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Effects of Pre-Weaning Supplementation of Betaine Hydrochloride on Weight Gain and Hematological Indices in Piglets

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Abstract
This study examined the effects of dietary betaine in its hydrochloride form on the average daily weight gain (ADG) and haematological parameters on postnatal piglets. Three sows were used for this study (n=9 piglets per sow) and they fed their piglets from day 1 to 28. Each group of piglets per sow was replicated three times in a completely randomized design. Each group of piglets was orally administered 0, 0.05 and 0.1g betaine hydrochloride respectively daily. The ADG of the piglets were calculated and blood samples were drawn from the jugular vein of each piglet at days 14, 28 and 42. The data obtained were subjected to analysis of Variance (ANOVA) with $\alpha_{0.05}$ as significant. There was no significant ($p>0.05$) difference in the ADG and haematological parameters of piglets irrespective of betaine hydrochloride supplementation. Numerical indices indicated that ADG was highest for piglets administered 0.1g betaine hydrochloride (7.54kg) while piglets on 0.05g betaine hydrochloride and the control weighed 5.83 and 6.38kg respectively. In conclusion, results obtained shows that pre-weaning supplementation of betaine hydrochloride did not negatively impact piglet performance.

Keywords: Betaine hydrochloride, pre-weaning, piglets, weight gain, haematology

Introduction

Betaine is present in large quantities in aquatic invertebrates and sugar beets, but also in wheat, wheat products and lucerne meal. Common sources of betaine are sugar beets and their by-products such as molasses and condensed molasses solubles. As a feed additive, betaine is also available in a purified form and most commonly added to animal diets in the form of anhydrous betaine, betaine monohydrate and betaine hydrochloride. Betaine is stable and non-toxic. Betaine has different functions both at the gastrointestinal and metabolic level .The animal's betaine need is strongly influenced by the concentration of other methyl group donors in the diet and the occurrence of osmotic stress in the intestinal tract or other organs. If the total betaine need cannot be met by endogenous metabolism, dietary betaine supplementation may be beneficial to maintain or to improve animal's health and performance. Studies on the dietary effect of betaine revealed variable results in animal performance (Attia *et al.,* 2005).

Piglets experience physiological, environmental and social challenges when they are weaned from the sows. Weaning is one of the most stressful periods in the life of piglets and can result in reduced health exposing the piglets to subsequent disease and other production losses (Campbell *et al.,* 2013). Stressors that are too great for piglets to overcome may lead to poor performance, susceptibility to disease and increase mortality. Organic osmolytes (such as betaine) maintain cell integrity under environmental stress to improve the performance of broilers. Addition of betaine to swine diets has been noted to increase ADG (average daily weight gain) in finishing pigs (Matthews *et al*., 1998). Other authors (Esteve-Garcia and Mack, 2000) however reported no effect of betaine on growth performance of animals. Betaine has improved average daily gain in finishing pigs (Haydon *et al.,* 1995). Madubuike and Ekenyem (2006) stated that haematological assay of livestock suggests the physiological disposition to their nutrition.

This study examined the effects of dietary betaine in its hydrochloride form on the average daily weight gain (ADG) and haematological parameters on postnatal piglets.

Materials and Methods

Three sows was used for this study. Nine piglets were randomly selected from each sow. The sows fed their respective piglets from day 1 to 28. Betaine hydrochloride supplements were given to each piglets except the piglets on the control (0g betaine hydrochloride). Each group of piglets per sow was replicated 3 times in a completely randomized design, and were orally administered 0, 0.05 and 0.1g betaine hydrochloride respectively daily for 28 days**.** Weight of the piglets was taken daily and weight gain calculated. Blood samples was also drawn from their jugular vein on days 14, 28 and 42 to ascertain their health status. Afterthe 28 day the piglets were weaned. The study was terminated on day 48.

The data collected were subjected to analysis of variance (ANOVA) using the completely randomized design (CRD). Significant differences in treatment means were separated using Duncan's New Multiple Range Test as outlined by Obi (1990) at 5 % level of probability.

Results and discussion

Results on the effect of betaine hydrochloride supplementation on ADG and haematological parameters (table 1) revealed that there was no significant (P>0.05) influence of betaine hydrochloride. The haematological indices considered are PCV, Hb, lymphocyte and eosinophils.

Table 1:Effect of betaine supplementation on weight gain andhematological indices on postnatal piglets

Parameters	Control 0gBetaine	0.05g Betaine	0.1g Betaine	SEM
ADG(kg)	6.38	7.54	5.83	0.33
PCV(%)	33..00	34.50	47.5	5.31
Haemoglobin(g/dl)	10.63	11.30	13.20	0.83
RBC(10^6/L)	11.27	11.76	11.98	0.38
WBC(10^3/L)	11,166.67	9,875.00	10,975.00	759.01
Lymphocytes (%)	63.00	58.50	61.00	1.70
Eosinophil (%)	1.07	2.00	1.75	0.93

ADG:Average daily weight gain, PCV:Packed cell volume, RBC:Red blood cell, WBC:White blood cell

The mean values for all haematological parameters in pigs obtained in this study fell within the normal physiological range for pigs according to (Mitruka and Rawnsley, 1977). The values of PCV obtained from the piglets with supplemental betaine hydrochloride indicate nutritional adequacy, though high PCV value of 47.50% was obtained from piglets with 0.1gbetaine hydrochloride supplementation. The PCV mean values indicate that dietary betaine had no adverse effect on the blood level and piglets were not anaemic. This is attributed to the effect of betaine addition which has the capacity to regulate blood temperature and keep it at equilibrium (Campbell *et al.,* 2013). Also, RBC values were similar for all piglets irrespective of supplemental betaine hydrochloride, this shows that blood level and immunity status of piglets were not negatively affected. WBCs, lymphocyte and eosinophil count all fell within the level recommended for piglets according to Mitruka and Rawnsley (1977).

The WBCs are involved in antibody formation and cell-mediated immunity (Iheukwemere and Odinamuo, 2009) and also plays a major role in defending the body against disease-producing microbes. This observation could be attributed to the evidence that betaine had improved the immune system in the blood via increasing the health status of the pigs (Fernandez *et al.,* 2009). Lymphocytes and eosinophil are a type of WBC which is capable of phagocyting bacteria. Betaine supplementation has been able to boost these haematological parameters to keep the piglets against invading bacteria and also assist to maintain physiological and environmental stress when weaned from their mothers. There was no significant effect of betaine hydrochloride (p>0.05) in the ADG of piglets irrespective of the level of supplementation. This agrees with other authors who revealed minimal or no effect of betaine supplementation on animal performance (Esteve-Garcia and Mack, 2000). Though there was a numerical increase in the ADG of piglets supplemented with 0.1g betaine, Smith *et al.* (1995) also reported an increase in ADG of pigs supplemented with betaine. This shows that betaine affects growth performance of pigs, but the effects have been variable(Attia *et al.,*2005).In the present study, doses of betaine hydrochloride used were between 0 and 0.1% on ADG and haematological parameters, whereas most studies with betaine as a dietary supplement for pigs have utilized either 0.1 or 0.125 g betaine.

Conclusion and Recommendation

Therefore, the results suggest that betaine hydrochloride supplementation on postnatal piglets had no deleterious effect on ADG and haematological indices. The use of betaine hydrochloride could be recommended at the rate of 0.1g for postnatal piglets.

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