

Original Research Article

DIETARY INCLUSION OF ETHANOLIC EXTRACTS OF *Jatropha curcas* ON THE PERFORMANCE AND CARCASS CHARACTERISTICS OF BROILER CHICKENS

Abstract

A study was conducted to evaluate the effect of *Jatropha curcas* leaf extract on the performance and carcass characteristics of broiler chickens. One hundred and fifty day old Arbor Acres broiler chicks were used. They were divided into five experimental groups treatments and each with treatment was replicated six five replicate times. T1 treatment one, (Negative control without, no antibiotics), T2 treatment two (positive control, with antibiotics), and while T3, T4 treatments three, four and T5 five included different had varying inclusion levels of the *Jatropha curcas* leaf extract (0.25g/100kg, 0.50g/100kg and 0.75g/100kg of feed, respectively). The birds were raised for a total number forty two days during which, they were fed experimental diets *ad libitum* on a deep litter system of management during forty two days. Weekly weight gained and feed intake consumed were recorded. Evisceration of carcass was done after forty two days, and; each part was weighed and recorded. Performance characteristics indicated no significant ($P>0.05$) difference in feed intake consumed and feed conversion ratio did not show significant ($P>0.05$) difference among experimental groups, but chicks fed treatment 4 with 0.50g/100kg of *Jatropha curcas* extract showed has the best feed conversion ratio (THERE IS NOT SIGNIFICANT DIFFERENCE AMONG EXPERIMENTAL GROUPS IN FCR), but there were significant ($P<0.05$) differences overall in weight gain (COMMENT; Be careful because only T3 and T5 showed lower WG than T2, so the inclusion of 0.25 and 0.75 g/100 kg had a negative effect on chick growth).

Keywords: Broilers, *Jatropha curcas*, Performance, Broiler carcass (sort in alphabetical order)

Introduction

In COUNTRY (Specify which country the use of antibiotic as a feed additive is allowed), a variety of non-nutritive feed additives mostly antibiotics are used in chicken production to improve the overall performance and immune status by eliminating stress. Some of these additives are recommended for chemotherapeutic and prophylactic purpose, while others are reported to have growth promoting effect. Continuous use of sub therapeutic levels of such additives in feed may result in the presence of their residues in animal products and the development of drug resistant microorganisms in humans.

Antibiotic growth promoters have been banned in developed countries. This ban on the use of synthetic feed additives has triggered intensive research to find and develop alternative strategies to maintain health and performance in intensive poultry production system. Researchers have identified several beneficial chemical compounds in medicinal plants, which play an important role in improving production and immune system of birds against different diseases, have strong medicinal value and could be effectively utilized as natural growth promoters to replace antibiotics and other synthetic feed additives.

Anti-microbial agents are substances that kill microorganisms or inhibit their growth. They are widely employed to cure bacterial diseases. Antimicrobial agents that reversibly inhibit growth

of bacteria are called bacteriostatic whereas those with irreversible lethal action on bacteria are known as bactericidal (1).

Ideally, antimicrobial agents disrupt microbial processes or structures that differ from those of the host. They may damage pathogens by hampering cell wall synthesis, inhibiting microbial protein and nucleic acid synthesis, disrupting microbial membrane structure and function, or blocking metabolic pathways through inhibition of key enzymes (2).

(3) reported that plant extracts and their products are used in many parts of the world as the active principles in herb remedies. They were used locally in the treatment of infections, many centuries before scientific studies were discovered.

Before an antimicrobial agent is accepted for use in human (USE IN HUMAN??) beings it must demonstrate most, if not all, of the following properties: selective toxicity (it should act on bacteria without damaging the host tissues); it should be bactericidal rather than bacteriostatic; it should be effective against a broad range of bacteria; it should not be allergic; it should remain active in plasma, body fluids etc.; it should be stable and preferably water soluble; desired levels should be reached rapidly and maintained for adequate period of time; it should not give rise to resistance in bacteria; it should have long shelf life; it should not be expensive (1). (DELETE THIS PARAGRAPH)

The effectiveness of chemotherapeutic agents depend on many factors, some of which include; the route of administration and location of the infection, the presence of interfering substances, the concentration of the drug in the body, the nature of the pathogen, the presence of drug allergies, and another factor that should not be overlooked is the resistance of microorganisms to the drug. The increasing number and the variety of drug resistance pathogen is a serious public health problem. Bacteria often become resistant in several different ways.

Unfortunately, a particular type of resistance mechanism is not confined to a single class of drugs. Two bacteria may use different resistance mechanisms to withstand the same chemotherapeutic agent. Furthermore, resistant mutants arise spontaneously and are then selected for in the presence of the drug. Bacteria can become resistant to a drug by excluding it from cell, pumping the drug out of the cell, enzymatically altering it, modifying the target enzymes or organelles to make it less drug sensitive (3). There are thousands of species of medicinal plants used globally for the cure of different infections. These plants are used as antimicrobial agents and several works have been carried out by scientists to find out its scientific basis (4).

Some of these plants include; *Anacardium occidentale* (cashew), *Pilostigma reticulatum*, *Anogeissus leiocarpa*, *Enantia chlorantha*, *Senna occidentalis*, *Jatropha curcas* ("Lapalapa"), *Azadirachta indica* ("Dogonyaro") etc. A great number of antibacterial agents exists for various purposes; some of these are usually in the form of plants. The action of these plants on microorganisms have been found to be due to the presence of certain substances such as alkaloids, glycosides, volatile oils, gums, tannins, steroids, saponins, phlobatannins, flavonoids and a host of other chemical compounds referred to as secondary metabolites that are present in them (5; 6; 7).

Medicinal plants like *J. curcas* have played a major role in the treatment of various diseases including bacterial and fungal infections. The extracts of many *Jatropha* species including *J.*

curcas displayed potent cytotoxic, anti-tumor and anti-microbial activities in different assays. The latex of *J. curcas* also showed antibacterial activity against *Staphylococcus aureus* (8), however the antimicrobial activity of the other parts have not been fully investigated.

Jatropha curcas Linn. (family Euphorbiaceae) Physic nut, is a drought resistant shrub which is widely grown in Central and South America, South-East Asia, India and Africa. *J. curcas* plant has been initially considered a traditional herb in many parts of the world (9). It has gained importance in Malaysia, but as a source of seed oil for biofuel production.

Traditionally, different parts of *J. curcas* have been used in treatment of different forms of infection. The leaves decoction is used as an antiseptic substance during birth, the root decoction is used to treat sexually transmitted diseases and the seed is used to treat skin diseases (9). However, its application as a remedy for many of these ailments has not been fully substantiated by the phytochemical compounds responsible for the various effects. Hence, this study was conducted to evaluate the performance and carcass characteristics of broiler chickens –fed different inclusion levels of *Jatropha curcas* leaf extract.

Materials and Methods

The study was carried out at the poultry unit of the Department of Animal Science Teaching and Research farm, University of Ibadan, Nigeria (latitude 7° 33' N and longitude 3° 51' to 3° 36' E). Ibadan is located 228 m above sea level and has a mean annual rainfall of 1289.2 mm based on 27 year of records (10). The experimental pens were thoroughly cleaned, washed and disinfected. The condition of housing and management of birds were the same in all groups.

Processing of Leaf Extract

Fresh leaves of *Jatropha curcas* were collected within Ibadan, South-Western Nigeria. The leaves collected per time was rinsed with clean water to remove any foreign matter, chopped and air-dried. The dried leaves were milled using a roller mill. One litre of an 80 % ethanol extraction fluid was mixed with 200 g of powdered plant material. The mixtures were kept for 2-5 days in tightly sealed vessels at room temperature protected from sunlight, and mixed several times daily with a sterile glass rod. This mixture was filtered through muslin cloth and the residue, adjusted to the required concentration (500 ml of 80% ethanol for the residue of 200 g of powdered plant material) with the extraction fluid for further extraction. Further extraction of the residue was repeated 3-5 times until a clear colorless supernatant extraction liquid was obtained indicating that no more extraction from the plant material was possible. The extracted liquid was subjected to rota-evaporator (Model # R) to remove the ethanol. Rota evaporation was used to concentrate the smaller quantity of extract. A 250 ml aliquot of extracted liquid was subjected to rota evaporation for 3-4 h. Extract from this method was then weighed and stored in desiccators until further use.

Experimental Birds and Management

A total number of 150 day old Arbor Acres strain broiler chicks were purchased from a commercial hatchery in Ibadan. They were divided into (5) groups of 30 birds each and randomly allocated to the 5 treatments and 6 replicates with 6 birds per replicate in a completely randomized design. Water and feed were supplied *ad libitum* while a standard medication and vaccination programs was adopted according to the recommendation of (11). Weekly feed intake

and individual bird weights were recorded for six weeks. Weekly weight gains and feed conversion ratio were calculated from the data collected.

Experimental Diets

Diet 1 - basal diet without [Antibiotics \(T1\)](#)

Diet 2 – basal diet with [Antibiotics \(T2\)](#)

Diet 3 – basal diet with 0.25g *J.atropha* curcas leaf extract/[100 kg feed \(T3\)](#)

Diet 4 – basal diet with 0.50g *J.atropha* curcas leaf extract/[100 kg feed \(T4\)](#)

Diet 5 – basal diet with 0.75g *J.atropha* curcas leaf extract/[100 kg feed \(T5\)](#)

The composition of [basalexperimental](#) diet is shown in Table 1

Table 1: [Ingredients and chemicalGross cComposition of basal dietExperimental Diets.](#)

INGREDIENTS	STARTER	FINISHER
Maize	56	59
Soyabean meal	36.50	28
Fish meal (72% crude proteinC.P)	2.20	1.30
Wheat offal	1.60	7.50
Dicalcium Phosphate (DCP)	1.50	1.50
Methionine	0.10	0.10
Salt	0.25	0.25
Premix	0.25	0.25
Total	100	100
Calculated Nutrient (%)Values		
Dry Matter	90.20	90.50
Crude Protein(%)	23.02	20.00
Crude Fibre	3.70	5.10 (Different values when comparing Table 1 and 2, please check)
Ether Extract	2.70	2.50
Ash	6.50	6.0
Metabolizable Energy (kcal/kg)	2995.10	2950.05
Crude Fibre (%)	3.51	3.79
Calcium (%)	1.03	1.00

Available ~~p~~ Phosphorus (%)	0.63	0.61
Lysine (%)	1.14	1.09
Methionine (%)	0.57	0.55

TABLE 1 AND 2 MUST BE MERGED

Table 2: Chemical Composition of Experimental Diets

Parameter	Starter	Finisher
Dry Matter	90.20	90.50
Crude Protein	23.05	20.9
Crude Fibre	3.70	5.10
Ether Extract	2.70	2.50
Ash	6.50	6.0

Growth Performance and Feed Efficiency characteristics

Feed and water was given *ad libitum*. Feed ~~intake~~consumed (FI, g/bird) was recorded daily, leftover was weighed and discarded. Individually, body weight (BW, g)/bird was taken on pen basis before offering feed the initial day and then at weekly intervals up to 7 weeks. Feed conversion ratio (FCR) was calculated as feed intake per unit gain (~~-i.e.-g feed/~~ intake/g BW gain).

Carcass Characteristics

At day 42, two birds were randomly selected from each of the replicate for carcass analysis. The selected birds were starved over night and their live weight recorded. The birds were slaughtered by severing the jugular vein and fully bled before scalding in hot water. The birds were defeathered after scalding and their plucked weight was taken. The eviscerated weights were recorded. The head, neck, shanks, back, breast, gizzard, and organs such as liver, kidney, heart, spleen, lungs, and pancreas were removed, weighed and recorded. The weight of different cut parts ~~were~~ expressed as percentage of dressed **weight**.

Chemical Analysis

Feed were subjected to proximate analysis according to (12) method. Crude Protein, Ether Extract, Ash, Dry Matter and Nitrogen Free Extracts were ~~determined~~^{the nutrients analyze for}.

Statistical Analysis

Data generated were subjected to one-way analysis of variance (ANOVA) using the (13) package and the **significant means were** separated using Duncan multiple range test of the same software.

Results and Discussion

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~~Growth p~~Performance ~~indices~~ of ~~experimental~~ birds fed ~~experimental diets~~^{*Jatropha curcas*} ~~extract-supplemented diets~~ ^{is}are shown in **Table 23** The final body weight (kg) obtained (~~1.73,1.84,1.61,1.75 and 1.67~~) for birds ~~fed~~ on diets ~~T1, T2, T3, T4, and T5~~ (~~1.73, 1.84, 1.61, 1.75 and 1.67~~, respectively) varied significantly (~~Pp~~^P<0.05). Values obtained for weight gain (kg) (~~1.72, 1.87, 1.56, 1.72 and 1.65~~ for birds ~~fed~~ on diet 1,2,3,4,and 5 respectively) varied significantly (~~Pp~~^P<0.05). Values obtained for feed intake (kg/bird) 4.11, 4.39, 3.85, 4.02 and 3.94 respectively) for treatment 1,2,3,4 and 5 were not statistically different (p>0.05). Also the values obtained for **Feed Conversion Ratio (FCR)** were 2.37, 2.43, 2.52, 2.35 and 2.41 respectively were not statistically **different** (p>0.05) but with birds on diet 4 with the best FCR.

Various reports (14; 15 and 16), indicated that plant extracts has the ability to improve FCR and increase BWG (Body Weight Gain). However, plant extracts are also known to exert anti-microbial actions *in vitro* against important pathogens including fungi.(17).This is due to the abundance of very complex mixture of bioactive components (17).

Results for weight gain showed that T2 had the highest value, followed by T4. This high values may be due to the ability of antibiotics to suppress sensitive populations of bacteria in the intestine which was in line with the findings of (18). ~~Also~~, diversion of nutrients from being used by the gut microorganism for the use of birds may be responsible for ~~–~~values observed. ~~Treatment-4~~ values can be said to be due to growth promoting effect of plant extract as explained by (14 and 15)

The higher feed intake observed in ~~treatment-T4~~ among the treatments with *J.atropha curcas* plant extract may be due to the effect of plant bioactive on digestion as this was in agreement with the work of (19) who believes that some plant extract may stimulate the production of saliva and of gastric and pancreatic juice favoring the secretion of enzymes and therefore improving nutrient digestibility. Once there is increase in pancreatic juice and gastric juice the animal tends to **feed** more because it will quickly degrade. Also it can be said that the synergistic effect of all primary and secondary component may be responsible for the higher feed intake.

There is improvement in feed conversion ratio of T4 when compared with other treatments with different level of *J.atropha curcas* leaf extract which further confirms the antibacterial and antifungal properties of *J.atropha curcas*. It can be said that the low body weight gain (BWG) recorded in ~~Treatment-3~~ may be due to low inclusion rate of the extract in the feed of the birds on that treatment. This is in support with (20) who stated that discrepancy may be attributed to

differences in the inclusion level of products containing plant extracts and essential oils or in the main components of the essential oil. Also the level of active **principal** content of supplements, the environmental conditions and the composition of the basal diet (20 and 21) has effect on the performance of the birds.

Table 3: Growth performance and feed utilization of Characteristics of Broiler Chickens Fed experimental diets.

Diets						
Parameters	T1	T2	T3	T4	T5	SEM
Initial body weight (g)	0.40	0.40	0.41	0.39	0.40	0.11
Final body weight (kg)	1.73 ^a	1.84 ^a	1.61 ^b	1.75 ^a	1.67 ^b	0.06
Total weight gained (kg)	1.33 ^{ab}	1.44 ^a	1.20 ^b	1.34 ^{ab}	1.27 ^b	0.14
Total feed intake consumed (FI, kg)	4.11	4.39	3.85	4.02	3.94	0.25
Feed conversion ratio (FCR)	3.09	3.05	3.21	3.00	3.10	0.21

ab: Means in the same row with different superscripts are significantly ($P < 0.05$) different

AUTHORS MUST AVOID REPEATING IN THE TEXT THE NUMERIC RESULTS THAT SHOWED IN TABLES.

Results obtained show that the dietary inclusion of *J. curcas* only had effect on wings, pancreas, kidney and head. Other parts of carcass were not affected so it is not necessary to repeat the same information available in Table for every one.

Table 4 shows the summary of different parts of broiler and organ weight as expressed in percentage of dressed weight. The average live weight of the birds at the end of the experiment ranges from 1710g to 1880g in T3 and T4 respectively. Value obtained showed, there were no significant ($P > 0.05$) differences.

The average dressed weight of the birds at the end of the experiment ranges from 1390g to 1540g in T2 and T5. Values obtained for T1 and T4 are 1500g and 1510g respectively, no significant ($P > 0.05$) difference across the treatment.

The carcass and organ parts were expressed as the percentage of the dressed weight. The values obtained for breast, thigh, drumstick, back, neck, liver, gizzard, heart, feet, spleen, lungs kidney and head were not statistically different across the treatment. The values for breast range from 25.46 to 27.85 respectively in T5 and T1. Values obtained for T2, T3 and T4 are 26.34, 26.78 and 27.62 respectively. Also values obtained for Thigh ranges from 14.04 to 12.88 in both T3 and T4 respectively. Values obtained for T2 and T5 are 13.20 and 13.00.

Values obtained for wing in T3 and T4 shows significant differences with the value ranges from 10.4 to 9.26. The pancreas also shows significant difference which ranges from 0.43 to 0.23 respectively in T1 and T3. Results of the carcass analysis and organ weights are shown in table 4. Best performance in terms of live weight and dressed weight were recorded for birds on treatment 1, 2, 4 and 5. Treatment 4 had the highest among the treatment especially in terms of live weight, thigh, and breast. Treatment 2 and 5 had the highest value for dressed weight while the highest values for drumstick and wing was observed in Treatment 3. The highest value for breast were also seen in T4. This means the treatments with extract had the best total edible meat yield compared to birds from the control.

Although, the results shows that treatment 2 had the highest body weight values, treatments with leaf extract competes favourably with birds on treatment controls (T1 and T2) in terms of dressed weight which means there was a better distribution and location of meat on several part especially the thigh, drumstick and breast.

Percentage values of wing shows that the values differ significantly while values for liver, gizzard, heart, spleen and lungs did not differ significantly. This development shows there was less concentration of anti-nutritional factors in the diet and extract fed to the birds. This is because higher physiological values in these has been said to be stimulated by the presence of anti-nutritional factors and other harmful secondary metabolites. The lower values observed in Treatment 3 and T4 for pancreas and treatment 4 for kidney shows that plant bio-actives present in *Jatropha curcas* leaf extract can enhance the functions of pancreas and kidney as digestive and excretory organs.

Table 4: Carcass Characteristics and Organ Weight of Broilers Fed experimental diets Leaf Extract

Parameters	T1	T2	T3	T4	T5	SEM
Live weight_(kg)	1.84	1.80	1.71	1.88	1.84	0.097
Dresses weight (kg)	1.50	1.54	1.39	1.51	1.54	0.08
Thighs_(% of dressed wt)	14.04	26.34	26.78	27.62	25.46	0.37
Drumsticks (√√???)	11.64	12.32	12.68	12.07	12.25	0.36
Wings (√√???)	9.69 ^{ab}	10.08 ^{ab}	10.4 ^a	9.26 ^b	9.88 ^{ab}	0.67
Backs (√√)	16.59	17.23	16.60	17.91	18.51	0.67
Breasts (√√)	27.62	26.34	26.78	27.85	25.46	0.85
Neck (√√)	5.31	5.80	5.38	6.04	5.53	0.29
Livers (√√)	3.50	3.24	3.32	2.92	3.16	2.28
Gizzards (√√)	4.46	4.25	3.99	4.19	4.37	0.34
Hearts (√√)	0.58	0.61	0.57	0.53	0.61	0.06
Feet (√√)	3.77	4.97	5.23	4.39	4.85	0.49
Pancreas (√√)	0.43 ^a	0.36 ^{ab}	0.23 ^b	0.25 ^b	0.42 ^a	0.05
Spleens (√√)	0.21	0.16	0.20	0.12	0.11	0.04
Lungs (√√)	0.78	0.72	0.65	0.59	0.78	0.42
Kidneys (√√)	0.81 ^a	0.89 ^{ab}	0.71 ^a	0.44 ^b	0.85 ^{ab}	0.10
Heads (√√)	3.04 ^{ab}	3.19 ^{ab}	3.66 ^a	2.91 ^a	3.11 ^a	0.22

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260 ab:Mean in the same row with different superscripts are significantly(P<0.05) different

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