RESPONSES OF GROWER-FINISHER PIGS TO DIETS CONTAINING VARYING LEVELS OF WHEAT BRAN WITH OR WITHOUT OPTIZYME – AN EXOGENOUS ENZYME COMPLEX

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ABSTRACT

Three isonitrogenous diets containing 20, 30 and 40% wheat bran (WB) were formulated and fed ad libitum to grower-finisher pigs. The 20% WB diet was the Control diet while the 30 and 40% WB diet were described as the experimental diets and both of these had 50g. of an exogenous feed enzyme complex known as OPTIZYME added to every 100kg. of the diet. A total of 15 pigs in 5 replicates were used for the study which was terminated when the individual pigs attained liveweight of 70 ± 0.5kg.

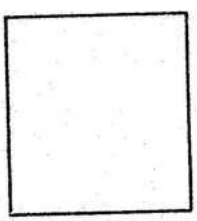
The mean values for daily weight gains and feed conversion efficiency were similar (P>0.05) for the pigs fed the 3 diets but mean daily feed intake was highest (P<0.05) for the pigs fed the WB_{30} + OPTIZYME diet. The pigs fed the WB_{40} + OPTIZYME diet also had a significantly (P<0.05) higher feed intake than pigs fed the Control (WB_{20}) diet. Both feed cost and feed cost per kg. liveweight values were decreased as the level of WB was increased despite the extra cost of the added OPTIZYME. The carcass characteristics of the pigs on all the 3 dietary treatments were similar (P>0.05). It was concluded that grower-finisher pigs can be fed as much as 40% WB without any adverse effects on growth performance, except for an increase in feed intake and carcass characteristics. Such high WB plus OPTIZYME were in fact cheaper to formulate and feed.

Keywords: *High Wheat bran, Optizyme, Growth Performance, Carcass Characteristics.*

INTRODUCTION

Wheat bran (WB) has been described as an agro-industrial by-product and together with varying amounts of maize, protein sources such as fishmeal and soya bean meal and vitamins and minerals, it provides all the nutrients required by commercial poultry and pig farmers in Ghana. Most of these ingredients contain carbohydrates, proteins and oils with the carbohydrate portion consisting of sugars, starch and crude fibre which is now more commonly known as non-starch polysaccharides (NSP). The main NSP in cereal grains and their by-products e.g. wheat bran are arabinoxylans and cellulose.

Monogastric species such as pigs and poultry produce several enzymes naturally in the gastro-intestinal tract (GIT) and it is these which are responsible for the breakdown of complex feed materials into simple absorbable forms for growth, development and reproduction. Diets, which contain high levels of NSP, are poorly digested especially in young monogastric species. This is due to the lack of sufficient quantities of suitable enzymes for NSP digestion. In a recent study it was reported [1] that even in finishing pigs, growth performance and some carcass characteristics are depressed significantly (P<0.05) when the WB level exceeded 40% of the diet. They attributed this to the poor digestibility of such diets. In an attempt to ensure the maximum utilization of all the nutrients in any feedstuff, scientific techniques have been developed to produce exogenous enzymes which can ensure



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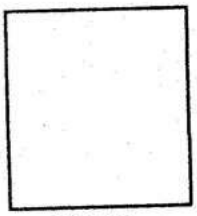

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[1]+*Optizyme: Manufactured by Optivite Ltd and Optivite International Ltd., Main Str; Lancham, Retford, Nottinghamslure, DN22 ONA., UK.*

a more complete digestion of the nutrients present in the feedstuffs. These enzymes have been found to be particularly useful in the digestion of the fibrous fractions of the diets of monogastrics. This then ensures that more of the nutrients are digested and absorbed. OPTIZYME [1] a complex of enzymes, including proteases, amylases, B-glucanases, amyloglucosidases, xylanases, hemicellulases, cellulases, pentosanases, cellubiase and α-galactosidase, is one such product which is currently available on the Ghanaian market.

The objective of the study was to determine the effects of the inclusion of OPTIZYME in pig diets formulated to contain 3 levels of wheat bran, on the growth performances, carcass characteristics and economics of production of grower-finisher pigs.

MATERIALS AND METHODS

The experiment was conducted at the Livestock Section of the Department of Animal Science at the Kwame Nkrumah University of Science and Technology, Kumasi. A total of 15 Large White castrate grower pigs with a mean weight of 20.5kg. were randomly assigned on the basis of liveweight, age and litter origin to three dietary treatments which were designated WB_{20}, WB_{30} + Opt and WB_{40} + Opt. The design employed was the randomized complete block design and each treatment was replicated 5 times i.e. one pig per replicate.

Each pig was housed in a welded mesh concrete-floored cage measuring 160x65cm. A total of 15 of such cages in a grower-finisher barn with an aluminium roof were used. Each cage contained one wooden feed trough and one concrete water trough. Routine management practices such as regular washing of pens and ecto-and endo-parasite control programmes were strictly adhered.

The percentage composition of the three diets is shown in Table 1. All the 3 diets were isonitrogenous and the increasing levels of WB were incorporated at the expense of maize. The WB_{30} and WB_{40} diets also contained lower amounts of fishmeal. Dietary treatment WB_{20} was the Control diet and no OPTIZYME was added to this diet. The two other diets (WB_{30} and WB_{40}) had an additional amount of 50g of OPTIZYME added for every 100kg. of diet. Both feed and water were provided ad libitum and feed spillage was avoided as far as possible.

Feed intake as well as liveweight changes were measured at weekly intervals and from these average daily feed intake and weight gain and feed conversion efficiencies were calculated. Each pig was taken off the experiment when it attained a liveweight of 70 ± 0.5kg. After a 24hr fast, the pigs were slaughtered, dressed and carcass parameters such as dressed weight, dressing percentage, carcass length, backfat thickness, loin eye area, viscera and G.I.T weights as well as the weights of certain body components were determined.

Samples of the feed were analysed for the DM, CP, CF and Ash contents using analytical methods recommended by the Association of Official Analytical Chemists [2]. All the data collected were analysed using the MSTAT procedures of the Michigan State University [3] and the least significant difference (lsd) procedure was used to separate significant treatment means.

RESULTS AND DISCUSSIONS

Growth Performance

The calculated and analysed nutrient composition of the diets are shown in Table 1. As indicated, the diets were isonitrogenous and all contained enough protein to meet the crude protein requirements of the pigs. Diets WB_{30} and WB_{40}, which had higher levels of 30 and 40% WB respectively, contained more crude fibre than the Control diet (WB_{20}) because WB usually has more CF (9.6%) than maize (2.4%).

The results obtained for the growth performance is shown in Table 2. Even though there were numerical differences in the treatment means for the initial and final liveweights of the pigs on the 3 diets, the differences were not statistically significant ($P>0.05$) and did not follow any clear trend. While the total feed intake per pig values were not significantly ($P>0.05$) different, the mean daily feed intake values were different ($P<0.05$) with the value for the pigs on treatment WB_{30} + OPTIZYME being the highest. The fact that these pigs ate significantly more feed than the others may explain why they grew faster ($P>0.05$) and took a shorter duration ($P>0.05$) to attain the final liveweight of 70 ± 0.05kg at the weekly weighing (Table 2). The mean feed conversion efficiency values for the 3 dietary treatments were similar ($P>0.05$) but was slightly better for the pigs on

dietary treatment WB_{30} + OPTIZYME than for the others. The feed cost declined as the level of WB was increased from 20 (Control) to 40% (WB_{40} + Optizyme). This was not unexpected since the higher WB diets contained more of the cheaper WB and lesser amounts of the more expensive maize and fishmeal. At the time of the experiment, the prevailing market prices for WB, maize and fishmeal were 168.00, 459.09 and 1,800.00 cedis/kg respectively. The corresponding price (per kg) of the OPTIZYME was ¢15,000.00 and the feed cost values provided in Table 2 included the additional cost of the OPTIZYME. The feed cost per kg liveweight gain values showed a trend similar to what was observed for the feed cost with the higher WB + OPTIZYME diets being cheaper to feed than the Control (no OPTIZYME) diet. In earlier studies [1, 4, 5] the authors found that diets containing high levels of WB led to depressions in animal performance. The results obtained in this current study suggest that with the inclusion of an exogenous enzyme complex such as OPTIZYME it is possible to feed higher levels of WB to growing pigs without any adverse effects on growth performance and still obtain an improvement in feed cost per kg liveweight gain. It is suggested that the inclusion of the OPTIZYME may have led to the more efficient digestion and absorption of the nutrients in the WB thereby facilitating growth responses that there were similar to and in some instances better than those obtained in grower-finisher pigs fed lower WB but no OPTIZYME diets (e.g. Control or Diet WB_{20}). In an earlier study [6] very good results were obtained in broiler chickens fed another exogenous enzyme preparation known as Roxazyme G.

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Carcass Characteristics

As shown in Table 3, the 3 dietary treatments imposed on the pigs did not lead to any significant ($P>0.05$) differences in the mean values obtained for all the carcass parameters studied. There was however, a clear trend towards a reduction in backfat thickness as the level of WB was increased from 20 to 40% and with the addition of OPTIZYME. A similar finding had been reported earlier [1] when high WB diets were fed to finishing pigs. It is worth mentioning that in the earlier experiment there was significant ($P<0.05$) decrease in mean dressed weight and dressing percentage as the level of WB was increased from 25 to 70% in finishing pig diets. Therefore the similarities in the dressed weight and dressing percentage in this latter study may suggest that the addition of OPTIZYME may have been responsible for the favourable responses observed. The mean absolute and relative weights of Full and Empty GIT tended to increase as the level of WB was increased from 20 to 40% and with the addition of OPTIZYME. While the differences between the various means were not significant ($P>0.05$) it is important to note that Okai et al [1] had reported a significant ($P<0.05$) increase in the absolute and relative full GIT weights when diets containing between 25 and 70% WB were fed to finishing pigs. They had explained that

these significant increases were probably due to a higher gut fill, but it should be noted that a thickening and enlargement of the GIT is a contributory factor as has been indicated by some researchers [7, 8].

CONCLUSION

The results of this experiment have shown that with the inclusion of the recommended level of an exogenous enzyme complex such as OPTIZYME, pig growth performance and carcass traits were not adversely affected when diets containing up to 40% WB were fed to grower-finisher pigs until 70kg liveweight. The extra cost of the OPTIZYME did not cause any increase in overall feed cost since such high WB diets were cheaper and the cost of a unit of the OPTIZYME was not high. Commercial pig and perhaps poultry producers in Ghana should consider the routine use of such enzyme preparations in diet formulation since the animals have better access to more of the nutrients in the feed and thereby produce less faecal material – an important consideration in our current efforts to reduce environmental pollution.

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Table 1: Percentage Composition of Diets

ITEM	DIETARY TREATMENTS		
	WB_{20} (CONTROL)	WB_{30}+ OPT#	WB_{40}+ OPT#
Maize	65.00	56.50	47.50
Wheat bran	20.00	30.00	40.00
Fishmeal	13.00	11.50	10.50
Vitamin trace minerals Premix*	0.25	0.25	0.25
Salt Common	0.25	0.25	0.25
Oyster shell	0.50	0.50	0.50
Dicalcium Phosphate	1.00	1.00	1.00
Total	100	100	100
CALCULATED COMPOSITION (%)			
Crude Protein	17.11	17.02	17.19
Calcium	1.17	1.10	1.06
Phosphorus	0.79	0.76	0.74
Lysine	0.88	0.85	0.84
Methionine	0.40	0.38	0.36
Crude Fibre	3.56	4.32	5.06
Digestible Energy (kcal/kg)	2837.00	2737.10	2567.04
ANALYSED COMPOSITION (%DM)			
Dry Matter	88.67	89.54	88.94
Crude Protein	17.32	17.54	17.33
Crude Fibre	3.23	4.04	4.63
Ash	7.80	8.03	9.10
Ether Extract	3.06	2.50	2.45

*Premix: Supplied the following/kg diet:
Vit. A – 8,000 IU; Vit. D – 3,000 IU; Vit. E – 8IU; Vit. K – 2mg; Vit. B_1 – 1mg; Vit. B_2 – 2.5mg; Vit. B_{12} – 5mcg; Niacin – 10mg; Pantothenic – 5mg; Antioxidant-6mg; Folic acid – 0.5mg; Choline-150mg; Iron-20mg; Manganese-80mg; Copper – 8mg; Zinc-50mg; Cobalt-0.225mg; Iodine-2mg; Selenium-0.1mg.
#The inclusion rate for the Optizyme is 50g/100kg diet.

Table 2: The growth and economic performance of the grower-finisher pigs on the three different dietary treatments

PARAMETER	DIETARY TREATMENTS			SE+	SIG*
	WB_{20} (CONTROL)	WB_{30}+ OPT	WB_{40}+ OPT		
No. of Pigs	5	5	5	-	-
Initial Weight, kg	20.50	20.60	20.60	1.690	NS$^{\phi}$
Final Weight. kg	70.90	70.40	71.80	0.270	NS
Duration. days	85.40	74.20	82.60	3.610	NS
Total Feed Intake. kg	159.19	152.41	158.44	5.160	NS
Daily Feed Intake. kg	1.88^{a}	2.07^{c}	1.94^{b}	0.050	*
Total Gain. kg	50.40	49.80	51.30	1.610	NS
Average Daily Gain. kg	0.60	0.68	0.63	0.020	NS
F.C.E.. Feed/Gain	3.19	3.07	3.12	0.100	NS
Feed Cost/kg. c	579.51	537.78	495.27		-
Feed Cost/kg Gain. c	1847.48	1648.83	1543.26	64.000	NS

S.E. - Standard Error
*SIG - Significance Level
ϕNS - Not Significant
* - Significant at 5%
a,b,c - Values in the same row with different superscripts differ significantly (P<0.05)

Table 3: Mean carcass traits of the pigs fed the three diets

PARAMETERS	DIETARY TREATMENTS			SE+	SIG≠
	WB_{20} (CONTROL)	WB_{30} +OPT	WB_{40} +OPT		
No. of Pigs	5	5	5	-	-
Liveweight at slaughter, kg	69.40	68.70	69.80	0.360	NS¢
Dressed weight, kg	48.53	46.13	48.13	0.460	NS
Dressing percentage, %	69.92	67.15	68.97	0.560	NS
Carcass length, cm	76.10	74.15	75.20	0.490	NS
Backfat thickness, cm	2.53	2.29	2.14	0.140	NS
Loin eye area, cm^2	28.52	25.81	31.11	1.140	NS
ABSOLUTE WEIGHTS OF SOME BODY COMPONENTS, KG					
Shoulder	4.32	3.97	4.29	0.090	NS
Ham	6.88	6.65	7.09	0.120	NS
Belly	5.17	5.00	5.08	0.090	NS
Loin	7.53	6.57	6.94	0.170	NS
Viscera	9.25	10.08	9.83	0.180	NS
G.I.T (Full)	6.21	6.58	6.62	0.150	NS
G.I.T (Empty)	2.97	3.25	3.38	0.090	NS
Heart	0.22	0.21	0.23	0.010	NS
Liver	1.35	1.91	1.46	0.120	NS
Spleen	0.11	0.11	0.10	0.010	NS
RELATIVE WEIGHTS (%) OF SOME BODY COMPONENTS*					
Shoulder	6.23	5.77	6.15	0.110	NS
Ham	9.92	9.66	10.16	0.150	NS
Belly	7.45	7.29	7.28	0.140	NS
Loin	11.20	9.58	9.94	0.270	NS
Viscera	13.33	14.67	14.08	0.570	NS
G.I.T (Full)	8.94	9.57	9.48	0.200	NS
G.I.T (Empty)	4.28	4.74	4.84	0.130	NS
Heart	0.32	0.31	0.33	0.010	NS
Liver	1.94	2.79	2.09	0.190	NS
Spleen	0.16	0.16	0.14	0.010	NS

S.E - Standard Error
≠SIG - Significance level
¢NS- not significant
G.I.T - Gastro-intestinal tract
*Relative weights refer to weight of the components expressed as percentage of carcass weight.