

Average weekly feed intake was recorded by subtracting feed left over from quantity of feed given during the week. Weekly body weight was also recorded and total body weight gain was determined after the experiment by subtracting the initial body weight in the first week from the final body weight in the last week of the experiment, feed conversion ratio was determined using the methods of Contreras-Castillo et al (2008) by dividing the total feed intake by the total body weight gained per treatment. Average weekly and daily feed intake, average weekly and daily body weight gain were also calculated. Mortality was recorded throughout the period of the study as it occurred.

All data obtained were subjected to the analysis of Variance (ANOVA) according to Steel and Torrie (1980) and their means separated using Duncan Multiple Range Test (DMRT) according to Duncan (1955) using the Statistical Package for Social Science (SPSS) software.

3. Results and Discussion

The feed intake (g/bird) of broilers as influenced by dietary inclusion levels of ginger supplemented to broiler feed is presented in Table 2. Statistical analysis of data on feed intake revealed significant differences between treatment groups with treatment 4 (T4) having the highest total feed intake of 4,270g/bird and treatment 1, T1 (control) having the lowest total feed intake of 4,070g/bird. Treatment 2 (T2) had a total feed intake of 4,175g/bird while treatment 3 (T3) had a total feed intake of 4,196/per bird.

There were also significant differences between the body weights and weight gains of birds in the different treatments. T4 had the highest final body weight of 2,350g/bird and an average body weight gain of 2,317g/bird while T1 (control) had the lowest final body weight of 1949.67g/bird and an average body weight gain of 1916.67g/bird. T2 had a total body weight of 2074.67g/bird and an average body weight gain of 2041.67g/bird while T3 had a body weight of 2,195g/bird and an average body weight gain of 2162g/bird.

Result also shows a significantly lower ($p < 0.05$) feed conversion ratio with broiler fed ginger meal when compared with those in the control treatment; this implies that there was a significant difference in feed conversion ratio between the different treatment groups. The mortality recorded in treatment 1, 2, 3 and 4 were; 1%, 2%, 1% and 2% respectively. Results showed that feed intake was significantly influenced by the dietary treatment. Feed intake was higher in diets containing ginger. This result is similar to the work of Ademola *et al.*, (2009) who reported higher feed intake of broilers on diet supplemented with ginger. The results were however at variance with the report of Herawati, (2010) who stated that broilers fed 2% dried supplementary ginger meal had significantly lower feed intake than those on the control diet. High feed intake of birds placed on ginger diets could be attributed to the property of ginger as an appetizer and its components which enhance the activities of gut micro flora, Ademola *et al.*, (2009). Appetite increase invariably increases feed intake and the higher the level of ginger contained in the

feed, the higher the appetite thus the higher the feed intake Ademola *et al.*, (2009).

Results showed that body weight gain was significantly influenced by the dietary treatment. Decreased feed intake in T1 (0g of ginger/kg of feed) and T2 (2g of ginger/kg of feed) resulted in a corresponding decrease in body weight gain whereas the improvement in weight achieved by ginger supplementation over the control indicates that ginger has a positive impact on the growth of the birds. This improvement is due to improved gut environment and micro flora achieved with ginger supplementation Ademola *et al.*, 2009. This effect is attributed to the fact that the susceptibility of pathogenic gram positive bacteria to the antibacterial components of ginger are higher than that of the physiological desirable intestinal bacteria (Reeds *et al.*, 1993; Cullen *et al.*, 2005). This observation is in line with the findings of Shi *et al.*, (1999) and Javandel *et al.* (2008). It is also backed up by the findings of Conley (1997) who observed that ginger acts as stimulant for feed digestion and conversion which increase body weight gain. Its active compounds which improves feed digestion and stimulates enzymes thus enhancing feed conversion ratio which lead to an increase body weight gain as the researchers noticed in during this study. Onimisi *et al.*, (2005) and Ademola *et al.*, (2009) also observed that ginger increased body weight when up to 2% level where included in broiler diet, Garcia *et al.*, (2007) and Al-Homidan (2005) also found an increase in weight gain of broiler when fed 2% and 6% ginger. This observation however, contradicts the reports of Omage *et al.*, (2007), Ademola *et al.* (2004) and Horton *et al.*, (1991) who reported that the inclusion of ginger did not improve the weight gain of broilers.

Results showed that feed conversion ratio was significantly affected by ginger supplementation. Feed conversion ratio in ginger diets were significantly higher in ginger diets thereby indicating better feed conversion efficiency. This could be attributed to the accumulation of the active ingredients in ginger which gives rise to the formation of more stable intestinal flora and improved feed conversion efficiency as a consequence of better digestion (Tekeli, 2007). These results agree with the work of Moorthy *et al.*, (2009) and Onimisi *et al.*, (2005) who reported significantly better feed conversion ratio in ginger fed groups of broilers compared to control. Authors such as Herawati (2006); Tollba (2003); Herawati (2010); Moorthy *et al.*, (2009) and Onimisi *et al.*, (2005) also illustrated that birds fed with diets containing ginger up to 2% recorded better feed conversion ratio than birds fed with un-supplemented diets, this finding was however contrary to Ademola *et al.*, (2004) who observed no significance when supplementing ginger in broilers ration and Wafaa *et al.*, (2012) who also reported no significant difference among birds fed on 0.5%, 1% and 1.5% ginger powder on feed conversion ratio.

4. Conclusion

It is evidence that ginger meal as feed additive in the diets of broiler birds enhanced growth performance characteristics of broiler chicks. The results suggest that

ginger can be included at these levels in broiler starter and finisher diets without adversely affecting their performance; however greater performance is attained at the level of 6g of ginger/kg of feed.

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Table 1: Ingredient composition and calculated analysis of Broiler Diets

Ingredient	T1	T2	T3	T4	T1	T2	T3	T4
Broiler Starter				Broiler Finisher				
Maize	48.00	48.00	48.00	48.00	57.00	57.00	57.00	57.00
Soya bean meal	24.00	24.00	24.00	24.00	15.00	15.00	15.00	15.00
Ground nut cake	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Fish meal	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Wheat bran	10.00	9.95	9.90	9.85	10.00	9.95	9.90	9.85
Oyster shell	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Bone meal	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Methionine	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Vitamin/mineral premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Ginger	0	0.05	0.10	0.15	0	0.05	0.10	0.15
Total	100	100	100	100	100	100	100	100
Calculated Analysis								
Crude Protein	23.41	23.44	23.46	23.48	20.25	20.28	20.30	20.32
ME (Kcal/kg)	2722.04	2722.85	2723.66	2724.47	2813.12	2813.93	2814.74	2815.55
Crude Fibre (%)	4.49	4.50	4.50	4.49	4.27	4.27	4.28	4.28
Lysine (%)	1.15	1.15	1.15	1.16	0.94	0.94	0.94	0.95
Methionine (%)	0.42	0.42	0.42	0.43	0.37	0.37	0.37	0.37
Calcium (%)	1.45	1.46	1.46	1.46	1.43	1.43	1.44	1.44

Table 2: The effect of treatment (Ginger) on the production parameters of broiler birds

Production Parameters	T1 (0g of ginger/kg feed)	T2 (2g of ginger/kg feed)	T3 (4g ginger/kg feed)	T4 (6g ginger/kg feed)
Initial Body Weight (g/bird)	33.00	33.00	33.00	33.00
final Body Weight (g/bird)	1,949.67 ± 5.49 ^d	2,074.67 ± 1.45 ^c	2,195.00 ± 1.53 ^b	2,350.00 ± 4.04 ^a
Total Body Weight Gain(g/bird)	1,916.67 ± 5.48 ^d	2,041.67 ± 1.45 ^c	2,162.00 ± 1.52 ^b	2,317.00 ± 4.04 ^a
Ave. weekly Body Weight Gain (g/bird)	239.58 ± 0.68 ^d	255.21 ± 0.18 ^c	270.25 ± 0.19 ^b	289.62 ± 0.50 ^a
Total Feed Intake (g/bird)	4070.00 ± 3.22 ^d	4175.00 ± 2.89 ^c	4196.00 ± 4.58 ^b	4270.00 ± 2.00 ^a
Ave. Weekly feed intake (g/bird)	508.75 ± 0.40 ^d	521.88 ± 0.36 ^c	524.50 ± 0.57 ^b	533.75 ± 0.25 ^a
Feed Conversion Ratio (FCR)	2.12	2.04	1.94	1.84

a, b, c: Means in the same column with different superscripts are significantly (P value < 0.05) different