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EFFECTS OF PRE-WEANING SUPPLEMENTATION OF BETAINE HYDROCHLORIDE ON WEIGHT GAIN AND HAEMATOLOGICAL 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 with each sow having nine piglets. The sows were fed the same quantity and quality of feed to enable them to cater and nurture their piglets from day 1 to 42. Each group of piglets per sow was replicated three times in a completely randomized design and were orally administered 0.0g, 0.05g, 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 on day 14, 28, and 42. The data obtained were subjected to analysis of variance (ANOVA) with $\infty_{0.05}$ as significant. The result showed 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 (7.5kg) while piglets on 0.05g betaine hydrochloride and the control weighed 5.83 and 6.38kg respectively. In conclusion, results obtained showed that betaine hydrochloride did not negatively impact the piglet's 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 soluble. As a feed additive, betaine is also available in a purified form and is 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 levels. 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 the endogenous metabolism, dietary betaine supplementation may be beneficial to maintain or improve the health and performance of animals (Fu, *et al*., 2022). Studies on the dietary effect of betaine

revealed variable results in animal performance (Attia *et al.,* 2005, Yating *et al*., 2021, Zhang *et al.,* 2014, Hwang *et al*., 2010*).* 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, disease susceptibility, and increased mortality. Organic osmolytes (such as betaine) maintain cell integrity under environmental stress to improve the performance of broilers. The addition of betaine to swine diets has been noted to increase ADG in finishing pigs (Mathews *et al.,* 2001). Other authors (Esteve-Garcia and Mack 2000) however reported no effect of betaine on the growth performance of animals. However, betaine has improved average daily weight gain in finishing pigs (Haydon *et al.,* 1995). Madubuike and Ekenyem (2006) stated that haematological assay of livestock suggests the physiological disposition of their nutrition.

This study examines 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

The study was carried out in the piggery unit of the Department of Animal Science and Animal Technology Teaching and Research Farm of Benson Idahosa University, Benin City, Edo State, Nigeria. Three sows were used for this study. Nine piglets were randomly selected from each sow. The sows were fed the same quantity and quality of feed to enable them to cater and nurture their respective piglets from day 1 to 42. Each group of piglets per sow was replicated three (3) times in a completely randomized design, and betaine hydrochloride was orally administered daily at the rate of 0.0g, 0.05g, and 0.1g respectively for 42 days. Betaine hydrochloride supplements were given to each piglet except the piglets on the control (0.0g betaine hydrochloride). The weight of the piglets was taken daily, and weight gain was calculated as the initial weight subtracted from the final weight Blood samples were also drawn from their jugular vein on days 14, 28, and 42 to ascertain their health status. The blood samples were collected in bottles containing anticoagulant (EDTA) for haematology. The collected blood samples were kept at slanting position for 45 mins and stored at –20°C for analysis. The haematological parameters such as packed cell volume (PCV), haemoglobin, red blood cell, white blood cell (WBC), lymphocytes and eosinophil were estimated by using Hematoanalyzer (Nihon Khoden, Japan). After 42 days, the piglets were weaned, and the study was terminated on day 48.

Data Analysis

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

Results on the effect of betaine hydrochloride supplementation on ADG

parameters (Table 1) revealed that there was no significant (P<0.05) influence of betaine hydrochloride on the piglets. Pigs given 0.05g betaine hydrochloride had the highest ADG (7.54kg) when compared with those piglets on the control (6.38kg) and 0.1g (5.83kg) betaine supplementation.

Table 1: Effect of betaine hydrochloride supplementation on the average daily weight gain on postnatal piglets

Betaine hydrochloride (g)	ADG (kg)
Control (0.0g)	6.38
0.05g Betaine	7.54
0.1g Betaine	5.38
SEM	0.33

ADG: Average Daily Weight Gain, SEM: Standard Error of Mean

Results on the effect of betaine hydrochloride supplementation on haematological parameters (Table 2) revealed that there was no significant (P<0.05) difference of betaine hydrochloride on the piglets. The haematological indices considered are Packed Cell volume (PCV), Haemoglobin (Hb), lymphocyte, and eosinophils. Numerical increases were observed for the PCV of piglets on 0.1g (47.5%), haemoglobin (13.20g/dl), and RBC ($11.98*10^6$L). Higher values were also observed for the WBC of piglets on the control (0.0g betaine) - $10,975*10^3$L and lymphocytes (63%). Eosinophil was highest for piglets given 0.05g (2.00%) betaine hydrochloride supplementation.

Table 2: Effect of betaine hydrochloride supplementation on the haematological indices of postnatal piglets

Parameters	Control 0.0g Betaine	0.05g Betaine	0.1g Betaine	SEM
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

Mean values in the same row without letters are not significantly different (*P >0.05*)
PCV: Packed Cell Volume, RBC: Red Blood Cell, WBC: White Blood Cell

DISCUSSION

The results revealed that betaine supplementation had no significant effect on the haemoglobin (Hb), packed cell volume (PCV), red blood cell (RBC) count, white blood cells (WBC) count, lymphocytes, and eosinophil. This report agrees with Alok *et al.* (2019) and Gao *et al.* (2020), these authors had similar results with the use of betaine on haematological parameters. 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 a high PCV value of 47.50% was obtained from piglets with 0.1g betaine 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.

White blood cells, lymphocytes, and eosinophil counts all fell within the level recommended for piglets according to Mitruka and Rawnsley (1977). The white blood cells are involved in antibody formation and cell-mediated immunity (Iheukwemere and Odinamuo, 2009) and play 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 by increasing the health status of the pigs (Fernandez *et al.,* 2009). Lymphocytes and eosinophils 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 assist in maintaining physiological and environmental stress when weaned from their mothers Gao *et al.* (2020).

There was no significant effect of betaine hydrochloride ($P>0.05$) in the ADG of piglets irrespective of the level of supplementation (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 the 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 0.0, 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 0.125g betaine, all reports have been positive.

CONCLUSION

The study suggests that betaine hydrochloride supplementation on postnatal piglets had no deleterious effect on average daily weight gain and haematological indices. The use of betaine hydrochloride could be recommended at the rate of 0.1g for postnatal piglets.

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