousness and palatability. Several tests were implemented to weaning piglets, while measuring their growth and development, to replace partial (25% and 50%) and completely (100%) water supply by sweet whey. These biological tests were performed in a swine farm in the town of Puente Grande, in Jalisco State, Mexico. Sixty four piglets were chosen randomly, although maintaining uniformity in weight, sex and age. They were distributed into four pens of 16 piglets each. Two groups of 8 piglets, were chosen for a different treatment. Each set was provided with the hardware required for the supply of sweet whey. The interpretation was done under completely randomized design and the Tuckey test was used to check the obvious differences in the middle of treatments. The variables that were measured in this experimental process were: weight gain, food consumption, feed conversion and consumption of sweet whey; the latter in order to be able to check the results of the repetitions and to get to know the proportion (%) of more convenient sweet whey. Strongly, we recommend using sweet whey in proportion of 25 and 50% of the total liquid supply in the diet.

Key words: Sweet Whey · Weaning · Weight Gain · Feed Conversion · Piglet

INTRODUCTION

Sweet whey is a byproduct of cheese industry characterized by its high nutritive value, palatability and its easiness to be digested. The global production of whey is estimated to be 186 million tons in 2008 and 200 million tons in 2011 with an annual increase rate of 2% [1, 2]. The sweet whey is produced from the milk coagulated with rennet and represents approximately 70 - 80% of milk volume[3, 4]. Therefore, the whey contains most of the soluble components and part of the insoluble components of milk including high-quality milk proteins (N X 6.25 = 12-13%), lactose (70-73%), minerals (7-11%), lactic acid (0.5 - 10%), citric acid (1%) and non-protein nitrogen (0.5 -. 8%) in addition to various vitamins and bio-active substances [5-11]. Furthermore, the whey does not contain anti-nutritional factors, very palatable and enhances animal health and performance [10, 12].

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The whey proteins are very essential for young growing animals. Not only is the whey rich with albumins, globulins and different essential amino acids as lysine, tryptophan, methionine and cysteine but it can also provide the growing animals with essential minerals for healthy growth such as calcium, phosphorus, sodium, potassium, zinc, iron, copper and manganese and even energy (26 Kcal/100 g)[5, 7, 9, 13-15].

The supplementation of animal feed with the suitable feed additive is controlled with economic calculations. The use of industrial byproducts which were usually discarded is an advantage. At present a relatively large proportion of the produced whey is discarded which has a negative environmental effect [11, 16, 17]. However, we can mark that, the whey becomes increasingly used to feed livestock in milk replacer for calves, also incorporating fresh sweet liquid whey for piglets [18]. It is also offered to older animals for breeding and fattening purposes [7, 10, 18].

In the last decades, modern pig husbandry aims to increase the delivered piglets per sow per year through the selection of sows with large litter sizes and in the same time encouraging lower weaning age. The young animals obtain less milk from the dams and are usually underweight at weaning time. For this reason, the need to supply the weaning pigs with milk components (e.g. in the form of whey) increased obviously in the last decades [10, 12, 19]. The benefits of feeding piglet on whey were reported by many authors [7, 20-24].The benefits included the improvement of the FCR and the decrease feed cost. Whey is difficult to be conserved; pork producers recommend its usage directly in places where it is produced [8, 15].

Whey digestibility in liquid diets was compared with that of different protein concentrates of animal and plant origin for weaning piglets [25, 26]. It was found that the digestibility of the whey is equivalent to that of the protein concentrate and better than concentrated protein from soybean [11, 23, 27]. In Guadalajara, Mexico, some producers take advantage of whey in fattening pigs [28, 29]. Pigs suffering from delayed growth rate showed a clear improvement in the FCR when fed on whey combined with bakery waste in Mexico [28].

In private pig farms, the substitution of water with whey results in better weight gain in shorter time. However, no published data about that point could be found in literature. Milk represents about 50% the total nutrition of young piglets, therefore after weaning piglet suffers the lack of fluid intake, since all of their diet is based on dry food. For this reason, practice shows that after weaning piglets suffer a decline in its growth.

The aim of the present work is to investigate the effect of partial (25% and 50%) and even complete (100%) replacement of drinking water with whey on the weight gain, feed intake and food conversion ratio of weaning piglets.

MATERIAL AND METHODS

In the present study, the experimental work was performed in three consequential phases: firstly, bromatological analysis of animal feed was carried out in accordance with the techniques of the Official Methods of Analysis of the Association of Official Analytical Chemists (AOAC) [30] then, the physico-chemical analysis of whey and finally the biological tests of pigs at weaning.

The study was carried outin in the town of Puente Grande, in Jalisco State, Mexico. Sixty four piglets were chosen randomly. The animals were divided into four groups, 16 animals each. The pigs were weaned at 21 days with an average weight of 6.105 kg. The amounts of eaten ration were daily weighed. The pigs were weighted three times during the experiment; at the beginning, after 16 days and at the end of the experiment (Day 37). The four groups involved in the study were; G1 (0% whey, control group, free access to water), G2 (25% whey at a rate of 0.250 L per day with free access to water), G3 (50% in a ratio of 0.500 L per day with free access to water) and G4 (100% whey, no access to water). All groups were kept under the same conditions and got the same ration. The piglets were monitored for their (a) weight gain, (b) general feed intake, (c) feed conversion ratio and (d) consumption of sweet whey.

The experiment was performed under a completely randomized design, the data were analyzed by Tukey`s test [31].

RESULTS

The present work measured the effect of partial and complete replacement of water with sweet whey on the weight gain, feed consumption, food conversion ratio and amounts consumed from sweet whey on weaned piglets. The obtained results are listed in details in the Tables I-IV. As shown in table I, the second treatment (G2 - 25%) led to highest weight gain in relation to the other groups, while the lowest weight gain was shown when replacing 50% of water with whey (G3). Concerning the feed consumption, the 4th group (G4-100%) exhibited the least feed intake among all treatments. In opposite to the first group (G1) which consumed more feed than other

Table 1: Weight Gain Accumulated in Piglets at Weaning (Minimum Significant Difference).

Treatment	Week 1	Week 2	Week 3	Week 4	Week 5	Total
G1 (a)	6.396	6.782	7.192	7.585	7.957	35.912
						7.182
G2 - 25% (a)	6.89	7.179	7.46	7.762	8.128	37.419
						7.484
G3 - 50% (a)	5.982	6.313	6.932	6.975	7.34	33.242
						6.65
G4 - 100% (b)	6.492	6.748	7.006	7.325	7.694	35.265
						7.053

In all treatments, there is a minimum significant difference (DMS) 0.62, corresponding to the letter (a), except in the treatment of 4 with different letter (b), to compare the average treatments with Tuckey tabular value at a level of probability of P < 0.05..

Table 2: Feed Intake in Weaned Pigs (Minimum Significant Difference)

Treatment	Week 1	Week 2	Week 3	Week 4	Week 5	Total
G1 (a)	34.764	39.604	44.564	45.314	45.664	209.91
						41.982
G2 - 25% (a)	32.44	31.89	32.39	36.14	41.04	173.9
						34.78
G3 - 50% (a)	32.3	31.75	32.25	36.45	40.08	172.73
						34.546
G4 - 100% (b)	31.35	26.65	27.95	35.8	43.3	165.05
						33.01

Table 3: Feed Conversion in Weaned Piglets (Minimum Significant Difference)

Treatment	Week 1	Week 2	Week 3	Week 4	Week 5	Total
G1 (a)	0.359	0.386	0.41	0.393	0.372	1.92
G2 - 25% (a)	0.308	0.289	0.281	0.302	0.33	1.51
						0.302
G3 - 50% (a)	0.357	0.331	0.319	0.343	0.365	1.715
						0.343
G4 - 100% (b)	0.137	0.256	0.258	0.319	0.369	1.519
						0.303

Table 4: Consumption of Sweet Whey by Piglets at Weaning (Minimum Significant Difference)

Treatment	Week 1	Week 2	Week 3	Week 4	Week 5	Total
G1 (a)	0	0	0	0	0	0
G2 - 25% (a)	23	20	20	26	31	120
						24
G3 - 50% (a)	48	41	41	52	62	244
						48.8
G4 - 100% (b)	103	102	106	108	125	544
						108.8

groups (Table II). It was noticed that the second group (G2 – 25%) had the best feed conversion ration among all treatments. The same results could be achieved in the 4th group (Table III). Finally, as expected, the 4th group consumed the largest volume of sweet whey as this groups was not allowed to serve water and depended mainly on sweet whey as a complete replacement of water (Table IV).

All piglets of the groups G1, G2 and G3 did not show any health problem through the experiment. Meanwhile those in the G4 suffered from chronic diarrhea.

DISCUSSION

One of the main goals of this experiment was to attempt to declare the impact and importance of using sweet whey in weaning piglets. sweet whey is traditionally used to feed monogastric animals due to its palatability, high digestibility and high nutritive value. It contains high amounts of essential amino acids, carbohydrates and minerals. However, in Mexico, the locally produced sweet whey is underutilized as a result of the lack of a proper conservation system [16, 21, 28, 29].

The unutilized product is then used as liquid fertilizer or discarded into the drain system, leading to biological pollution of rivers and lakes [8, 22, 27, 28].

The use of sweet whey for piglet feeding showed promising results if fed in 25% volume of offered water. This was seen as the highest body weight gain with the best feed utilization capacity (Lowest feed conversion ratio) was reported in the group fed on 25% sweet whey.

Little information could be found in literature about the efficiency and previous experience of whey feeding. However, in opposite to previous reports [7, 15] the obtained data from this work showed that the partial replacement of water with sweet whey had a positive impact on weaned pigs. No health problem or cases of diarrhea were noticed except in G4 which suffered from persistent diarrhea. The presence of diarrhea in previous works [7, 18] might be caused by the consumption of fermented sweet whey as this product contains high amounts of water and fermentable sugars and is not long lasting without efficient conservation [6]. The problems reported in previous researches may also be attributed to other factors rather than the use of whey. The use of liquid feeding for pigs in general is sometimes accompanied with the occurrence of certain diseases in the farm as haemorrhagic bowel syndrome, gastric torsion, tympany and even gastric ulcers. Moreover, the fermentation of the diet leads to the loss of essential nutrients from the feed [31].

Beside its high digestibility and nutritive value, other factors may be involved in the improvement of the weight of the piglets fed on whey in the present work. The whey is rich with milk sugar, lactose, which can easily be fermented by lactic acid producing bacteria in digestive system of the pigs. The acid production improves the digestion and activation of digestive enzymes in the stomachs of young pigs which produce insufficient amounts of the acids. The acids also inhibit the growth of pathogenic bacteria in the intestine as Salmonella [10, 32]. The less satisfactory results obtained when feeding larger amounts of whey may be attributed to that excess feeding of whey leads to excessive fermentation inside the gut and excessive gas production. This, in turn, may have an adverse effect on the digestion and microenvironment in the digestive tract leading to lower weight gain [32-34].

The unsatisfactory results reported in G4 especially the retarded growth of the piglets indicate that the drinking water cannot be completely replaced by sweet whey.

CONCLUSIONS

It was demonstrated that the use of sweet whey in liquid form 25% has a promising impact on the measured parameters. The utilization of sweet whey in liquid form at 25% and 50% did not result in rejection of the diet or any metabolic problems in piglets. It is unadvisable to completely replace water with sweet whey as the piglets received 100% sweet whey suffered from persistent diarrhea.

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