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USE OF MILK BY-PRODUCT AS ADDITIVE IN DIET OF WEANER PIGS

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ABSTRACT

The study assessed effect of powder milk waste (PMW) on the performance of weaner pigs. A basal diet that met the nutrient requirements of weaner pigs was formulated, which served as the control diet (Diet 1). Powder milk waste was added to the basal diet at 0.5 and 1 % to make diets 2 and 3 respectively. Fifty-four (54) weaned pigs (Large White × Landrace), average 11.8 ± 1.21 kg body weight (BW), were apportioned to three treatments by BW in three replications with 6 pigs per replicate in a completely randomized design. Pigs were fed each treatment diet throughout the experimental period using concrete drinker and semi-automatic feeders. Feed and water were supplied *ad libitum*. Weekly feed intake was recorded while body weight gain and feed conversion ratio were calculated. The experimental period was 28 days. Data obtained were subjected to one-way analysis of variance (ANOVA) using General Linear Model. The means were separated with the aid of Duncan's Multiple Range test. The performance indices had no significant ($p>0.05$) difference among dietary treatments. There was non-significant ($p>0.05$) treatment effect on daily weight gain, daily feed intake and feed conversion ratio. However, pigs fed diet with 0.5% PMW had improved daily weight gain (0.42 kg), better feed conversion ratio (2.64) and higher daily feed intake (1.11 kg). It was therefore concluded that addition of powder milk waste in the diets of weaner pigs had no deleterious effect on the performance of the animals.

Key words: Milk by-product, milk composition, weaner pigs, performance

INTRODUCTION

The use of more digestible protein from animal source is preferred to those from plant origin in weaner pig diets. This has been shown to improve gut health and result in improved growth performance. Protein from animal sources such as milk powder in piglet diets have been reported to be beneficial for intestinal development and health, especially after weaning (Le Huërou-Luron *et al*., 2018). According to Wellock *et al*. (2006), pigs offered diets based on dried skimmed milk powder had higher feed intake, greater rates of gain and improved feed conversion ratio than those offered soya-based diets.

Many studies have also shown that the use of protein from animal sources such as milk powder in piglet diets prevented behavioral disorders (manipulative, agonistic and abnormal behavior) and led to better performance (Araújo *et al*., 2010; Bouzerzour *et al*., 2012; Pluske *et al*., 2018). Milk and animal-based products were included in early nursery pig diets to help weaned pigs transition from a milk-based liquid

diet to a plant-based powdery diet. Previous research had demonstrated that increasing the levels of lactose (milk by-product) in nursery pig diets using dried whey resulted in an improvement in pig performance (Mahan *et al*., 2004). Milk powder had been reported to have a good amino acid profile and high digestibility. According to Mansoub (2011), milk powder protein was highly digestible and contained excellent amino acid profile responsible for increment in body weight gain. The ability of powder milk to improve the acceptance of the diet and promoted the development of the digestive tract made it an optimal feed component for piglets (Le Huërou-Luron *et al*., 2018). Supplementation of animal feed with the suitable feed additive was controlled with its economic benefits. Therefore, the use of industrial by-products which were usually discarded was an advantage (Juan *et al*., 2016). At present, a relatively large proportion of the produced powder milk unfit for human consumption was discarded which may have a negative environmental effect. There is a need for their alternative use in order to address the environmental issues. Therefore, it was hypothesized that use of powdery milk waste as feed additive in weaner pig diets could improve growth performance of the animals.

MATERIALS AND METHODS

Experimental location and duration

The study was carried out at AK Research Farms, Eleyele, Ibadan, Oyo State, Nigeria. Ibadan falls within the rain forest-savanna transition zone with an annual rainfall of 955 - 1100mm and temperature that ranges between 18 and 38°C as obtained from the Institute of Agricultural Research and Training (IAR&T), Ibadan Meteorological Station. The experiment lasted 28 days.

Experimental Animals Diets, , Design and Management

Fifty-four (54) weaner pigs of average weight of 11.8±1.21 kg were randomly apportioned to the three dietary treatments with each treatment having eighteen (18) pigs and three replicates with six (6) pigs per replicate. The animals were randomly allocated to the experimental treatments in a completely randomized design.

A basal diet that met nutrient requirement for weaner pigs (NRC, 2012) was prepared using common feed components (soybean meal, maize, palm kernel cake, wheat bran, maize bran and fish meal). Different levels (0.5 and 1%) of powder milk waste (PMW) obtained from FAN milk industry were added to this basal diet, representing three different dietary treatments: diet 1 which was the basal diet served as control diet without additive. In diet 2, 0.5% powdery milk waste was added to the basal diet while diet 3 contained 1% powdery milk waste (Table 1). The semi-automatic feeders were refilled twice daily (morning and evening) to provide *ad libitum* feed supply. Standard management practices were duly observed.

Feed leftovers were weighed at the end of every week to determine the weekly feed consumption on pen basis and thus the average daily feed intake per day and peranimal. Daily weight gain and feed conversion ratio were calculated. Data obtained were subjected to One-way Analysis of Variance (ANOVA) using General Linear Model of SAS (2002).

Table 1: Gross Composition of the Experimental Diets

Ingredients	Diet 1	Diet 2	Diet 3
Maize	45.00	45.00	45.00
Soybean meal	24.00	24.00	24.00
Fishmeal	3.00	3.00	3.00
Palm kernel cake	7.34	7.34	7.34
Maize bran	5.00	5.00	5.00
Wheat bran	10.00	10.00	10.00
Palm oil	2.00	2.00	2.00
Bone meal	1.60	1.60	1.60
Limestone	0.80	0.80	0.80
Methionine	0.03	0.03	0.03
Lysine	0.45	0.45	0.45
Threonine	0.03	0.03	0.03
Vitamins/Minerals premix	0.25	0.25	0.25
Common salt	0.50	0.50	0.50
Powder Milk waste	-	0.50	1.00
Total	**100.00**	**100.50**	**101.00**
Calculated values			
Metabolizable energy (Kcal/kg)	2908	2922.54	2937.08
Crude protein (%)	20.21	20.34	20.47
Crude fibre (%)	4.62	4.62	4.62
Lysine (%)	1.48	1.49	1.51
Methionine (%)	0.39	0.40	0.40

Data Collection and Analysis

Feed leftovers were weighed at the end of every week to determine the weekly feed consumption on pen basis and thus the average daily feed intake per day and animal. Daily weight gain and feed conversion ratio were calculated. Data obtained were subjected to One-way Analysis of Variance (ANOVA) using General Linear Model of SAS (2002).

RESULTS AND DISCUSSION

The analyzed nutritional composition of the test ingredient is presented in Table 2. The powder milk waste (PMW) incorporated in the experimental diets contained the following nutrients composition; 24.50% crude protein, 18.33% crude fat, 5.06% ash, 22.62% total sugar and 11.55% dietary fibre. The mineral compositions include 0.83, 0.71, 0.34 and 1.00%

respectively for calcium, phosphorus, sodium and potassium. The analyzed crude protein and crude fat values obtained in this study closely agreed with the earlier report of Moran (2012). The author reported 20-24 and 15-20% respectively for crude protein and crude fat. Ata and Al-Masad (2015) reported a lower value (21%) for crude protein and higher value (20%) for crude fat in a study with broiler chickens. Similarly, Ata and Al-Masad (2015) recorded lower value for calcium (0.57%) while higher values were recorded for ash (7.84%) and sodium (0.64%). The authors reported similar values for phosphorus (0.7%) and potassium (1.0%) when compared with that of the present study.

Table 2: Nutritional Compositions of the Test Ingredient (powder milk waste)

Parameter	Value (%)
Crude protein	24.50
Fat	18.33
Ash	5.06
Total sugar	22.62
Dietary fibre	11.55
Calcium (Ca)	0.83
Phosphorus (P)	0.71
Sodium (Na)	0.34
Potassium (K)	1.00

Performance of Weaner Pigs Fed Diets Supplemented with or without Powder Milk Waste

The performance indices of the weaner pigs fed diets supplemented with or without powdery milk waste are presented in Table 3 below. The weaner pigs were uniformly distributed at the onset of the experiment. This is evident by the insignificant probability value ($p=0.907$) of their initial weights across the treatments. The final body weight of the pigs across the treatments were similar and not statistically different ($p>0.05$) from one another. The highest but non-significant value (24.16 kg) was observed in pigs fed with 0.5 % powder milk waste while the lowest final body weight (20.93 kg) was observeed in pigs placed on control diet (0% PMW). At 0.5% inclusion of PMW, the pigs had improved body weight gain and feed conversion ratio compared with those fed diets that contained 0 and 1% PMW. There was about 12.4% increment in final body weight of pigs placed on the diet containing 0.5% PMW when compared with others. Negligible difference was observed between pigs fed diet without PMW and those on diet with 1% PMW. The body weight gains of the pigs across the treatments were not significantly ($p>0.05$) different and followed similar pattern with their final body weights. The pigs on diet with 0.5% PMW had 16.8 and 22.9% improvement in body weight gain when compared with those fed 0 and 1% PMW respectively. Again, the daily weight gains were comparable though slightly higher (0.432 kg) in pigs placed on diet with 0.5% PMW while the lowest daily weight gain

(0.33 kg) was observed in pigs fed diet with the highest PMW inclusion level (1%). The daily feed intakes were not significantly different across the treatments; the values ranged from 0.91 to 1.11 kg with the highest and lowest obtained in pigs placed on diets with 0.5 and 1% PMW respectively. Among the feed conversion ratios (FCR), the difference was negligible ($p>0.05$) with best FCR (2.64) found in pigs fed diet with 0.5% PMW and the worst (2.79) was observed in pigs placed on diet without PMW supplementation.

Most diets have been found to be inadequate according to organic production standards or ecological targets (Quander-Stoll *et al*., 2020). The use of animal-sourced proteins such as milk powder in piglet diets has been reported to prevent behavioral disorders such as manipulative, antagonist and other abnormal behaviours with consequent better performance (Bouzerzour *et al*., 2012; Pluske *et al*., 2018). This observation agreed with the findings of this study in which there was improvement, though non-significant, in body weight and daily weight gain of pigs fed diet with powder milk waste at 0.5% inclusion level. The improvement in the body weight gain as mentioned above, may be because of the influence of the type of protein source (powdery milk waste), on both the development of the digestive tract and its microflora as reported by Poulsen *et al*. (2017). While lack of improvement in pigs fed 1%, PMW may be ascribed to higher inclusion of the powder milk waste in the diet that might cause diarrhea for the animals, hence poor growth performance. The results disagreed with earlier findings of Mahmmod *et al.* (2014), who stated, that body weight gain increased in broiler birds, fed rations supplemented with milk by-product (dried yogurt powder) during the period of 22-35 days experimental period.

There was no significant difference observed in daily feed intake of the pigs across the treatments was in consonance with the results of Ata and Al-Masad (2015), who reported similar daily feed intakes in broilers fed diet with 0 and 0.5% milk powder. Although, there was slight increment in daily feed intake of pigs fed diet containing 0.5% milk powder in this study. The increment in feed intake of pigs fed diet with 0.5% powder milk waste over those without powder milk waste may be as result of increased diet acceptance caused by the presence of lactose in the milk (Le Huërou-Luron *et al*., 2018). With the above explanation, it is expected that pigs fed diet with higher inclusion (1.0%) of powder milk waste should record higher feed intake, but this was not so. This might suggest that higher level (1.0%) of powder milk waste was unsuitable for weaner pigs possibly because of higher content of the sugary lactose present in the diet. The results of this study are in harmony with earlier findings of Kermanshahi and Rostami (2006) in which there was no significant difference in feed intake for birds fed rations supplemented with dried milk whey powder and those fed with control diet. The non-significant effect of the powder milk waste on the performance of the weaner pigs may be an indication that use of powder milk waste in weaner diets as an additive may not be necessary using ‘over the top approach’ rather than adjusting the diet formulation to reduce nutrients.

Table 3: Performance of the Weaner Pigs Fed with the Experimental Diets

Parameters	Diet 1	Diet 2	Diet 3	SEM	P-value
Initial weight (kg)	11.083	12.322	12.038	1.0501	0.9075
Final Weight (kg)	20.933	24.156	21.167	1.9513	0.8026
Total weight gain (kg)	9.850	11.833	9.128	0.9897	0.5781
Daily weight gain (kg)	0.352	0.423	0.326	0.0353	0.5781
Daily feed intake (kg)	0.976	1.114	0.911	0.1022	0.7650
Feed conversion ratio	2.791	2.638	2.740	0.0565	0.5962

SEM; standard error of means

CONCLUSION AND RECOMMENDATION

The use of powder milk waste at 0.5% in the diets of weaner pigs has no demerit on the performance of the animals. Therefore, 0.5% inclusion of powder milk waste in the diets of weaner pig is acceptable for optimum growth performance.

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