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DETERMINATION OF THE NUTRITIONAL COMPOSITION OF AIDAN FRUIT (*TETRAPLEURA TETRAPTERA*) AND ITS EFFECT AS FEED ADDITIVE ON GROWTH PERFORMANCE OF BROILER CHICKENS

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Abstract

The dietary value of Tetrapleura tetraptera (dried Aidan fruit powder, DAFP) with its effect as feed additive on the growth performance of broiler birds was evaluated in this study. A day old 50 broiler chickens were separated into five treatment groups with 10 replicates each in a completely randomized experimental design. Four groups were assigned an experimental DAFP diet of 0.5 kg, 1 kg, 1.5 kg and 2 kg per 25 kg of basal feed except for the control group. Proximate analysis of DAFP showed the percentage (%) composition of moisture (45.11 $\pm$ 1.45), crude fibre (6.45 $\pm$ 0.34), crude protein (9.23 $\pm$ 0.19), crude fat (9.10 $\pm$ 1.12), ash (15.71 $\pm$ 0.26) and carbohydrate (47.25 $\pm$ 1.24). Mineral analysis showed low to moderate composition of sodium, potassium, phosphorus, calcium, magnesium, zinc, iron and copper respectively. Results obtained from feed conversion ratio (FCR), body weight gained (BWG) and organs weight (OW) showed significant differences ($p <$ 0.05) in all treatment groups. Broiler chickens given 2 kg of DAFP per 25 kg feed had the highest feed intake efficiency with a FCR of 1.35 $\pm$ 0.00, BWG of 3018.60 $\pm$ 0.49 and OW of 51.13 $\pm$ 0.04 for liver, 4.99 $\pm$ 0.01 for kidneys, 39.63 $\pm$ 0.02 for gizzard and 86.93 $\pm$ 0.02 for intestine except for the heart weight which was highest in broiler chickens given 1.5 kg of DAFP per 25 kg feed. Findings from this study suggest the beneficial properties of broilers feed inclusion of DAFP on FCR, BWG, OW and overall growth performance of broiler chickens.

Keywords

Tetrapleura tetraptera, broilers, feed additive, growth performance, feed intake

Introduction

Poultry farming has become an interesting agricultural venture due to increasing demands for affordable and easily available meat protein source. Poultry birds generally have short maturity period making it a more reliable meat source in meeting demands associated with increase in the world population. Poultry meat accounts for 39% of all meat types produced globally (Kumar et al., 2022). It constitutes meat from chicken, turkey, duck, pigeon and other domesticated avian species. Among all poultry meat sources, chicken is considered as the most globally consumed poultry meat with a global percentage production of 88% as compared to other poultry birds (Mendonca et al., 2020). Chicken meat is considered as a healthy meat option packed with valuable proteins and nutrients for human health and prevention of cardiovascular diseases including their risk factors like obesity, cancer and diabetes mellitus especially birds grown organically (Abadula et al., 2022).

Most chicken production for meat purposes often utilizes broiler birds which are a type of chicken bred for meat production. The breeding process usually involves the inclusion of excessive antibiotic and growth promoters to enhance growth within a short time frame. The excessive use of antibiotics and growth promoters are associated with antibiotic resistance, disruption of healthy gut microbiome, reduced biochemical health and organ toxicity or damage thus reducing the meat quality and affecting its suitability for human consumption (Amine et al., 2020; Izah et al., 2025). It is for this reason the use of natural and safe alternatives like plant additives is encouraged to ensure the health benefits of eating chicken meat is preserved.

The inclusion of plant materials as phytogenic feed additives has gained awareness in the poultry industry. This is because most plant additives like herbs and spices have shown great improvement on health and growth performance of poultry birds under study. The use of herbs and plant spices as feed additives depends on their bioactive components and their mechanism of action on the metabolic profile of poultry birds (Biswas et al., 2024). Al-Garadi et al. (2025) documented the beneficial effect of natural plant extracts on growth performance, carcass traits and gut health of broilers. Phytogenic feed additives are noted to enhance feed efficiency, immune health and boost antimicrobial response in poultry birds.

Most spice plant species have been identified as good and sustainable sources of phytogenic properties recommended for use as animal feed additives. Plants like cinnamon, peppermint, thyme, garlic, and ginger are commonly considered as feed additive to boost immunity, gut health and the overall growth performance of poultry birds. The use of cinnamon powder as feed additive showed positive impact on growth performance, meat quality and biochemical indices of broiler chickens (Odutayo et al., 2021). Ocak et al. (2008) documented the benefit of peppermint and thyme leaves as feed additives on body weight gain within 7 days to 42 days of feed supplementation. Garlic supplementation of broiler feed improved immune response, growth performance and carcass quality of birds under study (Ashour et al., 2025) and feed supplementation with ginger powder improved feed intake,

weight gain, immune response and digestive system of broiler birds (Ademola et al., 2004; Urban et al., 2025). Aside from these commonly utilized plant spices as feed additives, other plant spices are underutilized as phytogenic feed additives even with their numerous health benefits. Aidan fruit is an underutilized spice plant despite its health benefits.
Aidan fruit tree (*Tetrapleura tetraptera*) is a perennial fruit bearing tree widely distributed in tropical Africa lowland forest (Aladesanmi, 2007; Ingweye et al., 2019). The fruits constitute a semi-fleshy dark-brown four-winged pod with black-brown seeds. The fruit which is commonly used as a food spice for its unique and appetizing flavour is rich in crude fibre and amino acids with notable composition of fats, crude protein, moisture and ash content (Oguoma et al., 2015). Aidan fruit has anti-microbial and anti-helminthic properties (Aladesanmi, 2007). The numerous health benefits of Aidan fruit in human and animal health has made it a good food supplement. The use of Aidan fruit as a feed supplement in broilers showed significant increase in packed cell volume, red blood cells, thrombocytes, heterophils, lymphocytes, AST, ALT, albumin, globulin, protein, sodium, calcium, phosphorus, cholesterol, and creatinine values (Ingweye et al., 2019). Despite the growing interest in the utilization of Aidan fruit as feed additive, information on its impact on growth performance of broiler chickens is still scanty and requires more findings to validate its use as phytogenic feed additive. This study was carried out to evaluate the importance of supplementing broiler feed with dried Aidan fruit powder (DAFP) as a growth promoter for improved growth performance of broiler chickens.

Materials and Methods

Study location

The study was carried out at the Animal House, Department of Genetics and Biotechnology, University of Calabar, Nigeria. The average temperature of the facility was between 25°C and 30°C providing an adequate environment for broiler growth. Ethical standards following Macer (2019) protocol for care and use of poultry birds were observed. Proximate and mineral composition analysis was performed at the Chemistry laboratory, Department of Chemistry, University of Calabar, Nigeria and a private laboratory in Calabar, Cross River State Nigeria.

Preparation of plant material, experimental animal and diets

Matured and healthy fruits of *Tetrapleura tetraptera* (Figure 1) were purchased from Marian market, Calabar, Nigeria. The fully matured four winged fruits were deseeded and air dried under room temperature for 14 days to remove residual moisture. The purpose of using the air drying method is to preserve the nutritional benefits often altered under high temperatures. The dried fruits were milled to a fine powder using 3HP Turbocrush BX250 Classic Model Buchymix electric blender. The blended plant material was stored in airtight

Figure 1. Photograph of Dried Aidan fruit (*Tetrapleura tetraptera*)

containers for use during this study. A total of 50, one-day old broiler chicks were purchased from New Hope Agricultural and Technology Ltd. The supplemented poultry diets used for this study was the standard broiler starter feed (21% crude protein) and finisher (20% crude protein) diets purchased from Top Feed Nigeria Ltd.

Proximate and mineral analysis of DAFP

Samples of milled DAFP were subjected to proximate and mineral analysis for determination of moisture content, crude fiber, crude protein, crude fat, ash content, carbohydrate content, potassium, calcium, magnesium, iron and zinc respectively following the official protocols provided by Association of Official Analytical Chemists (2005).

Moisture content analysis

The moisture content of Aidan fruit was determined using the gravimetric method. 10 g of deseeded fruits of *Tetrapleura tetraptera* was weighed before and after drying in the oven at 105°C for 1 hour. The dried plant material was transferred into a desiccator to cool after which the dry moisture content was determined by calculating the percentage ratio of moisture loss to the weight of analyzed plant material.

Ash content analysis

10 g of the plant sample was measured into ashing crucible and placed in a benchtop laboratory muffle furnace at 600°C for 4 hrs until the sample became grey ash. The ash was transferred into a desiccator to cool below 100°C before calculating for the percentage ash content using the equation described by AOAC and Horwitz (2003).

Crude fiber analysis

Crude fiber content of Aidan fruit was determined using the ANKOM2000 Fiber Analyzer and following the Association of Official Analytical Chemists (2005) method for analyzing crude fiber content.

Protein content analysis

The total protein content was determined using the Kjeldahl method while the percentage (%) crude protein content was determined by multiplying the value obtained as the total protein content with 6.25.

Fat content analysis

The fat content of Aidan fruit was determined using Soxhlet extraction as described by Association of Official Analytical Chemists (2005). The procedure was repeated for 4 hrs after which the defatted sample was removed and dried in an oven at 100°C for 40 minutes and allowed to cool before weighing. Determination of fat content was calculated as percentage (%) weight loss during the extraction process.

Carbohydrate content analysis

The percentage (%) carbohydrate content was determined by the differential method described by AOAC (1995). This involves subtracting the percentage content values of moisture, ash, fibre, protein and fat content from 100%. The remaining value is assumed to be the carbohydrate content.

Mineral content analysis

The mineral content analysis was done by dry ashing DAFP at 600°C for 1 hr after which the grey ash obtained was used to determine sodium (Na), Potassium (K), Calcium (Ca), Magnesium (Mg), Zinc (Zn) and Iron (Fe) by means of atomic absorption Spectrophotometer (Buck Scientific Model-200 A/210) and phosphorus (P) was determined colorimetrically by Spectronic 20 (Gallenkamp, UK) using the phosphovanado molybdate method (Association of Official Analytical Chemists, 2005).

Experimental design and procedure

50 broiler chicks that were one day old were divided into five experimental units with each treatment unit having 10 chickens as replicates using the completely randomized design. Broiler chickens were housed in a well-ventilated wire mesh cages with deep litter flooring using wood shavings. Daily spot-cleaning of wet areas was done and chicken litter replaced weekly to maintain a clean and healthy environment. Group I served as the control group while groups II, III, IV and V received 0.5 kg, 1 kg, 1.5 kg and 2 kg per 25 kg feed supplementation of DAFP. Chickens were fed with starter feed and allowed to acclimatize for 10 days before feed supplementation with DAFP. DAFP supplementation with starter feed was done for the first three weeks while DAFP supplementation with finisher feed was done from the fourth to sixth week. The weight of individual bird was documented at the start of the experiment and subsequently at weekly intervals for 6 weeks. The body weight gain was calculated by determining the difference in weekly average live weight gain compared to the weight gain recorded in the previous weeks (initial body weight). Feed intake (FI) of birds in each treatment group was calculated by subtracting the daily leftover feed from the initial weight of feed given to the birds. The feed conversion ratio (FCR) was determined by dividing the amount of feed consumed in gram with body weight gain in gram. The organ weight of birds in all treatment groups was determined at the end of the experimental period. Birds were sacrificed and the following organs; liver, heart, gizzard, intestines and kidneys were carefully excised, weighed and examined to determine the effect of DAFP on organ weight.

Statistical analysis

Data obtained were subjected to one-way ANOVA test at ($p < 0.05$) using the Statistical Package for Social Sciences (SPSS) software version 27 (IBM, New York, USA). Results obtained represent the standard error of mean ± (SEM) of 10 replicates in each treatment group.

Results and Discussions

Results

Proximate and mineral composition of DAFP

The proximate composition (g/100g dry weight) of DAFP reveals varying percentage composition of moisture, crude fibre, crude protein, crude fat, ash and carbohydrate with carbohydrate having the highest percentage composition of 47.25 ± 1.24 and crude fibre having the lowest percentage (%) value as shown in Table 1. Results obtained from mineral composition analysis of DAFP as shown in Table 2 indicates that P has the highest mineral value of $3{,}410.81 \pm 1.41$ mg/kg while Zn has the lowest mineral value of 2.20 ± 0.23. The mineral composition of other minerals analyzed in this study is presented in Table 2 respectively.

Table 1. Percentage (%) proximate composition of DAFP

Nutritional components	Percentage value % (g/100g dry weight)
Moisture	45.11 ± 1.45
Crude fibre	6.45 ± 0.34
Crude protein	9.23 ± 0.19
Crude fat	9.10 ± 1.12
Ash	15.71 ± 0.26
Carbohydrate	47.25 ± 1.24

Note: Values are presented as mean ± standard deviation. DAFP = Dried Aidan Fruit Powder.

Table 2. Mineral constituent of DAFP

Mineral constituent	mg/kg dry weight
Sodium	105.14 ± 0.18
Potassium	840.10 ± 0.94
Phosphorus	3,410.81 ± 1.41
Calcium	2,861.40 ± 0.56
Magnesium	241.21 ± 0.66
Zinc	2.20 ± 0.23
Iron	14.61 ± 0.14
Copper	4.10 ± 0.24

Note: Values are presented as mean ± standard deviation. DAFP = Dried Aidan Fruit Powder.

Table 3. Effect of DAFP on Feed Conversion Ratio of Broiler Chickens

Treatment Duration	Treatment Groups				
	Group I (No treatment)	Group II (0.5 kg)	Group III (1 kg)	Group IV (1.5 kg)	Group V (2 kg)
14 to 28 Days	1.43 ± 0.00^{a}	1.35 ± 0.00^{b}	1.32 ± 0.00^{b}	1.29 ± 0.00^{d}	1.29 ± 0.00^{d}
29 to 42 Days	1.60 ± 0.00^{a}	1.48 ± 0.00^{b}	1.45 ± 0.00^{b}	1.43 ± 0.00^{b}	1.35 ± 0.00^{c}

Note: Results are presented as mean ± standard error. Means with same superscript letters within the same row do not differ significantly ($p < 0.05$). DAFP = Dried Aidan Fruit Powder; FCR = Feed Conversion Ratio. Treatment groups received DAFP supplementation per 25 kg of basal feed.

Table 4. Effect of Aidan Fruit Powder on the Body Weight Gain of Broiler Chickens

Treatment duration	Treatment Groups				
	Group I (No treatment)	Group II (0.5 kg)	Group III (1 kg)	Group IV (1.5 kg)	Group V (2 kg)
21 Days	805.80 ± 0.75^{a}	831.40 ± 0.49^{b}	851.40 ± 0.49^{c}	875.60 ± 0.49^{d}	881.00 ± 0.63^{e}
35 Days	2140.40 ± 0.49^{a}	2290.80 ± 0.75^{b}	2320.80 ± 0.75^{c}	2341.20 ± 0.98^{d}	2349.80 ± 0.75^{d}
42 Days	2910.00 ± 0.63^{a}	2941.00 ± 0.89^{b}	2971.00 ± 0.63^{c}	3010.80 ± 0.75^{d}	3018.60 ± 0.49^{d}

Note: Results are presented as mean ± standard error. Means with same superscript letters within the same row do not differ significantly ($p < 0.05$). DAFP = Dried Aidan Fruit Powder. Treatment groups received DAFP supplementation per 25 kg of basal feed.

Table 5. Effect of Aidan Fruit Powder on Organ Weight of Broiler Chickens

Organ	Treatment Groups				
	Group I (No treatment)	Group II (0.5 kg)	Group III (1 kg)	Group IV (1.5 kg)	Group V (2 kg)
Liver	38.85 ± 0.07^{a}	44.75 ± 0.01^{b}	48.63 ± 0.04^{c}	48.80 ± 0.14^{c}	51.13 ± 0.04^{d}
Heart	5.53 ± 0.04^{a}	7.53 ± 0.04^{b}	7.60 ± 0.14^{b}	9.35 ± 0.07^{d}	9.20 ± 0.14^{d}
Kidneys	3.14 ± 0.01^{a}	3.85 ± 0.07^{b}	4.10 ± 0.02^{c}	4.83 ± 0.04^{d}	4.99 ± 0.01^{d}
Gizzard	29.53 ± 0.03^{a}	32.41 ± 0.06^{b}	35.38 ± 0.03^{c}	38.50 ± 0.00^{d}	39.63 ± 0.02^{e}
Intestine	59.13 ± 0.02^{a}	68.28 ± 0.11^{b}	74.22 ± 0.02^{c}	86.08 ± 0.04^{d}	86.93 ± 0.02^{d}

Note: Results are presented as mean ± standard error in grams (g). Means with same superscript letters within the same row do not differ significantly ($p < 0.05$). DAFP = Dried Aidan Fruit Powder. Treatment groups received DAFP supplementation per 25 kg of basal feed.

Broilers feed conversion ratio

Broiler chickens fed with different ration of DAFP showed better feed intake efficiency as compared to birds in the control group. It was observed that birds given 1.5 kg and 2 kg of DAFP per 25 kg feed had the highest feed intake efficiency within 14–28 days of feed supplementation with a FCR of 1.29 ± 0.00 while at 29–42 days feed supplementation, birds given 2 kg of DAFP per 25 kg feed had the highest feed intake efficiency with a FCR of 1.35 ± 0.00. FCR for other treatment groups are presented in Table 3.

Live body weight gain of broiler chickens

The mean live body weight of broilers fed with DAFP at 3 treatment durations (21, 35 and 42 days) indicated a dose dependent increase. Birds given 2 kg of DAFP per 25 kg feed had the highest live body weight gain in all treatment durations as shown in Table 4. Birds with the lowest live body weight gain were in the control group. However, birds given 0.5 kg, 1 kg and 1.5 kg of DAFP per 25 kg feed showed significant ($p < 0.05$) improvement in the live body weight gain.

Organ weight of broiler chickens

The weight of organs; liver, heart, kidneys, gizzard, and intestine were determined to evaluate the effect of different ration of DAFP on organ weight. Results obtained showed a dose dependent increase in organ weight. As presented in Table 5, birds fed with 2 kg of DAFP per 25 kg feed had the highest liver weight of 51.13 g ± 0.04 followed by birds fed with 1 kg and 1.5 kg per 25 kg feed with liver weight of 48.63 g ± 0.04 and 48.80 g ± 0.14 respectively. The heart weight of birds fed with 1.5 kg was the highest (9.35 g ± 0.07) while the heart weight of birds fed with 0.5 kg, 1 kg and 2 kg of DAFP per 25 kg feed were within the range of 7.53 g ± 0.04 – 9.20 g ± 0.14. The weight of kidneys and intestine was highest in birds fed with 1.5 kg and 2 kg of DAFP per 25 kg feed with a weight range of 4.83 g ± 0.04 – 4.99 g ± 0.01 for kidneys and 86.08 g ± 0.04 – 86.93 g ± 0.02 for intestine. The weight of gizzard for birds fed with 2 kg of DAFP per 25 kg feed was highest (39.63 g ± 0.02) followed by birds fed with 1.5 kg of DAFP (38.50 g ± 0.00). However, as shown in Table 5, birds in the control group had the lowest organ weight values as compared to all treatment groups.

Discussion

The proximate and mineral constituent of DAFP was determined in this study to evaluate its nutritional benefit as a phytogenic feed additive in broiler birds. Feed supplementation is an essential practice in animal breeding to enhance growth performance, health and meat quality. The proximate composition of DAFP revealed the presence of recommendable values of moisture, crude protein, crude fibre, crude fat, carbohydrate and ash content. According to Afolabi et al. (2021), phytogenic additives with high levels of crude protein, moderate crude fat and low crude fibre with an ideal moisture and ash content is considered suitable as feed additive for poultry birds. This is linked to the dietary requirements of poultry birds as they are often bred for meat and egg production. Minerals are also considered as essential nutrients required for growth, bones development and metabolic processes in poultry birds (Alagawany et al., 2021). Poultry birds fed with essential minerals are often healthier with a high survival rate due to the importance of minerals in boosting their immune system (Mir et al., 2018). The mineral analysis of DAFP in this study shows that DAFP is a rich source of essential minerals and can be regarded as a good phytogenic feed additive. Phosphorus was the highest mineral present in DAFP with a value equivalent to 0.34% of available phosphorus ideal for broiler chicks that are within 1–35 days old. According to Li et al. (2022), the optimal requirement for dietary phosphorus in broiler birds falls within 2500 mg–4590 mg/kg of feed. On the contrary, egg laying birds require a lower non-phytate phosphorus content of 2,200 mg/kg of feed as higher levels can hinder egg production and eggshell quality (Rodehutscord et al., 2023). The value of dietary calcium content in DAFP falls within the recommended dose for growing broiler birds; however, this value is considered too low for laying hens as more calcium is required to support egg production (Bai et al., 2022).

The dietary potassium content in DAFP aligns with the ideal dietary potassium requirements for poultry birds even though other factors like birds' age, electrolyte balance and environmental conditions further determines the exact potassium requirement (Oliveira et al., 2005). Potassium helps to enhance body weight gain in poultry birds (Ahmad et al., 2008). The magnesium and sodium content in DAFP falls below the recommended values for poultry birds. Since DAFP is often used as a feed additive, the mineral values can be beneficial as a secondary mineral source. Also, the mineral composition of zinc, iron and copper in DAFP as trace elements is ideal in supporting the recommended mineral requirements of poultry birds for improved feed intake and growth performance.

The growth performance of broiler chickens fed with different quantities of DAFP showed significant growth improvement in all parameters under study. The feed conversion ratio for chickens fed with varying quantities of DAFP was dose dependent as birds fed with higher rations of DAFP had the best feed intake efficiency. Similar studies carried out by Essien et al. (2022) on the use of Aidan fruit powder as feed additive proved the beneficial impact of Aidan fruit powder on feed intake efficiency. Ingweye et al. (2020) in his study on growth response of rabbit bucks to the inclusion of Aidan fruit powder in their feed reported that adding at least 1% Aidan fruit powder resulted in the best feed conversion ratio with increase in body weight gain. Generally, the inclusion of plant spices as feed additives in animal feed is linked with the stimulation and secretion of digestive enzymes needed for improving digestion and nutrient absorption (Kalpana and Srinivasan, 2001). Plant spices are also known to modulate gut microbiota thus ensuring healthy gut and better nutrient use by animals (Dahl et al., 2023).

The body weight gained by broiler chickens fed with DAFP in this study reflects the significant growth enhancing role of DAFP as a phytogenic feed additive across all treatment groups. However, birds fed with higher DAFP inclusion rate of 1.5 kg–2 kg per 25 kg feed gained more weight as compared to other treatment groups. This implies that birds are likely to perform better with higher inclusion rate. Body weight gain is often linked to the ability of birds to convert feed consumed into body mass. Similar findings were reported by Essien et al. (2022) using 100 g–300 g of Aidan fruit powder per 100 kg feed inclusion rate even though lower inclusion rates were used in his study. Ingweye et al. (2020) also reported the beneficial effect of 1.0% Aidan fruit powder as feed additive on the body weight gain of broiler birds.

The effect of DAFP intake was also evaluated on the physical appearance and weight of organs under study. Physical observation of organs showed all organs were healthy. Determination of organ weight showed that organs from birds in all treatment groups were weightier than those in control group. This suggests that there is strong correlation between weight of internal organs and the overall body weight gain of broiler birds. Birds with higher body weight gain had the highest organs weight. Also, the increase in the weight of organs was dose dependent as higher inclusion rate showed higher organ weight. The liver weight was highest in birds given 2 kg of DAFP. The increase in liver weight might be due to phytochemically enhanced metabolic activation at higher DAFP inclusion levels (Olugbenga et al., 2025). No significant difference was observed on the liver weight of birds given 1 kg and 1.5 kg DAFP. Studies suggest that an average liver weight in healthy matured broiler birds is between 45 g to 60 g (Ahmed et al., 2014). According to Alshamy et al. (2019), the liver weight in broiler birds is primarily linked to the age and overall body weight of birds.

The variation in heart weight was also dose dependent and birds in all treatment groups had higher heart weight as compared to the control group. However, birds fed with 1.5 kg of DAFP had the highest heart weight value with no significant difference with what was obtained from birds fed with 2 kg of DAFP. Aidan fruits are rich in bioactive phytochemicals essential in supporting improved cardiovascular function and overall development of the heart (Mensah et al., 2024). According to Karthika et al. (2019) the average heart weight in broiler birds is between 8 g to 15 g and this depends on several factors including the broiler line, age, type of feed and feed additives used. A relatively large heart size to body weight in poultry birds is an indicator of healthy birds with high cardiovascular capacity (Olkowski, 2007).

Healthy pairs of kidney in poultry birds are essential in the filtration of metabolic waste and regulation of electrolyte balance. The renal system in commercial poultry birds are often affected due to excessive use of synthetic growth promoters like antibiotics and steroids (Amine et al., 2020). This detrimental effect has been reduced through feed supplementation with phytogenic additives. Findings from this study showed the healthy impact of DAFP as feed additive on kidneys of poultry chickens. Kidneys were found to be elongated, reddish-brown with no visceral gout and within the documented average size of 4.0 g–6.8 g in healthy broiler chickens (Sultana et al., 2021). The highest weight of kidneys were from chickens given 2 kg of DAFP per 25 kg feed followed by birds given 1.5 kg of DAFP per 25 kg feed although no significant difference was observed between them. However, the average weight of kidneys in matured broiler birds depends on several factors like disease, toxins, sex, age and dietary feed components (Babińska et al., 2013).

The effect of feed supplementation with DAFP was also observed in gizzard weight as broiler chickens given different rations of DAFP showed increased gizzard weight when compared to the control group. The gizzard plays an important role in the digestive system of birds. Chickens with larger gizzard size tend to exhibit better feed digestion and nutrient uptake efficiency due to larger surface area for food particles making them more susceptible for digestive enzymes activity crucial for feed digestion and utilization (Svihus, 2011). The relatively larger gizzard size to the BW of chickens in treated groups might be the reason for high feed intake efficiency. Huang et al. (2022) in his study reported that birds with the highest gizzard weight had the highest feed intake efficiency.

The intestine is regarded as an important digestive organ responsible for the digestion of food. The efficiency of feed digestion in broiler chickens depends on size and health condition of the intestine. Birds with larger size intestine often have increased mucosal surface area essential for enhancing digestion and nutrient uptake (Duque-Correa et al., 2022). In this study, a significant increase in the size of intestine was observed in birds given different rations of DAFP. The highest intestine weight was observed in chickens fed 2 kg of DAFP per 25 kg feed followed by chickens fed with 1.5 kg of DAFP. This value is slightly lower than what was reported by Iwujia et al. (2022) even though it falls within the normal intestine weight range for broiler birds.

The inclusion of DAFP as feed additive in the diet of broiler chickens in this study has shown convincing benefits on the overall health and growth performance of broiler birds. A significant growth enhancing effect of DAFP dietary inclusion was observed in chickens fed with higher ration of DAFP which suggest that poultry chickens tend to perform better with DAFP inclusion levels of 1.5 kg–2 kg per 25 kg feed. Since broiler chickens are specifically grown for meat production, it is necessary to find better ways to enhance growth and percentage survival of birds without depending on antibiotics due to associated detrimental effects. This study affirms existing reports on the growth enhancing and health benefits of feed supplementation with Aidan fruit (*Tetrapleura tetraptera*) on poultry chickens and other livestock animals.

Conclusion

Tetrapleura tetraptera is a notable but underutilized plant spice mostly as a feed additive in the poultry industry. In this study, the beneficial potentials of DAFP were evident on all growth parameters of broiler birds. Like other beneficial plant spices already in use as feed additive, DAFP has shown to possess growth enhancing properties thus enhancing the feed intake efficiency which is an important factor for promoting growth in poultry birds. This study focused on the effect of DAFP on growth performance of broiler chickens. However, to obtain a comprehensive DAFP analysis on broiler chickens, studies on the effect of DAFP on all biochemical indices is recommended to further ascertain the efficacy of using DAFP as feed additive for effective broiler production and other domesticated avian species.

Conflict of Interest

All authors agreed for the publication of this research findings and there is no existing conflict of interest between authors.

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