EFFECT OF DIETARY INCLUSION OF PROCESSED WILD SUNFLOWER (*Tithonia diversifolia*) AND GOAT WEED (*Ageratum conyzoides*) LEAF MEALS ON MEAT QUALITY OF BROILER CHICKENS

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Abstract
This study evaluated the effects of wild sunflower and goat weed composite leaf meal mix (CLM) on the meat of 42-day old broiler chicken. Three hundred day-old Arbor-acre broiler chicks were used for the experiment. The chicks were randomly assigned into five experimental groups at sixty chicks per treatment and ten chicks per replicate. The experimental diets were supplemented with CLM at various inclusion levels: diet 1 (0%), diet 2 (0.11% Oxytetracycline supplementation), diet 3 (0.4% CLM supplementation), diet 4 (0.80% CLM supplementation), and diet 5 (1.20% CLM supplementation). Feed and water were giving ad-libitum and routine management strictly observed. The meat cholesterol level of the broiler chickens fed OXY supplemented diet (diet 2) was lower ($P<0.05$) to those that were fed the control diet. However, further significant ($P<0.05$) decrease were recorded in the birds fed the CLM supplemented diets (diets 3, 4 and 5) such that the least cholesterol content was recorded in 0.8 CLM supplemented-diet. The broiler meat glutathione peroxidase content recorded in the birds fed the 0.8% and 1.2% CLM supplemented diets were lower ($P<0.05$) compare to those birds fed the control diet; OXY and 0.4% CLM supplemented diets. However, the lipid oxidation of the broiler meat fed the OXY and CLM supplemented diets (diets 2, 3, 4 and 5) were ($P<0.05$) lower than those birds fed the control diet. In conclusion, 0.8% and 1.2% dietary supplementation of the broiler chicken diets reduced the meat cholesterol content and the glutathione. The phyto-additives reduced the meat lipid oxidation.

Keywords: Antioxidants, Cholesterol, Meat quality, Phyto-additives

Introduction
Phyto feed additives are plant-based feed additives or botanicals that are used in natural substances in poultry nutrition. They are derived from herbs, spices, other plants and their extracts, like essential oils. Phytogenics or phyto-additives are natural, less toxic, residue-free and ideal feed additives for poultry when compared to synthetic antibiotics. Phyto feed additives have antimicrobial, antifungal, antiviral, antioxygenic, antiparasitic and insecticidal properties. The benefits of using phyto- feed additives in poultry nutrition include increased feed intake, stimulation of digestion, increased growth performance, reduced incidence of disease, improved reproductive parameters, feed efficiency, profitability and reducing poultry house emissions (Windisch *et al*., 2008). The proximate composition (20.6% crude protein, 18.90 crude fibre, 4.00% ether extract, 42.5% carbohydrate and 14.00% ash) and Phyto-constituents (79.1 mg/100g phytin, 0.39 mg/100g tannin, 1.76 mg/100g oxalate, 2.36 mg/100g saponin, 1.23 mg/100g alkaloid and 0.87 mg/100g flavonoid) of wild sunflower leaf meal was reported by Fasuyi *et al*., (2010). The proximate analysis has shown that goat weed (*Ageratum conyzoides*) contains 11.93% crude protein (Gbolade, 1999). According to Okunade (2002), the extract of goat weed has anti-inflammatory, antipyretic and analgesic activities in mice and rats while the oil has antibacterial and antifungal activity. Verma *et al*., (2013) reported that the phytochemical investigation of the plant extract of goat weed shows a high concentration of phenolic compounds and flavonoids, for protection against disorders associated with an excess of free radicals or reactive oxygen species. The goat weed was reported to play a significant role in the eradication of Enteropathogenic microorganism causing inflammation of the intestine (Ram *et al*.,

2008). Little attention has been given to the effects of herbal mixture on poultry physiology when compared to other animals. There could be an interaction of the bioactive compounds in these botanicals (Oloruntola *et al*., 2018). Therefore, the study aimed at assessing the effects of dietary composite leaf meal mix of wild sunflower and goat weed leaf meals on broiler meat quality.

Materials and methods

The experiment was carried out at the Teaching and Research Farm of the Federal College of Agriculture (FECA), Akure, Nigeria. Fresh goat weed and wild sunflower leaves were plucked within the campus of FECA, Akure. The leaves were washed in running tap water, suspended on tray under shade for 20 minutes to ensure proper water drainage and chopped into small pieces with the sharp stainless knife, thereafter spread lightly on tarpaulin under the shed to air-drying for about 14 days and then after milled (100 µ size) to produce goat weed and sunflower leaves meals. Thereafter, equal portion of goat weed meal (GLM) and wild sunflower meal (WLM) were mixed to form wild sunflower and goat weed composite leaf mix (CLM) and analysed for proximate analysis, *terpenoid* (Ferguson, 1956), *saponin* (Shad *et al*, 2013), *flavonoid* (Shad *et al*, 2013), ferric reducing antioxidant property (FRAP) (Pulido *et al*, 2002) and 2,2-diphenyl-1- picrylhydrazyl hydrate (DPPH) (Gyamfi *et al*, 1999). Two basal diets were formulated for the starter (1 to 21 days) and finisher phase (days 22 to 42) (Table 1) to meet the minimum requirement of broiler chicken (NRC, 1994). At each phase, the basal diets were divided into five (5) equal portions and labeled diets 1 to 5. Diet 1 contained 0g/kg of CLM supplement, diet 2 was supplemented with 0.11% Oxytetracycline while Diets, 3, 4 and 5 were supplemented with 0.40%, 0.80% and 1.20% of g/kg CLM, respectively. Three hundred a-day old Arbor acre broiler chicks were distributed to five (5) dietary treatments (60 birds/treatments: 10 birds per replicate) in a complete randomize design. Feed and water were provided *ad-libitum* throughout the 42 days of the experiment.

Results and Discussion

Table 2 shows the proximate composition of phytochemical and antioxidant properties of WLM, GLM, and CLM. The crude protein and crude fibre contents of CLM was higher than the crude protein of WLM but lower than that of GLM. The phenol and flavonoid content of CLM was 6.07 mg/g and 9.56 mg/g, respectively. Saponin (68.91 mg/g) and terpenoid (56.02 mg/g) were also detected in CLM. The antioxidant properties determination shows that CLM has 65.59% DPPH and 1.70 mg/g FRAP. The CLM phytochemical and antioxidant parameter profiles recorded shows that the phyto-additive used in this study has phytochemicals of pharmacological importance. Earlier reports show that phytogenic feed additives usually possess phytochemicals that can be of benefits to the health (Maisarah *et al*., 2014, Oloruntola *et al*., 2018a,b). The effects of phyto-additives on meat analysis of broiler chickens are shown in table 3. The cholesterol content of the meat of the broiler chickens fed OXY supplemented diet (diet 2) was lower ($P<0.05$) to those that were fed the control diet. However, further significant ($P<0.05$) decrease were recorded in the birds fed the CLM supplemented diets (diets 3, 4 and 5) such that the least cholesterol content was recorded in 0.8 CLM supplemented-diet. This observed reduced meat cholesterol in the birds fed the phyto-additive supplemented diets in this study may be a result of activities of phytochemicals such as saponin in CLM which impaired and reduced the uptake of cholesterol in the gut (Oloruntola *et al*., 2019). The broiler meat glutathione peroxidase content recorded in the birds fed the 0.8% and 1.2% CLM supplemented diets were lower ($P<0.05$) compare to those birds fed the control diet; OXY and 0.4% CLM supplemented diets. However, the lipid oxidation of the broiler meat fed the OXY and CLM supplemented diets (diets 2, 3, 4 and 5) were ($P<0.05$) lower than those birds fed the control diet. In conclusion, 0.8% and 1.2% dietary supplementation of the broiler chicken diets reduced the meat cholesterol content and the glutathione. The phyto-additives reduced the meat lipid oxidation.

Table 1: Composition and Nutrient Contents of Experimental Basal Diets

Ingredients (g/kg)	Starter (1 to 21 days)	Finisher(22 to 42 days)
Maize	426.60	485.60
Wheat offal	121.00	101.00
Soybean meal	386.90	347.90
Vegetable oil	22.00	23.00
Di-calcium phosphate	18.00	17.00
Limestone	14.00	14.00
Premix	3.00	3.00
Methionine	3.00	3.00
Lysine	2.50	2.50
Salt	3.00	3.00
Analysis (g/kg DM)		
Crude protein	220.00	205.60
Crude fibre	45.30	43.80
Metabolizable energy (kcal/kg)	2955.88	3 000.24
Calcium	10.20	9.30
Available Phosphorus	6.00	5.50
Methionine	6.30	3.80
Lysine	11.50	10.30

Table 2: Composition of leaf meals and their composite mix

Composition	WLM	GLM	CLM
Proximate composition (%)			
Crude protein	8.05±0.70	11.79±0.13	9.83±0.41
Crude fibre	13.29±0.27	15.80±0.24	14.28±0.25
Ether extract	6.02±0.01	4.97±0.20	5.59±0.13
Ash	14.79±0.14	13.71±0.09	14.28±0.16
Nitrogen free extract	48.54±0.63	45.87±0.51	47.14±0.47
Phytochemicals (mg/g)			
Phenol	6.27±0.01	5.87±0.16	6.07±0.09
Flavonoid	10.25±0.04	8.52±0.13	9.56±0.16
Saponin	60.11±0.15	81.15±0.06	68.91±1.75
Terpenoid	57.85±0.05	53.73±0.27	56.02±0.14
Antioxidant properties			
DPPH (%)	77.85±0.43	48.13±0.07	65.59±2.24
FRAP (mg/g)	1.44±0.01	2.01±0.15	1.70±0.09

CLM: Wild sunflower and goat weed composite leaf mix; WLM: Wild sunflower leaf meal; GLM: Goat weed leaf meal

Table 3: Effects of phyto-additives on meat analysis of broiler chickens

Parameters	Diet 1 Control	Diet 2 OXY	Diet 3 0.4% CLM	Diet 4 0.8% CLM	Diet 5 1.2% CLM	SEM	P value
CHOL (mg/dl)	123.71[a]	60.10[b]	40.16[c]	10.66[e]	30.59[d]	10.37	0.00
GPx (µg/g)	60.12[b]	60.71[a]	60.27[ab]	31.07[d]	40.23[c]	3.32	0.00
LO (mgMDA/g)	1.55[a]	0.83[b]	0.75[b]	0.89[b]	0.94[b]	0.09	0.02

Means within a row with different superscripts are significantly different (P<0.05), OXY: Oxytetracycline, CLM: Composite leaf mix (WLM+GLM 1:1), CHOL: Cholesterol, GPx: Glutathione peroxidase, LO: Lipid oxidation, SEM: Standard error of the mean.

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