EFFECTS OF HIGH FIBRE DIET ON PLASMA GLUCOSE CONCENTRATION AND TOTAL CHOLESTEROL OF WEANED MALE PIGS

[1]*Ogunwumiju B., [1]Alaba O.,[1]Sokunbi, O. A., [2]Ojo, T. Y. and [1]Abdulsalam K. O.
1Animal Physiology and Bioclimatology Unit, Department of Animal Sciences, University of Ibadan, Ibadan, Nigeria.
2 Department of Animal Production and Health, LadokeAkintola University of Technology, Ogbomoso, Oyo State, Nigeria
**Corresponding author: Ogunwumiju B.; E-mail: anjolababsy@gmail.com; : +23408097108319*

ABSTRACT
The cost of feeding in livestock production account for almost 70% of variable expenses as cereal-based diet makes cost of production unnecessarily high. Blood sugar levels, as principal source of energy for various physiological activities, outside the normal range may be an indicator of health condition. The objective of this study was to investigate the effect of high fibre diet on glucose concentration and cholesterol profile of weaned male pigs. Twelve 6-week old intact weaned male pigs weighing 6.02±0.9kg, were used for the study and randomly assigned to three (3) dietary treatments of different fibre levels 4.5 (control diet 1), 5.5 (diet 2) and 6.5% (diet 3) with four pigs per treatment and two replicates. Data obtained were subjected to descriptive statistics and one-way ANOVA, while significant means were separated using Duncan Multiple Range Test. Results from, show no significant difference across treatments (P>0.05) in feed intake, although pigs in T3 had better feed conversion ratio when compared to other treatments. Likewise weights of pigs in T3 had better weight gain compared to other treatments. Plasma glucose is not significantly affected by dietary fibre, even though each treatment differs in glycemic loads. Early weaned piglets fed moderate-fiber diets (up to 5%) exhibited improved growth performance compared to those on a lower-fiber diet, suggesting potential benefits of moderate fiber inclusion without compromising metabolic health. However, further research is necessary to explore subjective observations and optimize dietary fiber content for optimal growth and resource utilization.
Keywords: Fibre, diet, boar, Serum,

INTRODUCTION

Dietary fibre is usually defined as the indigestible portion of food derived from plant, which forms a key component of many pig diets. Although not fully digested, dietary fibre can affect a number of physiological processes both directly (e.g. by gut fill) and indirectly by production of gas and physiologically by-products following fermentation in the colon (Jarrett and Ashworth, 2018).

The use of dietary fibre has increased in animal nutrition because it can be used as a cheap source of energy and because of its potential to increase animal welfare and reduce abnormal (mainly stereotypic) behaviour. Animal welfare is impaired if the diet does not provide sufficient satiety, combined with an environment that does not meet specific behavioural requirement related to natural feeding habits (e.g. rooting in pigs). Fermentable fibre has been said to increase satiety and prolong postprandial and thereby reduce physical activity, appetitive behaviour for many hours after a meal. Also, fermentable fibre reduced substrate-directed behaviour in sows and physical activity in sows and growing pigs for many hours after meal (Leeuw *et al.,* 2008).The greatest advantage of using high fibre diet is that it improves the reproductive efficiency of pigs. Increase in dietary fibre before mating improves oocyte maturation, prenatal survival and litter size; providing a consumer-acceptable means of increasing the amount of saleable meat produced per sow (Jarrett and Ashworth, 2018).

Various techniques can be applied to enhance nutritional value and utilization of available feed resources. In addition, the extent of fibre utilization is affected by the age of the pig and the pig breed. The use of potential prebiotic effects of dietary fibre is an attractive way to stimulate gut health and thereby minimize the use of anti-microbial growth promoters (Lindberg, 2014). Dietary fibre also changes the nature of the contents of the gastrointestinal tract, which in turn affects how other nutrients and chemicals are absorbed.

The major disadvantage of using fibre in the feed of pigs is that pigs' digestive enzymes cannot break down certain fibre components to a form that can be utilized by the animals. More so, the rate of feed

passage in the pig gut is increased as a result of high fibre diet. Nutrients are also trapped in the fibre matrix making them unavailable for digestion. Fibre also increases the bulkiness of diets which limits the quantity of feed the pig can consume. Blood sugar levels outside the normal range may be an indicator of a medical condition (Mathew *et al*., 2023). A persistently high level is referred to as hyperglycaemia; low levels are referred to as hypoglycaemia. During the first few days of life the new-born piglet is unable to mobilize the low glycogen reserves in the liver to provide adequate levels of glucose in the blood. It is therefore dependent for energy on a regular intake of lactose from the sow's milk. If a piglet cannot obtain sufficient lactose to maintain its energy output, it runs out of energy, its body temperature drops and ultimately it goes into a coma and dies. Hypoglycaemia usually occurs in the first 12 to 24 hours of birth (Staarvik et al., 2019).Cholesterol levels are measured by the concentration of HDL and LDL in the blood. A blood test will identify the amount of HDL, LDL, and triglycerides (the most common type of fat found in the body) present in the blood. A total cholesterol value is calculated by adding the amount of HDL, LDL, and 20% of the triglycerides together (Cordova and Cordova, 2013). Feeding growing pigs with cereal-based diets containing 20% or 40% wheat bran decreased lipid digestibility (Son*et al.,* 2023). Dietary fibre depresses lipid digestibility through several mechanisms. For example, dietary fibre can increase digesta passage rate and thereby limit the time required by digestive enzymes to digest dietary lipids (Agyekum and Nyachoti, 2017).

MATERIALS AND METHODS

Location of the study

The study was carried out at the Piggery Unit of the Teaching and Research Farm of the University of Ibadan, Nigeria (7° 20'N and 3° 50'E, 200 m).

Experimental Animals and Design

Twelve intact six weeks old weaned male piglets (average weight of 6.02 ± 0.9 kg) were used for the study. The piglets were randomly assigned to three dietary treatments of different fibre levels (required, medium, high) with four piglets per treatment, in a completely randomized design. Feed intake, weight gains, Feed Conversion ratio as well as blood was sampled from experimental animals were collected weekly for 3 weeks to assess the serum glucose and cholesterol concentrations.

Table 1: Composition of the Experimental Diets

Ingredient (%)	Diet 1	Diet 2	Diet 3
Maize	49.00	39.00	29.00
Soybean Meal	15.00	15.00	15.00
Corn bran	0.00	10.00	20.00
Wheat Offal	13.00	13.00	13.00
Groundnut Cake	15.00	15.00	15.00
Palm Oil	1.00	1.00	1.00
72 % fish meal	2.00	2.00	2.00
Dicalcium Phosphate	2.50	2.50	2.50
Oyster shell	1.50	1.50	1.50
Broiler Starter Premix	0.25	0.25	0.25
Common salt	0.25	0.25	0.25
Lysine	0.30	0.30	0.30
Methionine	0.20	0.20	0.20
Total	100.00	100	100
Calculated Nutrient Values			
Crude Protein (%)	19.08	18.61	18.14
Crude Fibre (%)	4.77	5.52	6.27
Energy (Kcal/g DM)	2692.70	2562.70	2432.70

Statistical Analysis

Data were analysed using one-way analysis of variance (Statistical Analysis System, version 9.2, 2005) and the differences in mean values where significant were separated using the Duncan Multiple Range Test of the same software.

RESULTS AND DISCUSSION

Results shown in Tables 2 revealed that piglets on Diets 2 and 3 have similar (P>0.05) mean values for WG and FCR with the control, which are similar in week 2 and 3. Though significant differences (P<0.05) in mean values for glucose and cholesterol were observed among treatments, all values fall within normal range (glucose 85-150mg/dL, cholesterol 90-120mg/dL) for these parameters. Glucose and cholesterol concentrations were higher in diet 3, though mean values are statistically similar to those in diet 2, there is significant difference between glucose and cholesterol mean values from those in diet 1. Contributions of each diet to weight gain are shown in figure1.

Table 2: Effects of High fibre Diets on Growth Performance, Glucose and Cholesterol Concentrations of Early Weaned Piglets

Parameters	1	2	3	SEM
WG (g/day)	132.69	260.15	254.28	31.17
FI (g/day)	300	300	300	0.00
FCR	2.45[a]	1.32[b]	1.22[b]	0.26
Glucose (mg/dl)	62.6	67.8	68.77	3.50
Cholesterol (mg/dl)	58.92[b]	63.44[b]	90.23[a]	6.99

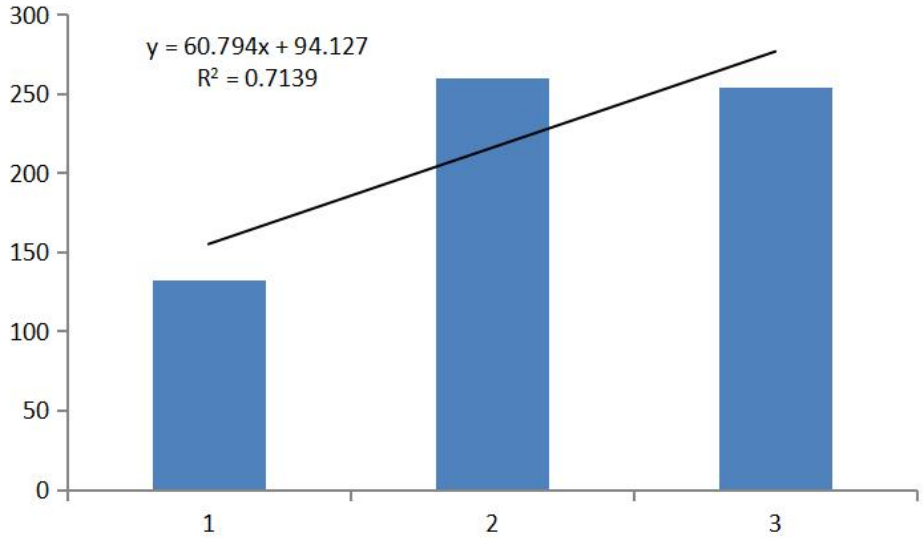

Figure 1: Average weight gain with coefficient of determination r^2

Discussion

Effects of High Fiber Diets on Growth Performance of Early Weaned Piglets:

This study investigated the impact of dietary fiber level on growth performance in early weaned piglets. While subjective observations suggested improved "radiance" in piglets consuming higher fiber diets (Diets 2 and 3), this requires further investigation using objective measures. Interestingly, Diets 2 and 3 resulted in superior average daily gain and feed conversion ratio (FCR) compared to Diet 1. These findings suggest that early weaned piglets can potentially adapt to higher fiber diets without compromising growth performance. This aligns with the hypothesis proposed by Selene and Jarett (2018), suggesting that controlled incorporation of specific fiber types may enhance nitrogen utilization, potentially increasing the availability of nitrogen for protein synthesis and tissue growth.

Effects of High Fiber Diets on Glucose and Cholesterol Concentrations of Early Weaned Piglets:

While significant differences were observed in serum glucose and cholesterol concentrations among groups, all values remained within the established normal range for piglets (Mitruka & Rawsley, 1977). This indicates that the dietary fiber levels employed in this study did not adversely affect these key metabolic parameters. It is important to acknowledge that, as stated by Lindberg (2014), the fiber composition of feedstuffs can influence the glycemic index and contribute to both metabolic and physiological functions.

CONCLUSION:

Early weaned piglets fed diets containing moderate levels of fiber (up to 7% in this study) demonstrated improved growth performance compared to those on a lower fiber diet. Based on the observed parameters, it can be cautiously concluded that moderate fiber inclusion (up to 7%) does not appear to negatively impact the metabolic processes or health status of early weaned piglets. However, further research is necessary to explore the subjective observation of "radiance" and delve deeper into the potential interactions between specific fiber types and their impact on piglet physiology and well-being. Additionally, while this study suggests potential benefits of moderate fiber inclusion, it is crucial to consider that a high FCR observed in some groups suggests the need for further optimization of dietary fiber content and composition to achieve optimal growth performance while minimizing feed waste

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