



## Evaluation of Partial Replacement of Fish Meal with Lablab Purpureus Seed Meal on the Performance of Broilers

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**Abstract.** This study investigated the use of *Lablab purpureus* seed meal as protein ingredient replacing fish meal. One hundred eighty (180) broiler chicks were used in a complete randomized block design. Three treatments were used; A (fish meal, as control), B (30% fish replacement by roasted lablab with enzyme supplement) and C (45% fish replacement by roasted lablab with enzyme supplement). The parameters studied were; feed consumption, weight gain and feed conversion ratio (FCR). Results revealed significant ( $P<0.05$ ) differences in feed intake, weight gain and feed conversion ratio among the treatments. Throughout the study, chicks registered high feed intake on diet C and A while that in group B reported the least. Average weight gains were high for group C and A while group B registered the lowest. Feed conversion ration; lowest for group C and highest in group B. Therefore, a better performance of broilers is enhanced consumption by high intake of feed, high weight gains and low FCR, 45% dietary fish meal can be replaced by *Lablab purpureus* seed meal with enzyme supplement in a compounded broiler finisher.

**Keywords:** Optimization, Alternative protein, Feed technology.

### Introduction

Globally, poultry production is the fastest growing livestock enterprise driven by a combination of factors including demand for animal protein, urbanization, shift in consumption patterns and rapid population growth (Rushton, 2009; FAO, 2010). Additionally, Chicken is very important for household incomes, food security and nutrition (animal protein and micronutrients) contributing 33% of global meat supply, second per capita consumption after pork (36%) (USDA, 2021). The demand for animal protein by the growing world population is steadily increasing particularly in developing countries (OECD and Food and Agriculture Organization for United Nations, 2010; Ravindran, 2013).

In Uganda, poultry, cattle and pig are increasingly promoted to enhance production and productivity of animal and animal products. Although, per capita consumption of poultry meat is still low at 13.4kg compared to the world's estimated at 45.3 kg by 2030 (FAO, 2019; USAID, 2010). Largely (75-90 %), family poultry contributes to total poultry meat consumed (FAO,

2008; USAID, 2010, Komi and Nakimbugwe, 2017). Unfortunately, the extensive system is constrained by low level of genetics, management and lack of application of technology and innovations resulting into reduced quality and quantity of poultry meat; increasingly the gap between supply and demand is expected to continue (Ravindran, 2013). Moreover, there is limited investment in broiler production business (MAAIF and UBOS, 2009, 2010).

Formulation of balanced diets is critical in the profitability of the broiler production. Compounded feed contributes 60-80% of the cost of production, largely (70%) attributed to rising prices of fish meal as protein ingredients which results into expensive formulated feeds (Davis, 2015; Makinde and Olayinka, 2015; Komi and Nakimbugwe, 2017, Ssepunya *et al.*, 2017). This in turn limits feed availability (quality and quantity) and consequently, hinders efficient animal production and productivity (MAAIF, 2010). In Uganda, the prices of fishmeal doubled in the last decade; from UGX 2,000/kg (USD 1.12) in 2005 to UGX 3,500/kg (USD ~1.0) in 2017 and still increasing with little prospect of receding (Gordon and Ssebisiubi, 2012; Katende, 2017; Komi and Nakimbugwe, 2017). This has made initial investment in the enterprise expensive, limiting new entrants into broiler production business and expansion of the existing farms. As a cope up strategy, most (53.3%) poultry farmers have resorted to formulating homemade feeds with the majority of protein dietary requirement supplied by plant protein sources and a limited part of animal protein sources (Komi and Nakimbugwe, 2017). The commonly used plants protein sources in feed formulation include; soy bean, palm kernel cake, cotton seed cake and sunflower meal, among others. Although, largely (90%) soybean meal is preferably used as plant protein ingredient in poultry diets because of its amino acid profile, unfortunately it's becoming scarce and costly (FAOSTAT, 2012, Ravindran, 2013).

By implication, optimization of alternative protein source ingredients which are less expensive, abundant and easily accessible in formulation of least cost compounded poultry feeds is necessary to realize sustainable and profitable broiler production (Leeson and Summers, 2009, Van Huis *et al.*, 2013). Insects in form of larvae (maggots) and adult flies have increasingly been used as alternative sources of proteins ingredients in production of livestock feeds (Maurer *et al.*, 2015; Makinde and Olayinka, 2015, Van Huis *et al.*, 2013). Plant protein sources that have been used in replacement of fish meal during formulation of poultry feeds include, ground nut cakes, velvet beans, pigeon pea and lablab beans, among others (Abeke *et al.*, 2008). One of the key plants that can be of good use for poultry feed formulation as a partial replacement for fish meal is *Lablab purpureus*. The plant belongs to the family of legumes, Fabaceae with scientific name *Lablab purpureus* and is locally known as Hyacinth bean seeds. It is largely used in livestock feeding by many cattle farmers. The seed can be made available as part of the ingredients for making animal feeds. The use of *Lablab purpureus* seed as livestock feed has limited applicability in spite of the fact it provides a high protein source of 23-25.4%, metabolisable energy (ME) ranges from 347.4 -353.7 kcal/kg, rich in essential amino acids like lysine, and methionine, among others (Soetan and Fafuoso, 2010; Kilonzi *et al.*, 2017). Studies that have attempted to replace fish meal by *Lablab purpureus* seed at levels of 5-30% and have registered poor performance in broilers (Abeke *et al.*, 2008). Currently in Uganda, *Lablab purpureus* seed is mostly utilized in ruminant nutrition with limited applicability in poultry feed production and as human food (Bawa *et al.*, 2003). Moreover, *Lablab purpureus* is a single most legume plant largely grown as local forage legume under integrated sustainable agriculture for ruminant nutrition, nitrogen fixing and soil improvement, and erosion control. Thus, its availability and can be sustainability used in poultry feed formulation. This study evaluated the partial replacement of fish meal with *Lablab purpureus* seeds meal on the performance of finishing broilers.

## Materials and Methods

The experimental study was conducted in a poultry experimental house at Kyanja Agriculture Resource Centre, situated at coordinates 0.4015076 °N and 32.5933198 °E in Kampala district for a period of six weeks. A completely randomized design comprising of three experimental treatments replicated three times was used. The three experimental treatments were: 1, A (0% fish replacement by lablab seed meal, control), 2, B (30% fish meal replacement by lablab seed meal with enzyme supplement) and 3, C (45% fish replacement by lablab seed meal with enzyme supplement). Lablab seed was roasted at 100°C for 30 minutes before grinding it into seed meal to remove anti-nutritional factors (Abeke *et al.*, 2008). A total of 180 experimental units (unsex commercial broiler chicks-Ross breed) were randomly allocated to three replicates each with 60 birds. Treatments A was commercial broiler finisher feed used as a control, B and C were formulated using computer methods based on recommended nutrient requirements (NRC, 1994). The birds were given feed and water ad libitum.

Representative samples of the experimental diets were taken for laboratory analysis to ascertain their chemical composition reference to standard nutrient composition of broiler diet (FAO, 2012). Data was collected during the finishing phase after brooder (three weeks) and adaptation phases (one week). Subsequent sampling for collect data was done at weekly interval.

Data was transcribed into the Micro-soft Excel (Version 2013) for sorting, editing and filtering. Later, it was exported to STATA Microsoft ware for descriptive and inferential analyses. Descriptive analysis generated graphs and charts. Analysis of Variance (ANOVA) generated means, variances and standard means, and significantly different means separated by Duncan's Multiple Range Test at 5% level of significance.

## Results

The results of laboratory analysis of the nutrient composition of the experimental diets are shown in Table 1.

**Table 1:** Chemical composition of the experimental diets

Variables	Experimental treatments		
	A	B	C
DM	95.98	92.63	94.78
EE	1.46	1.20	1.48
CP	19.60	17.60	19.20
CF	9.07	8.05	8.05
Ash	6.31	5.22	6.12
NFE	55.54	49.53	51.42
Lysine	1.10	1.10	1.10
Methionine	0.45	0.35	0.45
Ca%	1.20	1.20	1.20
P%	0.64	0.54	0.54
ME(Kcal/kg)	3102.27	3100.10	3101.26

DM (dry matter), EE (ether extract), CP (crude protein), CF (crude fibre), NFE (nitrogen free extract), Ca % (calcium percentage), P % (phosphorus percentage), ME (metabolizable energy).

The findings indicate that the specific energy levels of the control experimental diets (A) and the formulated (B & C) were consistent with recommended standard nutrient composition ration for feeding broilers. Further, the results showed that feed intake of broilers on different experimental diets varied significantly ( $P < 0.05$ ) with a higher average feed intake of experimental diet C throughout 28-49 days (Table 2).

**Table 2.** Average feed intake of broilers (g/day) fed on experimental diets

<b>Experimental Treatment</b>	<b>28-35 days</b>	<b>36-42 days</b>	<b>42-49 days</b>
A0%	80.5 <sup>b</sup>	102.9 <sup>b</sup>	125 <sup>b</sup>
B30%	68 <sup>a</sup>	97 <sup>a</sup>	123 <sup>a</sup>
C45%	84.5 <sup>c</sup>	107 <sup>c</sup>	128 <sup>c</sup>
s.e.d	0.01	0.01	0.01
l.s.d	0.02	0.02	0.01
CV %	1.5	1.1	0.5
<i>F pr.</i>	0.001	0.001	0.001

Means with similar letters in a column are not significantly different at  $p \leq 0.05$  based on the Duncan's Multiple Range Test.

Similarly, the study explored the performance of birds in terms of average daily weight gains and feed conversion ratios. The results revealed increase in mean daily weight gain during the experimental period. Treatment C expressed the highest average daily weight gain throughout the 28-49 days' period with maximum of 100.1g in 42-49 days; followed by A at 90.1g and B with the least average daily weight gain at 80.3g (Table3). The variation in average daily weight gains were significant ( $p < 0.05$ ).

**Table 3.** Average daily weight gains of broiler birds fed on experimental diets

<b>Experimental Treatment</b>	<b>28-35 days</b>	<b>36-42 days</b>	<b>42-49 days</b>
A0%	65.4 <sup>ab</sup>	79.6 <sup>ab</sup>	90.1 <sup>ab</sup>
B30%	46.9 <sup>a</sup>	62.8 <sup>a</sup>	80.3 <sup>a</sup>
C45%	88.3 <sup>b</sup>	96.3 <sup>b</sup>	100.1 <sup>b</sup>
s.e.d	0.01	0.01	0.01
l.s.d	0.01	0.01	0.02
CV %	30.7	20.3	33.3
<i>F pr.</i>	0.001	0.001	0.34

Means with similar letters in a column are not significantly different at  $p \leq 0.05$  based on the Duncan's Multiple Range Test.

Regarding the feed conversion ratios (FCR) of broiler feed on experimental diets. The results indicated increasingly trend in FCR as birds aged. However, of all the diets, C expressed the best feed conversion ratios followed by A and least B. More importantly, the variations in FCR were significant ( $P < 0.05$ ) (Table 4).

**Table 4.** Feed conversion rate of broilers fed on the experimental diets

Experimental Treatment	28-35 days	36-42 days	42-49 days
A0%	1.23 <sup>ab</sup>	1.29 <sup>ab</sup>	1.39 <sup>ab</sup>
B30%	1.44 <sup>b</sup>	1.55 <sup>b</sup>	1.53 <sup>b</sup>
C45%	0.96 <sup>a</sup>	1.11 <sup>a</sup>	1.27 <sup>a</sup>
s.e.d	3.50	2.56	4.79
l.s.d	7.19	5.26	9.83
CV %	29.2	21.3	34.7
<i>F pr.</i>	0.015	0.010	0.51

Means with similar letters in a column are not significantly different at  $p \leq 0.05$  based on the Duncan's Multiple Range Test.

## Discussion

There has been an ever-raising cost of poultry feeds in Uganda because of expensive protein ingredients especially fish. This has curtailed investments in the poultry sector, thus impacting on the vulnerable small-scale holders particularly around the urban and peri-urban areas. These largely depend on poultry enterprises as income generating enterprises and source of cheap animal protein. Notwithstanding, there is rising demand and competition on use of silver fish for human consumption and in animal feed. Investigating the potential of alternative protein ingredients to replace fish as animal protein source ingredients is the only desirable intervention now to promote sustainable commercial broiler production. This study is the first of its kind in Uganda to explore the use of *Lablab purpureus* seed meal as an alternative protein ingredient replacing fish (silver fish) in formulating compounded poultry feeds (broiler finisher meal).

Generally, the results have revealed good performance with enhanced consumption of feed, high weight gains and low FCR at 45% replacement of fish by *Lablab purpureus* seed meal. The results obtained showed higher feed intake and weight gains with low feed conversion ratio in broiler chicks. These findings were in agreement with the study by Elamin et al. (2013), who reported significant ( $P > 0.05$ ) effect of lablab diets on weight gains and feed conversion ratio.

On the contrary, the result were inconsistent with the report by Abeke et al. (2008), who noted a significant ( $P < 0.05$ ) reduction in weight gains, feed intake and feed efficiency of broilers fed on compounded feed with increased level of *Lablab purpureus* seeds meal. Similar observations were noted in another study by Okeke et. al. (2003). The explanations for the observed variations are associated with lablab seed processing methods used. Inadequate processing of the Lablab seed fails to completely remove the anti-nutritional factors which are responsible for poor palatability and consequently, decrease feed intake and weight gains. This is supported by Bawa et al. (2003a), who re-affirmed that phytic acid and tannin contents of lablab seed are very resistant to heat treatment and substantial amount remains on heat treatments.

Another observation by Abeke et al. (2008) and Rasha and Abdel (2007), emphasized that proper processing of the *Lablab purpureus* seeds meal effectively reduces the anti-nutritional factors to enable full utilization of nutrients by the birds for better performance. This is because seed roasting at 100°C for 30 minutes reduces inherent anti-nutritional factors (76% destruction of anti-trypsin and phytic acid), boiling breaks trypsin inhibitors and cooking water dissolves the toxic cryogenic glycoside which improves taste, palatability and aroma of the formulated diet (Rasha and Abdel, 2007).

Furthermore, the study exhibited lower feed conversion ratio for experimental diets of 45% replacement of fish by a leguminous *Lablab purpureus* seed meal. This concurred with study by Amaefule and Onwudike (2000), who reported better food conversion ratio in broilers, fed well on roasted pigeon pea and lablab beans meals. Generally, this validates the acceptable view that processing by roasting, cooking and boiling reduces the bio-chemicals (anti-nutritional factors) in the raw form of the legume which affect bioavailability and utilization of nutrients in the digestive system of the bird.

## Conclusion

This experimental study has established that 45% of dietary fish meal can be replaced by *Lablab purpureus* seed meal with enzymes. This conclusion is premised on the improved higher feed intake which translated into increasingly higher average weight gains with impressive low FCR. Therefore, poultry producers should be encouraged to use *Lablab purpureus* seed meal enhanced with enzyme supplement as an alternative protein source ingredient for production of broiler value added feed (broiler finisher). It is recommended that further studies on serology and histological changes due to optimization of poultry feed mix with *Lablab purpureus*, and other processing methods; soaking, cooking and boiling and complete replacement of fish (100%) by *Lablab purpureus* seed meal be conducted.

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