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## **Effect of Dietary Supplementation with *Polyalthia longifolia* - Garlic Powder Mixture on the Growth Performance, Nutrient Retention and Egg Quality of Laying Japanese Quails Fed Corn- Soya Meal Diet**

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# Effect of Dietary Supplementation with *Polyalthia longifolia* - Garlic Powder Mixture on the Growth Performance, Nutrient Retention and Egg Quality of Laying Japanese Quails Fed Corn-Soya Meal Diet

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## ABSTRACT

A study was conducted to assess the effect of dietary supplementation of *P. longifolia* and garlic powder mixture (PLMGPD) on the growth performance, nutrient retention and egg quality of laying Japanese quails. One hundred and fifty (150) sixteen weeks' old laying quails were used for the study. Experimental animals which weighed between 240.4 to 246.1grams were allotted to five dietary treatments of 30 quails per group in a completely randomized design. The five treatments groups had diets containing PLMGPD at 0, 1.5, 2.0, 2.5 and 3.0% dietary inclusion levels. The performance criteria were initial live weight, final live weight, daily weight gain, daily feed intake, feed conversion ratio, hen day production, nutrient retention and mortality while the egg quality characteristics includes egg weight, albumen weight, egg shell thickness, shell weight, egg yolk index, egg yolk colour and egg haugh unit. The feed intake, albumen weight, egg yolk index, egg haugh unit, protein retention, fat retention were not significantly ( $P>0.05$ ) affected by the inclusion of PLMGPD. Significant influences ( $P<0.05$ ) were observed for final live weight, egg weight, egg shell thickness, egg colour and mortality.

The results of this experiment demonstrated that the inclusion of PLMGPD up to 3.0% has no deleterious effect on the performance and health status of laying Japanese quails.

**Key words:** Growth performance, nutrient retention, egg quality, laying quails.

## INTRODUCTION

Complementary medicine is now gaining interest due to bacteria resistance to the available antibiotics and their residual effect on human being and animals. People around the world are now aware of the limitations of the synthetic drugs and chemicals in terms of higher cost, anticipated toxicity and adverse effects (Adu et al., 2009). According to Coe and Anderson (1996) most drugs in vogue that was used in the treatment of bacteria were first isolated from ethno-medicinal plants and other natural sources. Herbal therapy needs to be practiced in poultry industry as growth promoters and for fighting against various infections (Mahima et al., 2012). Medicinal plants produce certain bioactive molecule which exhibits both antibacterial and antifungal cellular oxidation reactions and other pathogens highlighting the importance of starch for natural antimicrobial drugs (Bajpai et al, 2005). *Polyalthia longifolia* and Garlic powder are among the most well known herbs.

Garlic (*Allium sativum*) belongs to the family Alliaceae, it is commonly used as flavoring, culinary and herbal remedies (Mariam and Usna, 2016). Garlic extract contains a higher level of sulfur compounds which is responsible for its medicinal effects (Singh et al, 2008), it is an herbal remedy to treat and prevent a variety of heart diseases, cancer, diabetes and other metabolic diseases (Amagase et al, 2001). It has been demonstrated that garlic has multiple biological activities including antiviral and antibacterial properties attributed to their antioxidant and antiradical activity (Adibmoradi et al, 2006; Khaksefidi and Ghoorchi, 2006). Garlic has been reported to contain allicin which is responsible for its characteristic odour, colour and flavor (Heinrich et al., 2004).

*Polyalthia longifolia* belongs to the family Annonaceae, is an evergreen plant used as an ornamental tree due to its effectiveness in combating noise pollution. Almost all the plant is used in the Indian traditional system for the treatment of various ailments. It possesses significant biological and pharmacological activities such as antibacterial, antifungal, antitumor, anti-ulcer, anti diabetic and antioxidant (Prateek et al., 2014). Previous studies on its leaves,

barks, roots and seed revealed various types of diterpenoids and alkaloids with several biological activities such as anti-inflammatory, antimicrobial and cytotoxic effects. The preliminary antibacterial activity of various solvents extract of *P. longifolia* leaves was studied against six different bacteria by disc diffusion method (thenmozhi and Sivaraj, 2010), the results revealed that all the extract possess potent antimicrobial against all the test pathogenic organisms (Subramanion et al., 2013).

Animal studies revealed that feeding garlic powder at levels of 1.5, 3.0 and 4.5% had no effect on broilers performance (Fadlalla et al., 2010). Sklan et al (1992) observed depressed hepatic cholesterol concentration in chickens when 2% garlic was fed for 14 days. Qureshi et al (1983) reported that garlic powder lowers the serum and liver cholesterol level of birds. Nair et al (2009) reported acute toxicity of *P. longifolia* leaf in mice. Studies performed on the effect garlic powder and *P. longifolia* leaf meal shows that they can improve the immune response and general performance of birds, therefore, it has gained attention in poultry farming because it allows the production of healthy foods. This study was conducted to evaluate the effects of dietary supplementation of *P. longifolia* leaf + garlic powder mixture on the growth performance, nutrient retention and egg quality characteristics of laying Japanese quails fed corn-soya meal diet.

## MATERIALS AND METHODS

### Site of the experiment

The experiment was carried out at Dan- malafia Farms, Oyo State, Nigeria. The experiment was carried out between the months of March to April, 2017, at the farms poultry unit in Ibadan, Nigeria.

#### Preparation and processing of experimental diets

Fresh healthy mature disease free *Polyalthia longifolia* leaves were harvested from Dan-malafia farms, Ibadan. The leaves were separated, first washed with running tap water and then with distilled water, shade dried without any contamination for 8 days and passed through a hammer mill to produce *P. longifolia* leaf meal (PLM). Fresh garlic were purchased from a local market in Ibadan, washed with clean water and peeled. Afterwards the garlic was sun dried for 10 days. It was then hammer milled into garlic powder.

#### Formulation of experimental diets

The *Polyalthia longifolia* leaf meal (PLM) and the garlic powder were mixed together in ratio of 3:1 respectively to form *Polyalthia longifolia* leaf meal – garlic powder mixture (PLMGP). PLMGP were mixed with other materials to form five experimental diets:

Treatment 1: 0% level inclusion

Treatment 2: basal diet + 1.5% level of inclusion of PLMGP

Treatment 3: basal diet + 2.0% level of inclusion of PLMGP

Treatment 4: basal diet + 2.5% level inclusion of PLMGP

Treatment 5: basal diet + 3.0% level inclusion of PLMGP

The diet was formulated to meet the nutrient requirement of broilers according to [NRC, 1994].

### Experimental animals and their management

A total of One hundred and fifty (16 weeks old) laying quails were used for the study which lasted for 60 days. The quails were randomly allocated to five (5) dietary treatments replicated three times with each replicate having ten (10) quails in a completely randomized design (CRD). They were housed in cages whose floor was covered with wood shavings; feed and water were provided ad libitum.

#### Parameters measured

Quails were weighed at the beginning of the experiment and body weight changes was taken thereafter weekly, feed intake was calculated by difference between the feed offered and the left over, feed conversion ratio, feed cost/kg and hen-day egg production, health of the experimental birds were carefully observed and mortality was recorded as it occurred.

The eggs collected from each replicate group on 2<sup>nd</sup>, 4<sup>th</sup> 6<sup>th</sup> and 8<sup>th</sup> week were weighed and the average was taken as the egg weight per treatment. After weighing, three eggs from each replicate were randomly selected and used for egg quality analysis (Haugh unit, yolk height, yolk length and breadth, shell thickness). Yolk index was measured with a pair of Vernier calipers, shell thickness was also determined with a micrometer screw gauge. Haugh unit values were obtained from the formula:

$$HU = 100 \log (H + 7.57/1.7W^{0.37})$$

HU- Haugh unit (%)

H – Height of albumen (mm)

W- Weight of the eggs (g)

### Nutrient retention trial

The nutrient retention trial was carried out at the eight week of the experimental period; a known quantity of feed was given to each replicate and their faecal output were collected over 72 hour period and subjected to further laboratory analysis.

### Laboratory analysis

The proximate components of the *Poyalthia longifolia* leaf –garlic powder mixture and samples of the five experimental diets were determined according to AOAC (2000).

### Statistical analysis

All data obtained were subjected to analysis of variance (ANOVA) using completely randomized design (Steel and Torrie, 1980) and treatment means where significant were separated using Duncan Multiple Range Test (Duncan, 1955).

**Table 1. Composition of experimental diets (%)**

| Ingredients          | Diets  |        |        |        |        |
|----------------------|--------|--------|--------|--------|--------|
|                      | 1      | 2      | 3      | 4      | 5      |
| Maize                | 50.00  | 50.00  | 50.00  | 50.00  | 50.00  |
| Wheat offal          | 15.25  | 15.25  | 15.25  | 15.25  | 15.25  |
| Soya meal            | 32.10  | 32.10  | 32.10  | 32.10  | 32.10  |
| Limestone            | 1.50   | 1.50   | 1.50   | 1.50   | 1.50   |
| Bone meal            | 2.00   | 2.00   | 2.00   | 3.00   | 3.00   |
| Lysine               | 0.15   | 0.15   | 0.15   | 0.15   | 0.15   |
| Methionine           | 0.15   | 0.15   | 0.15   | 0.15   | 0.15   |
| Premix*              | 0.25   | 0.25   | 0.25   | 0.25   | 0.25   |
| Salt                 | 0.30   | 0.30   | 0.30   | 0.30   | 0.30   |
| GLPD +PLM            | 0.00   | 15.0   | 2.00   | 2.50   | 3.00   |
| Total                | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Chemical composition |        |        |        |        |        |
| Crude protein        | 20.10  | 20.11  | 20.11  | 20.11  | 20.11  |
| Crude fibre          | 4.01   | 4.01   | 4.01   | 4.01   | 4.01   |
| Ether extract        | 2.63   | 2.63   | 2.63   | 2.63   | 2.63   |
| Ash                  | 4.76   | 4.76   | 4.76   | 4.76   | 4.76   |
| Calcium              | 1.15   | 1.15   | 1.15   | 1.15   | 1.15   |
| Phosphorus           | 0.31   | 0.31   | 0.31   | 0.31   | 0.31   |
| ME (Kcal/kg)         | 2804.4 | 2804.4 | 2804.4 | 2804.4 | 2804.4 |

\*Premix supplied per kg diet :- Vit A, 15,000 I.U; Vit E, 5mg; Vit D3, 3000I.U, Vit K, 3mg; Vit B2, 5.5mg; Niacin, 25mg ; Vit B12, 16mg ; Choline chloride, 120mg ; Mn, 5.2mg ; Zn, 25mg ; Cu, 2.6g ; Folic acid, 2mg ; Fe, 5g ; Pantothenic acid, 10mg ; Biotin, 30.5g ; Antioxidant, 56mg.

**Table 2. Proximate Composition of Test materials**

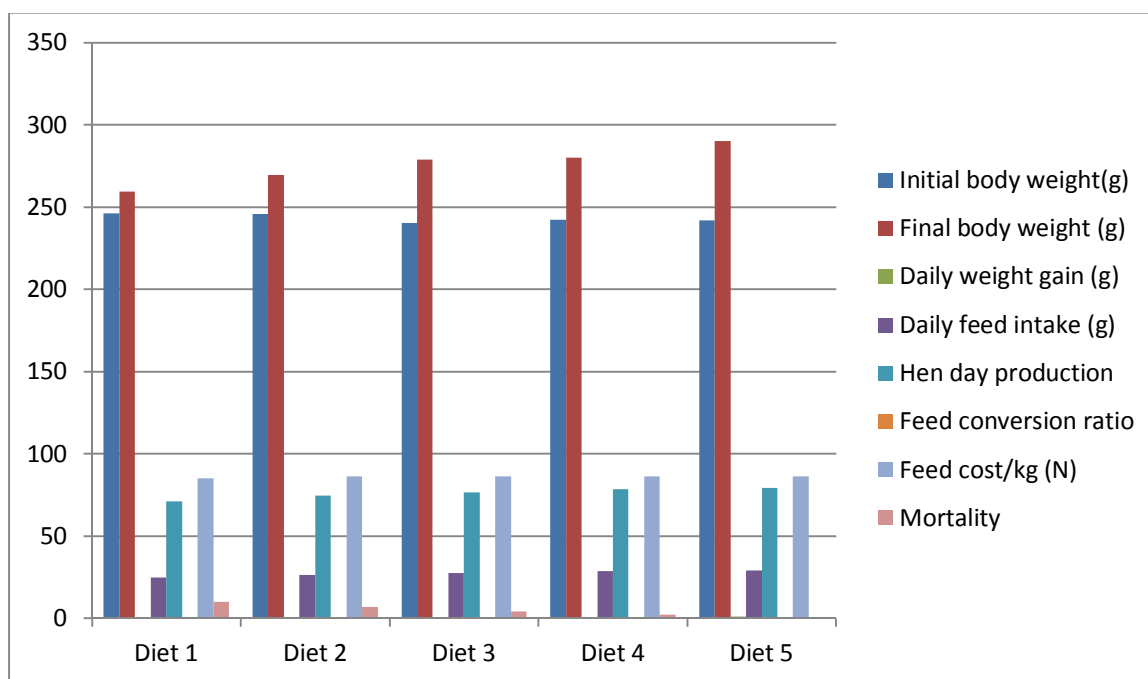
| Nutrients             | % DM  |       |
|-----------------------|-------|-------|
|                       | PLM   | GLPD  |
| Crude Protein         | 10.07 | 7.80  |
| Crude Fibre           | 19.70 | 3.07  |
| Ether extract         | 0.18  | 0.68  |
| Total ash             | 6.02  | 2.49  |
| Nitrogen free extract | 64.03 | 85.96 |

PLM: Polyalthia longifolia leaf meal  
GPD: Garlic Powder

**Table 3. Performance traits of laying Japanese quails fed PLMGPD mixture**

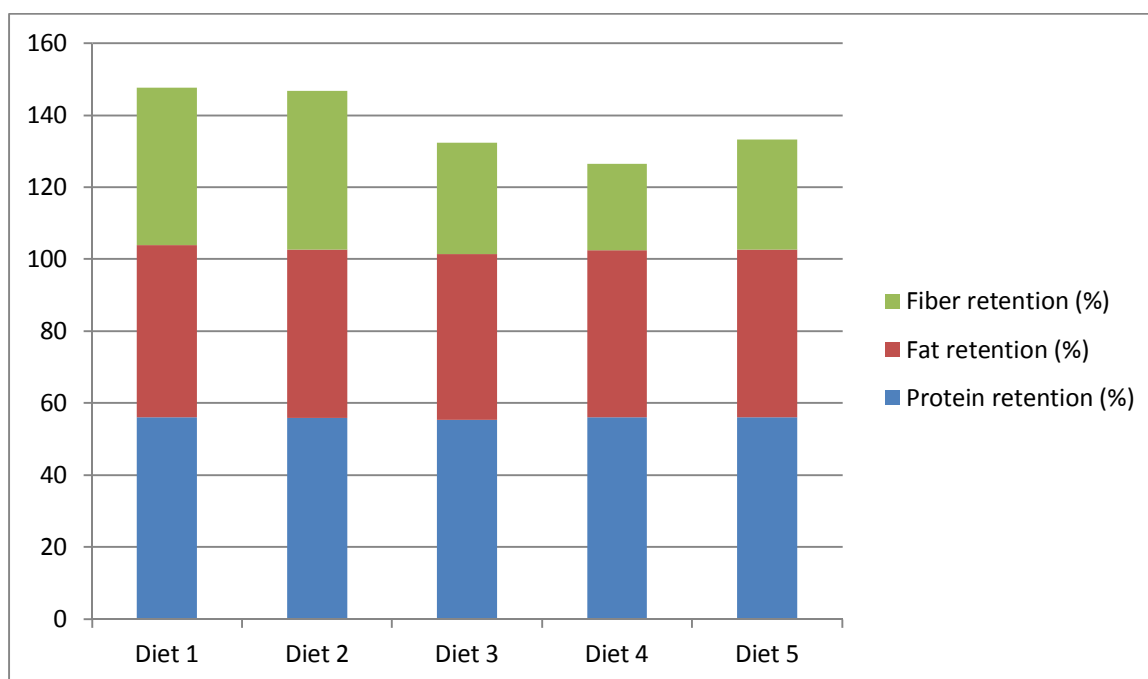
| Parameters              | Diets  |        |        |        |        |       |
|-------------------------|--------|--------|--------|--------|--------|-------|
|                         | 1      | 2      | 3      | 4      | 5      |       |
| SEM                     |        |        |        |        |        |       |
| Initial body weight (g) | 246, 1 | 245.7  | 240.4  | 242.3  | 241.9  | 10.40 |
| Final body weight (g)   | 259.3b | 269.4b | 278.9a | 280.1a | 290.2a | 9.78  |
| Daily weight gain (g)   | 0.25   | 0.40   | 0.64   | 0.63   | 0.81   | 1.23  |
| Daily feed intake (g)   | 24.9   | 26.3   | 27.5   | 28.7   | 28.9   | 1.60  |
| Hen day production      | 71.2c  | 74.6b  | 76.5b  | 78.6a  | 79.2a  | 3.05  |
| FCR                     | 0.40   | 0.41   | 0.36   | 0.35   | 0.35   | 0.03  |
| Feed cost/kg (N)        | 85.0   | 86.1   | 86.2   | 86.2   | 86.2   | 7.62  |
| Mortality               | 10.0   | 7.00   | 4.00   | 2.00   | 0.00   | 0.01  |

FCR – Feed conversion ratio

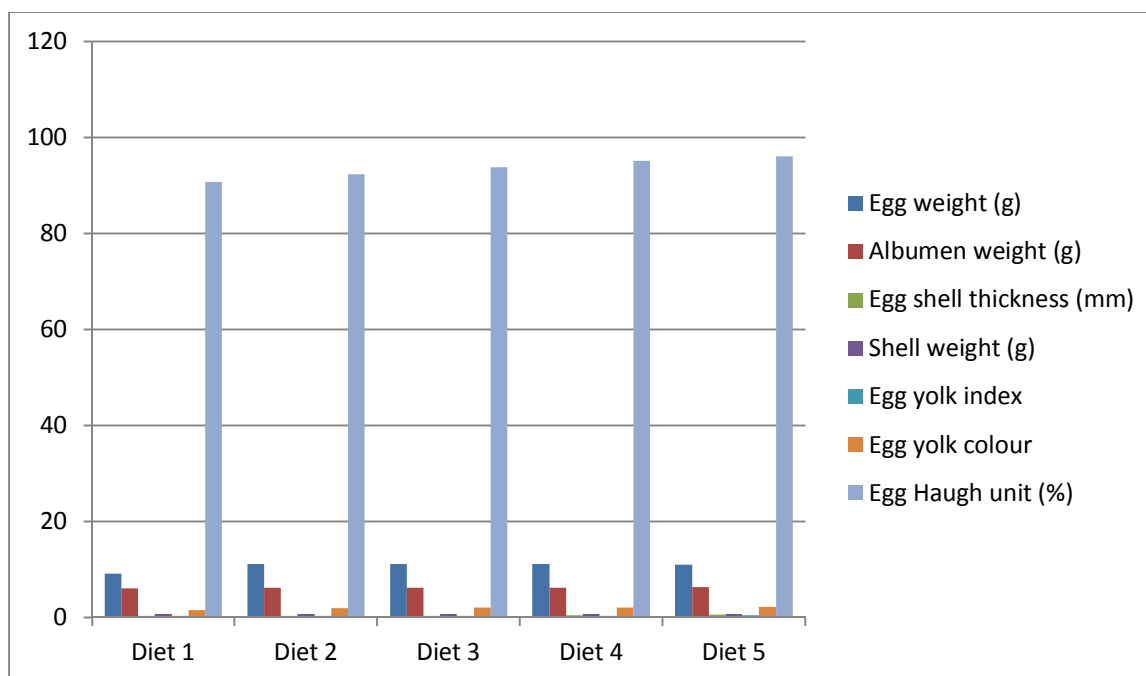
**Figure 1: The effect of dietary inclusion of PLMGPD mixture on the performance of laying quails**

**Table 4. Nutrient retention values of laying Japanese quails fed PLMGPD mixture**

|                       | Diets  |        |        |        |        |
|-----------------------|--------|--------|--------|--------|--------|
| Parameters            | 1      | 2      | 3      | 4      | 5      |
| SEM                   |        |        |        |        |        |
| Protein retention (%) | 56.04  | 55.79  | 55.31  | 56.01  | 56.11  |
| Fat retention (%)     | 47.91  | 46.88  | 46.08  | 46.44  | 46.63  |
| Fiber retention (%)   | 43.76b | 44.02a | 31.06b | 24.01c | 30.51c |

**Figure 2 : The effect of dietary inclusion of PLMGPD mixture on the nutrient retention of Laying quails****Table 5. Egg quality parameters of laying Japanese quails fed PLMGPD mixture**

|                          | Diets             |                    |                    |                    |                    |
|--------------------------|-------------------|--------------------|--------------------|--------------------|--------------------|
| Parameters               | 1                 | 2                  | 3                  | 4                  | 5                  |
| SEM                      |                   |                    |                    |                    |                    |
| Egg weight (g)           | 9.06 <sup>c</sup> | 11.13 <sup>a</sup> | 11.07 <sup>a</sup> | 11.06 <sup>b</sup> | 11.01 <sup>b</sup> |
| Albumen weight (g)       | 6.07              | 6.14               | 6.21               | 6.17               | 6.30               |
| Egg shell thickness (cm) | 0.27 <sup>c</sup> | 0.33 <sup>b</sup>  | 0.35 <sup>b</sup>  | 0.47 <sup>a</sup>  | 0.49 <sup>a</sup>  |
| Shell weight (g)         | 0.70              | 0.71               | 0.70               | 0.71               | 0.70               |
| Egg yolk index           | 0.33              | 0.34               | 0.35               | 0.34               | 0.36               |
| Egg yolk colour          | 1.46 <sup>c</sup> | 1.94 <sup>b</sup>  | 2.02 <sup>a</sup>  | 2.06 <sup>a</sup>  | 2.18 <sup>a</sup>  |
| Egg Haugh unit (%)       | 90.8              | 92.4               | 93.8               | 95.2               | 96.1               |



**Figure 3. The effect of dietary inclusion of PLM + GLPD mixture on the egg quality traits of Japanese laying quails**

## RESULTS

The proximate compositions of test material (PLM and GPD) are presented in Table 2. The proximate component of *P. longifolia* leaf meal used in this experiment are 10.07%, 19.70%, 0.18%, 6.02% and 64.03% for crude protein, crude fiber, ether extract, ash and nitrogen free extract respectively while those of Garlic powder are 7.08%, 3.07%, 0.68%, 2.49% and 85.96% for crude protein, crude fiber, ether extract, ash and nitrogen free extract respectively. The proximate content shows that PLM had a higher crude protein, crude fiber and ash than GLPD. However, the proximate analyses of PLM are comparable with the earlier findings of Ojewuyi et al (2014). They showed that crude protein, crude fiber, crude lipid, total ash and moisture contents in PLM sample were  $10.05 \pm 1.14$ ,  $18.50 \pm 0.05$ ,  $0.26 \pm 0.05$ ,  $5.05 \pm 0.05$  and  $8.70 \pm 0.50$  respectively while those of Garlic powder (GPD) agrees with the reports of Otunola et al (2010) and Nwinuka et al (2005).

The combination of PLMGPD mixture slightly increased the crude protein of the experimental diet, however, all the values recorded fall within the range recommended by NRC (1994) for laying quails.

The performance traits as influenced by the diets are presented on Table 3. The quail's final live weight ranges between 259.3g and 290.2g. The daily feed intake values obtained are 24.9, 26.3, 27.5, 28.7 and 28.9g for diets 1, 2, 3, 4 and 5 respectively while those of hen day production are 71.2, 74.6, 76.5, 78.6 and 79.2% for diets 1, 2, 3, 4 and 5 respectively. The final live weight and the hen day production were significantly affected ( $P < 0.05$ ) by the dietary inclusion of PLMGPD mixture, the daily feed intake increases slightly as the level of PLMGPD increased though not at a significant level. The feed conversion ratio values obtained are 0.40, 0.41, 0.36, 0.35 and 0.35 for diets 1, 2, 3, 4 and 5 respectively while feed cost /kg (N) values are 85.0, 85.8, 85.9, 86.0 and 86.1 for diets 1, 2, 3, 4 and 5 respectively.

Table 4 shows the nutrient retention values of laying Japanese quails fed PLMGPD mixture. Protein retention values obtained are 56.04, 55.79, 55.31, 56.01 and 56.11% for diets 1, 2, 3, 4 and 5 respectively while fat retention values are 47.91, 46.88, 46.08, 46.44 and 46.63% for diets 1, 2, 3, 4 and 5 respectively. Fiber retention values are 43.76, 44.02, 31.06, 24.01 and 30.51% for diets 1, 2, 3, 4 and 5 respectively. Protein retention values increased from diet 1 to 2 after which the value declined, fiber retention values were significantly ( $P < 0.05$ ) influenced by the different inclusion levels of PLMGPD mixture.

The egg quality parameters as influenced by the diets are presented on Table 5. The egg weight values obtained are 9.06, 11.3, 11.07, 11.06, 11.01g for diets 1, 2, 3, 4 and 5 respectively while those of Albumen weight are 6.07, 6.14, 6.21, 6.17 and 6.30 g for diets 1, 2, 3, 4 and 5. The values obtained for egg shell thickness are 0.27, 0.33, 0.35, 0.47 and 0.49 mm for diets 1, 2, 3, 4 and 5 respectively while shell weight values are 0.70, 0.71, 0.70, 0.71 and 0.70. The values of the egg weight and egg shell thickness marginally increased from diet 1 to 5 and were

significantly ( $P < 0.05$ ) influenced by the different inclusion of PLM + GPD mixture. The values obtained for egg yolk index are 0.33, 0.34, 0.35, 0.34 and 0.36 for diets 1, 2, 3, 4 and 5 respectively while those of egg yolk colour are 1.46, 1.94, 2.02, 2.06 and 2.18 for diets 1, 2, 3, 4 and 5 respectively. Egg Haugh unit values obtained are 90.8, 92.4, 93.8, 95.2 and 96.1 for diets 1, 2, 3, 4 and 5 respectively. Egg yolk colour were significantly ( $P < 0.05$ ) different among the dietary treatments, egg yolk index and egg haugh unit were not significantly ( $P > 0.05$ ) affected.

## DISCUSSION

The result from the proximate analysis of the test material clearly shows that both PLM and GPD have a lower crude protein which is less than 30%, thus it cannot serve as a good alternative protein source for livestock. Final live weight was significantly ( $P < 0.05$ ) influenced by the different inclusion levels of PLMGPD. Highest final weight (290.2g) was observed in quails fed 3% PLMGPD followed by quails fed diet 4 with 280.1g, the lowest weight was recorded in quails fed diet 1 with 259.3g. This observation agrees with the views of Dieumou et al (2012) on the effect feeding ginger and garlic on the performance of broilers and Alagbe, J.O (2017) on the dietary inclusion of *P. longifolia* leaf meal as phytobiotic compared with antibiotics on broiler performance and contrary to the reports of Amouzmehr et al (2013); Botsoglu et al (2004); Kamal and Abo (2012) and Safa et al (2012). The higher weight recorded could be as a result of the synergistic combination of PLM + GLPD mixture which help to reduce disease pressure on the animals, thereby increasing the opportunity of the flock to achieve better FCR and improved performance. Garlic and *Polyalthia longifolia* leaf meal have been reported to perform multiple biological activities, including antibacterial and antiviral properties attributed to their antioxidant and antiradical activities (Kim et al., 2008; Canogullari et al., 2010; Alagbe, J. O 2017).

Feed intake increased with increasing level of PLMGPD but was not statistically significant. This report agrees with the findings Raeesi et al (2012) on the periodic use of Garlic powder on broilers and contrary to the reports of Eid and Iraqi (2014). Quails fed diet 1 had the highest mortality of 10, followed by diet 2 with 7 quails, no mortality was recorded for quails fed diet 5, and this is contrary to the reports of Safa M A El Tazi (2012). Hen day production showed that laying quails on diet 5 performed better than those on diet 4, 3, 2 and 1 respectively, this observation agreed with the views of Odunsi et al (2007) and contrary to the reports of Khan et al (2007) on effects of dietary garlic on the performance and egg yolk cholesterol in laying hens.

The significant ( $P < 0.05$ ) differences in the values of obtained for fibre retention across the treatment group agrees with the reports of Sola et al (2011) when layers were fed Baobab seed meal based diets.

Egg weight, egg shell thickness and yolk colour values showed that there were significantly ( $P < 0.05$ ) different this could be due to high minerals and vitamins in the test ingredients. According to Ojewuyi et al (2014) PLM is rich in calcium ( $89.18 \pm 3.20\text{mg}$ ), potassium ( $23.55 \pm 0.17\text{mg}$ ), sodium ( $30.03 \pm 2.20\text{mg}$ ) and magnesium ( $27.55 \pm 1.10\text{mg}$ ) while GPD contains calcium ( $19.83 \pm 0.83\text{mg}$ ), phosphorus ( $9.54 \pm 0.34\text{mg}$ ), iron ( $4.21 \pm 0.15\text{mg}$ ), sodium ( $4.10 \pm 0.18\text{mg}$ ), magnesium ( $3.94 \pm 0.13\text{mg}$ ), zinc ( $0.34 \pm 0.01\text{mg}$ ), manganese ( $0.016 \pm 0.00\text{mg}$ ), copper ( $0.012 \pm 0.00\text{mg}$ ) and potassium ( $54.65 \pm 1.74\text{mg}$ ) Marina et al (2014).

Shell thickness values were significantly ( $P < 0.05$ ) higher for quails fed diet 5. Quails fed diet 1 had a reduction in thickness; this could be due to low mineral content in the feed.

Egg Haugh unit values were influenced ( $P < 0.05$ ) by the dietary treatments, quails fed diet 5 had the highest haugh unit of 96.1% followed by diet 4, 3, 2 with 95.2%, 93.8% and 92.4% respectively. Quails fed diet 1 had the lowest of 90.8%. These reports do not agree with USDA recommendation on Haugh unit values because they are higher than 72%, but corresponds to the findings of Odunsi et al (2007) on comparative evaluation of maize, sorghum, millet and biscuit waste as dietary energy sources for laying Japanese quails in a derived savannah zone of Nigeria.

## CONCLUSION

The results of this experiment clearly shows that *Polyalthia* leaf meal + Garlic powder mixture have a positive impact on the growth performance and egg quality of birds, it can therefore be concluded that inclusion of PLMGPD up to 3.5% does not have a deleterious effect on the performance and health status of laying quails.

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