# EFFECT OF DIETS CONTAINING FERMENTED WHOLE ALMOND FRUITS ON CARCASS CHARACTERISTICS OF BROILER FINISHER CHICKENS

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**ABSTRACT**
*A 28-day experiment was conducted to assess the impact of diets containing fermented whole almond fruit (FWAF) carcass characteristics of broiler finisher chickens. Eighty (80) broiler chickens (21 days old) were divided into four treatment groups: FWAF0 (no FWAF included) served as the control diet, FWAF5, FWAF10, and FWAF15 containing 5, 10, and 15% FWAF as the experimental diets in a completely randomized design. Each treatment was replicated two times having 10 birds per replicate. Feed and water were provided ad libitum, and standard feeding and management procedures were followed. FWAF10 had similar dressing percentage with FWAF0. Therefore, the carcass parameters of broiler finisher chickens can be improved with diets containing up to 15% fermented almond fruits without effects on their carcass parameters.*
**Keywords**: Livestock Farmers, Feed companies, Alternative feedstuffs, Poultry, Meat

## INTRODUCTION

The cost associated with feeding broiler birds accounts for about 70-80% of the production cost (Olugbenga et al., 2015) relatively due to increasing competition for the conventional sources of energy (maize) and protein (soybean) by humans and animals. It is now imperative to shift focus to the exploration of other alternative sources of these important nutrient bases. The utilization of low-cost, non-conventional feedstuffs, such as tropical almond fruit, proves to be both economical and sustainable. Studies have reported that almond fruits, as a fibrous resource, offer sufficient nutritive value suitable for ruminants and swine (Homedes et al., 1993; Yalchi and Kargar, 2010; Williams et al., 2018). The decision to include almond fruits in the diets of poultry is still not widely accepted by feed companies and livestock owners. Even though apart from the inherent dietary fibers which are important in poultry for nutrient utilization, gastrointestinal tract (GIT) development, gut health, and overall performance, the hulls in almond fruits are reported to contain total sugar ranging from 25% to 46%, presenting the potential to serve as an energy source in broiler diets (Holtman et al., 2015; Jha and Mishra 2021). Additionally, they are rich in antioxidants, such as polyphenols, triterpenoids, betulinic acid, oleanolic acid, and ursolic acid, exhibiting strong antioxidative activities (Esfahan et al., 2010; Prgomet et al., 2017). The polyphenol compounds from almond hulls have been reported to possess higher in vitro antioxidant capacity compared to vitamin E (Takeoka and Dao, 2003). Previous studies in swine diets, incorporating up to 10% almond hulls, did not compromise growth performance but led to a reduction in body fatty acids (Calvert and Parker, 1985; Homedes et al., 1993). The dietary fiber, fermentable sugars, and antioxidants in almond hulls could potentially offer valuable nutrients for broilers (Oztürk-Urek et al., 2001; Takeoka and Dao, 2003; Jha and Leterme, 2012). However, to ensure full exploration of the inherent nutrients in feed resources, including whole almond fruits, fermentation has been earlier regarded as a veritable means of processing that could improve their nutritional content and promote better growth performance in broiler chickens (Ari and Ayanwale, 2012). Despite the nutritional and health benefits of almond fruits, to our knowledge, studies on the utilization of fermented whole almond fruits' effects on carcass characteristics, microbial count, sensory evaluation, and haematology of broiler finisher chickens have not been reported. The study aimed to determine the effect of diets containing fermented whole almond fruits on carcass characteristics, gut microbial counts, sensory evaluation, and blood profiles of broiler finisher chickens. We hypothesized that the inclusion of FWAF in the diets of broiler finisher chickens could provide better results in terms of carcass characteristics, microbial population, and sensory parameters without affecting their blood profiles. The effects could depend on the quantity included in the diets.

## MATERIAL AND METHODS

### Location of the study

The research was conducted at the Teaching and Research Farm of the Faculty of Agriculture Shabu Lafia, Nasarawa State University. The Farm is situated at latitude $08^0$ 35' N and longitude $08^o$ 33' E in the Guinea savanna zone of North Central Nigeria. The average monthly relative humidity was 74%, and the lowest and highest temperatures were 23°C and 37°C, respectively. The monthly average temperature is 35.06°C, and the average annual rainfall is 207.45mm (NIMET, 2022).

**Sources of experimental feed ingredients and processing**

Whole *Terminalia catappa* fruits also known as almond fruits (about 200kg) were collected from farms, stones, debris, and dirt were removed, and the fruits were washed and sundried at room temperature until they became dry. The dried fruits were crushed, soaked in boiled for one hour, and were later ensiled tightly for ten days to allow for microbial fermentation. as described by Ari and Ayanwale (2012). It was removed and dried again at room temperature thereafter milled using 1mm sieve and kept closely tight until used for chemical analysis and feed formulation.

**Experimental animals, diets, and design**

Twenty-one days old broiler chickens were randomly allotted to four treatments each having 20 birds per treatment and each treatment was replicated twice to have ten birds in each. The experiment used a total of eighty (80) birds until day 49 of their lives. The birds were fed 0, 5, 10, and 15% diets containing FWAF. The birds were housed and properly managed to ensure adequate provision of water and *ad libitum* feeding and vaccination. The ingredients and compositions of the calculated nutrients of experimental diets are presented in Table 1.

**Table 1.** Percentage composition of feed ingredients and calculated nutrients of experimental diets (Baba et al., 2024)

| | **Fermented whole almond fruit diets** | | | |
|---|---|---|---|---|
| Feed Ingredients | FWAF0 | FWAF5 | FWAF10 | FWAF15 |
| Maize | 46.7 | 42.3 | 39.7 | 35.4 |
| Millet | 15.0 | 15.0 | 13.0 | 12.9 |
| Maize bran | 9.50 | 9.45 | 9.25 | 9.11 |
| Soybean | 9.50 | 9.20 | 9.20 | 9.00 |
| Groundnut Cake | 12.5 | 12.2 | 12.0 | 11.8 |
| Fish meal | 1.50 | 1.50 | 1.50 | 1.50 |
| Bone Meal | 2.00 | 2.00 | 2.00 | 2.00 |
| Palm oil | 2.50 | 2.50 | 2.50 | 2.50 |
| Methionine | 0.16 | 0.16 | 0.16 | 0.16 |
| Lysine | 0.20 | 0.20 | 0.20 | 0.20 |
| Premix | 0.20 | 0.20 | 0.20 | 0.20 |
| Salt | 0.25 | 0.25 | 0.25 | 0.25 |
| Fermented whole almond fruit | 0.00 | 5.00 | 10.0 | 15.0 |
| **Total** | **100** | **100** | **100** | **100** |
| ***Calculated Analysis** | | | | |
| Crude Protein | 19.9 | 19.8 | 19.7 | 19.7 |
| Crude Fiber | 4.98 | 4.95 | 4.84 | 5.01 |
| Lysine (%) | 0.82 | 0.80 | 0.84 | 0.82 |
| Methionine (%) | 0.31 | 0.34 | 0.34 | 0.32 |
| Ether extract (%) | 6.46 | 6.70 | 6.90 | 7.12 |
| Metabolisble energy (kcal/kg DM) | 3170 | 3170 | 3169 | 3172 |
| Phosphorus (available) | 0.78 | 0.82 | 0.83 | 0.80 |
| Calcium | 0.83 | 0.86 | 0.84 | 0.84 |

Premix contains vitamin A (8,000,000 I.U); vitamin D3 (2,000,000 I.U); vitamin E (5,000mg); Niacin (15,000mg); vitamin B1 (1,500mg); vitamin B2 (8,000mg); vitamin B6 (1,5000mg); vitamin B12 (10mg); vitamin K3 (2,000mg); calpan (5,000mg); Biotin (20mg); Folic acid (500mg); Antioxidant (125,000mg); Choline chloride (200, 000mg); Cobalt (200mg); Copper (5,000mg); Iodine (1,200mg); Iron (40,000mg); Manganese (80,000mg); Selenium (200mg); Zinc (60,000mg);FWAF0 =0%, FWAF5=5%, FWAF10=10%, and FWAF15= 15% fermented whole almond fruit-containing diets respectively; * calculated nutrient compositions

**Data collection**

**Determination of carcass characteristics parameters**

At the end of the 28-day trial, two birds from each treatment (one per replicate) were randomly chosen for organ and carcass examination. Birds were deprived of feed and water for 6-8 hours before slaughter. Live weights, carcass weights, and various organ weights using a digital weighing scale (Infitek Precision balance, BP-2C Series) and reported as a percentage of live weight. All procedures followed the modified kosher method as described by Abe et al. (1996).

**Data analysis**

Data generated were checked for normality using Shapiro Wilk's test Q-Q plots and box plots to ensure homogeneity of the data. Data were statistically analysed using Analysis of Variance (ANOVA). Significant difference was separated using the Duncan Multiple Range Test (DMRT).

**RESULTS AND DISCUSSION**

The data in Table 2 revealed that diets containing FWAF0 and FWAF5 were not significantly different ($P>0.05$) similarly, FWAF0 and FWAF10 were similar ($P>0.05$) in the dressing percentage, but there was a significant ($P<0.05$) reduction when FWAF was included up to 15%. Other carcass parameters were not significantly

(P>0.05) affected by the inclusion of FWAF in the diets. There was a decline in the dressing percentage when the animals were fed FWAF15 diets, overall, we can say that most of the carcass parameters were not affected by the inclusion of the test ingredients. This agrees with studies by Uchewa et al. (2012) and Tni (2013) who reported no effects of fermented feeds on some carcass parameters of broilers. According to Tni (2013), carcass weight and abdominal fats were unaffected by diets containing fermented banana peel though it led to a reduction in carcass percentage. However, Uchewa et al (2012) reported no effects in all the carcass parameters. The microbial counts observed are lower than those reported by Oluwafemi et al. (2022) in broiler chickens fed composite leaf meal and fall below the contamination threshold set by NSA (2009).

**Table 2:** Effects of diets containing fermented whole almond fruits on carcass characteristics (as percentage of liveweight) of broiler finisher chickens

| Parameters | T1 | T2 | T3 | T4 | SEM | P. values |
|---|---|---|---|---|---|---|
| Live weight (g) | 1854.00 | 1905.50 | 1852.50 | 1751.00 | 34.53 | 0.55 |
| Dressed weight (g) | 1364.50 | 1294.00 | 1395.50 | 1173.50 | 33.27 | 0.01 |
| Dressing percentage | 73.61$^{ab}$ | 68.18$^{b}$ | 75.39$^{a}$ | 67.02$^{c}$ | 1.63 | 0.18 |
| Breast | 20.35 | 20.55 | 21.23 | 21.77 | 0.59 | 0.90 |
| Drumstick | 9.94 | 10.10 | 10.04 | 10.11 | 0.13 | 0.98 |
| Wings | 3.95 | 4.32 | 4.01 | 4.40 | 0.22 | 0.91 |
| Thigh | 20.02 | 21.29 | 20.33 | 20.89 | 0.46 | 0.86 |
| Back | 6.42 | 5.84 | 5.81 | 5.61 | 0.23 | 0.73 |
| Shank | 3.08 | 2.97 | 3.05 | 2.97 | 0.04 | 0.81 |
| Lungs | 0.24 | 0.26 | 0.19 | 0.20 | 0.02 | 0.31 |
| Liver | 1.19 | 1.22 | 1.05 | 1.02 | 0.07 | 0.81 |
| Gizzard | 2.11 | 1.96 | 2.44 | 2.07 | 0.20 | 0.91 |
| Gastrointestinal tract | 4.12 | 6.34 | 6.10 | 6.35 | 0.54 | 0.48 |
| Caecum | 0.54 | 0.35 | 0.59 | 0.46 | 0.06 | 0.58 |
| Kidney | 0.35 | 0.30 | 0.39 | 0.36 | 0.03 | 0.83 |

$^{abc}$= means in the same row having different superscript are significantly different (P<0.05); SEM= standard error of mean;
T1: FWAF0, T2: FWAF5, T3: FWAF10, and T4: FWAF15

## CONCLUSION

Feeding broiler chickens diets containing up to 15% FWAF did not affect carcass parameters except dressing percentage where there was a reduction at 15%. Therefore, broiler finisher chickens can be improved with diets containing up to 15% fermented almond fruits without effects on their carcass parameters.

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