Research Article

Effects of *Tridax procumbens* Powder on Zootechnical, Biochemical Parameters and Carcass Characteristics of Hubbard Broiler Chicken

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Abstract | This study aims to evaluate the effects of substitution of soybean meal by the *Tridax procumbens* powder on performance and biochemical parameters and on the characteristics of the carcass of Hubbard broilers. For this purpose, 120 day-old chicks with initial average weight of 32.77 ± 1.17 g were divided into 3 different groups of 40 chicks each. Those were T0 (control group); T10 (10% substitution of soybean meal by *Tridax procumbens* powder); and T20 (20% substitution rate). The experiments lasted 56 days and blood samples were taken on the 28th and 56th days for the analysis of various hematological parameters. No significant difference was obtained for the zootechnical parameters such as: the final average weight, feed efficiency, feed intake and average daily gain ($p>0.05$). The final average weight was 1823.62 ± 337.77g; 1828.38 ± 358.55g; and 1933.25 ± 440.57g respectively for groups T0, T10 and T20. Blood glucose level was significantly lower at the T20 group level ($p>0.05$). The urea concentration in the blood has decreased at the level of T10 and T20 groups. It appears from this study that the technological qualities of the meat and the colour parameters of the breast muscle were not significantly altered by the use of *Tridax procumbens* powder. Overall, this experiment allowed us to see that the powder of *Tridax procumbens* can replace soybean meal in the diet of Hubbard broilers without negative effects on their growth performance and the sensory quality of their meat.

Keywords | *Tridax procumbens*, zootechnical parameter, carcass characteristics, Hubbard Broiler

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INTRODUCTION

Agriculture is the second component of the economy and contributes for 36% in the gross domestic product of Benin (INSAE, 2008). It also contributes to the growth of production of animal protein in particular through the promotion of short cycle species in general and especially poultry. Thus, poultry farming is one of the tracks on which the countries of West Africa, Benin in particular, undertake to increase production of animal proteins (Leroy and Lebailly, 1999). Poultry farming in Benin contributes 2.4% to the net agricultural business from which 1.4% for the sub-sector eggs production for human consumption. However this farming has multifactorial constraints leading to a high mortality rate (65-70%) between 0 and 2 months old and a decrease in zootechnical performance (Laurenson, 2002). Among these constraints, those related to feeding hold a prominent place. Indeed, the feed represents 70% of the production cost in breeding broilers, so it is important to pay particular attention to this parameter (Abdelouahab, 2008). The scarcity and cost of some raw materials such as corn and especially soybeans, the main source of protein in poultry, constitute a limit to the development of poultry farming in Benin. It is important to find an endogenous alternative that would be much more accessible and may validly replace soybean meal in poultry feed. In this regard, interest increasingly was developed for increasing the use of natural products such as plants, spices and plant extracts in animal feed (Hernandez et al., 2004).

This interest is justified by the positive effects of plants in animal farming (Frankič et al., 2009; Grashorn, 2010). According to Chen et al. (2008) and Satish and Tushar (2012), leaves of *Tridax procumbens* mainly contain brute protein (up to 26%), 17% of brute fiber, 39% of soluble carbohydrates and minerals such as calcium, magnesium,

potassium, sodium and selenium. These nutritional characteristics of *Tridax procumbens* indicate that this plant can be used as a substitute for soybean meal in breeding broilers. This is what justifies the present study whose primary objective is to evaluate the effects of *Tridax procumbens* in substitution for soybean meal on performance and carcass parameters in Hubbard broiler chicken.

MATERIAL AND METHODS

Animal

The trial included a total of 120 day-old broiler chicks of Hubbard race imported from the Tema hatchery (Ghana). Body average live weight of the chicks was 32.77 ± 1.17 g.

The chickens were bred for 56 days in wire mesh enclosure of 2 x 2 meters in size and each equipped with water troughs and feeders. Three groups of 40 birds each were formed with four replication. At each of these groups, was randomly assigned one of the following feed: T0; T10; and T20 with:

T0: Control feed without addition of *Tridax procumbens* powder;

T10: Feed containing a substitution rate of 10% of soybean meal by the *Tridax procumbens* powder; and

T20: Feed containing a substitution rate of 20% of soybean meal by the *Tridax procumbens powder.*

Experimental Feed

Three types of feed in different substitution rate of soybean meal by the powder of *Tridax procumbens* were used for this experimentation. The first (T0) is the control diet without *Tridax procumbens* (18% of crude protein and 2800 kcal ME / kg of feed). The second has a substitution rate of 10% (T10) and the latter has a substitution rate of 20% (T20). The feed is manufactured at the feed factory "La Confiance" according to the formulation shown in Table 1.

Collection and Powdering of *Tridax procumbens* Plant

The *Tridax procumbens* plants used in this study were collected in an experimental field in Abomey-Calavi. Once collected, the plants (leaf + stem + roots) were dried in the laboratory at a temperature of 28°C for 14 days. After drying, the plants were pulverized at the Polytechnic School of Abomey by using an electronic grinder branded YG -9FQ. After completion of grinding, the powder was sent to the feed factory and then mixed with the other raw materials for the preparation of the feed.

Phytochemical Screening of the *Tridax procumbens* Powder

A phytochemical screening was conducted at the Laboratory for Study and Research in Applied Chemistry (LERCA) of the Polytechnic School of Abomey-Calavi (EPAC) to identify the main chemical constituents of the *Tridax procumbens* powder. This screening was performed following the protocol described by Houghton and Raman (1998).

Evaluation of Growth Performance in Broilers

The chickens were fed following the rationing plan proposed by Petit (1991). The quantity of refused feed was weighed daily; the quantity of consumed feed was determined weekly. It is calculated as follows: difference between the total quantities served per week and the sum of the weekly refusal. The sum of weekly consumption allowed to get the total quantity of feed consumed during the experimental period. The chicken's weight measurement was realized every 7 days. The collected data such as weight of the chickens, the quantity of unconsumed feed, were used to calculate the following production parameters:

Individual Feed Consumption (IC)

$$IC = \frac{\text{Quantity of distributed feed (g)} - \text{Quantity of refused feed (g)}}{\text{Nomber of birds}}$$

Average Daily Gain (ADG)

$$ADG = \frac{(Wf - Wi)}{d}$$

With W_f = final average weight, W_i = initial average weight

Table 1: Percentage composition of different food items used

Food items	Control		10%		20%	
	Start-up	Finishing	Start-up	Finishing	Start-up	Finishing
Corn (%)	60.68	62	60.68	62	60.68	62
Wheat bran (%)	7	7	7	7	7	7
Soybean meal (%)	18	18	16.2	16.2	14.4	14.4
Tridax procumbens (%)	0	0	1.8	1.8	3.6	3.6
Fish Meal (%)	8	6.68	8	6.68	8	6.68
Oyster shell (%)	1	1	1	1	1	1
Concentrate (%)	5	5	5	5	5	5
Salt (%)	0.32	0.32	0.32	0.32	0.32	0.32

and d = duration in days

Feed Conversion Ratio (FCR)

$$\text{FCR} = \frac{\text{Quantity of the feed consumed (g)}}{\text{weight gain (g)}}$$

Evaluation of Biochemical Parameters

A 4 ml of blood samples were taken from 10 chickens per group at the wing vein using a syringe (Venoject®, gauge 22). The samples were taken on 28th day of age and at the end of the experimentation on 56th day of age. The blood was collected divided in tubes without anticoagulant (EDTA) for biochemical analyses. These parameters were evaluated at Research Laboratory in Applied Biology (LARBA). The measured biochemical parameters were: blood glucose, creatinine, urea, alanine aminotransferase (ALT), aspartate aminotransferase (AST). This assessment was made by introducing the blood obtained into a hematology analyzer nicros-ABX type for the analysis of parameters.

Evaluation of Carcass Characteristics

At the end of the experiments, 36 chickens (12 chickens per group) were slaughtered. After being plucked, the viscera were removed. The eviscerated carcass was weighed. The head, neck and legs have been removed and the carcass without head, legs and neck (chicken ready to cook) was weighed. Internal organs such as liver, gizzard, and kidneys were weighed separately. The quantity of abdominal fat was weighed for each slaughtered animal. The yield, relative to the live weight at slaughter, eviscerated carcass; chicken ready to cook and organs was calculated.

Evaluation of Sensory Quality

Sensory analysis was performed on each group of slaughtered chickens with a jury panel of 10 trained members. The breast meat samples were boiled in a double boiler at a temperature of 75°C for 15 minutes. After cooling to room temperature, the samples of cooked meat were cut into small identical cubes. Each judge received in a different colour dish a portion of each cutting homologue belonging to each group and filled out a summary form of the results of the tasting. The judges evaluated the tenderness, juiciness and flavour. The first three characteristics were rated on scales of 1 to 5. For the tenderness, the number 1 is very hard, the number 2: hard, acceptable for the number 3, number 4 for tender and 5 being very tender. As for juiciness, the number 1 corresponds to very dry, dry for the number 2, number 3 for acceptable, the number 4 for soft and 5 being very soft. The intensity of flavour is very low (1), low (2), acceptable (3), strong (4) and very high (5). Finally, each judge has given an overall rating of appreciation ranging from 1 to 5.

Statistical Analysis

The SAS software (Statistical Analysis System, 2006) was used for data analysis. The source of variation was the substitution rates of soybean meal by *Tridax procumbens* powder. The Proc GLM procedure was used for the analysis of variance. The F test was used to determine the significance of the rate effect. The means were compared in pairs by the t-test.

RESULTS

Major Secondary Metabolites Present in the *Tridax procumbens* Powder

The results of the phytochemical screening of the *Tridax procumbens powder* are shown in Table 2. The phytochemical screening shows that the *Tridax procumbens* powder used contains proteins, saponins, mucilages, sterols and terpenes, tannins, alkaloids reducing compounds, polyphenols, flavonoids, anthocyanins, Leuco-anthocyanins. The other compounds that are anthraquinones, coumarins and quinones are absent.

Table 2: Main secondary metabolites present in the *Tridax procumbens powder*

Secondary metabolites		Results
Alkaloids		+
Polyphenols		+
Flavonoids		+
Anthocyanins		+
Leuco-anthocyanins		+
Anthraquinones		-
Free anthraquinone		-
Combined anthraquinones	o-heterosides	-
	o-heterosides with reduced genins	-
	c-heterosides	-
Reducing compounds		+
Tannins	Gallic	+
	Catechic	+
Sterols and terpenes		+
Mucilages		+
Saponosides		+
Coumarin		-
Quinones		-
Proteins		+

+: Presence; - : Absence

Food Consumption, Weight Gain, Average Daily Gain and Feed Conversion Ratio of Broilers

Individual feed consumption, final average weight, the

Table 3: Zoo technical parameters of broilers

Parameters	Groups			Test of significance
	T0	T10	T20	
Individual average consumption / day (g)	76.00 ± 54.77 [a]	79.99 ± 53.59[a]	81.12 ± 53.89 [a]	NS
Initial average weight (g)	34.10 ± 3.28[a]	31.87 ± 2.23 [b]	32.35 ± 2.56 [b]	**
Final average weight (g)	1823.62 ± 337.77[a]	1828.38 ± 358.55[a]	1933.25 ± 440.57[a]	NS
ADG (g/j)	30.91 ± 5.57[a]	32.64 ± 5.57[a]	34.59 ± 5.57[a]	NS
CI	2.42 ± 0.46[a]	2.28 ± 0.54[a]	2.24 ± 0.49[a]	NS

** = P<0,01, **T0**: Control feed without addition of *Tridax procumbens* powder; **T10**: Feed containing a substitution rate of 10% of soybean meal by the *Tridax procumbens* powder; **T20**: Feed containing a substitution rate of 20% of soybean meal by the *Tridax procumbens* powder; **ADG**: Average Daily Gain; **CI**: Consumption Index; Values in the same row followed by different letters are significantly different at the 5% threshold.

Table 4: Biochemical parameters of Hubbard broilers

Paramètres	Age (days)	Groups			Test of significance
		T0	T10	T20	
Glucose (g/l)	D28	0.60 ± 0.07[a]	0.58 ± 0.06 [a]	0.54 ± 0.05 [b]	*
	D56	0.58 ± 0.08 [a]	0.58 ± 0.06 [a]	0.55 ± 0.05 [b]	*
creatinine (mg/l)	D28	5.17 ± 0.08 [a]	5.19 ± 0.07 [a]	5.18 ± 0.07 [a]	NS
	D56	5.21 ± 0.15 [a]	5.22 ± 0.10 [a]	5.17 ± 0.07 [a]	NS
urea (g/l)	D28	0.05 ± 0.00 [a]	0.038 ± 0.01 [b]	0.03 ± 0.00 [b]	***
	D56	0.05 ± 0.00 [a]	0.03 ± 0.00 [b]	0.03 ± 0.00 [b]	***
AST (UI/l)	D28	149.75 ± 0.78 [a]	149.95 ± 0.60 [b]	150.15 ± 0.67 [b]	**
	D56	149.50 ± 0.60 [a]	150.00 ± 0.64 [b]	150.05 ± 0.51 [b]	**
ALT (UI/l)	D28	5.85 ± 0.67 [a]	6.20 ± 0.69 [b]	6.55 ± 0.51 [b]	***
	D56	5.65 ± 0.81 [a]	6.25 ± 0.55 [b]	6.35 ± 0.48 [b]	***

NS: Non Significant (p>0.05); *: p<0.05; *: p<0.01; ***: p<0,001; **T0**: Control feed without addition of *Tridax procumbens* powder; **T10**: Feed containing a substitution rate of 10% of soybean meal by the *Tridax procumbens* powder; **T20**: Feed containing a substitution rate of 20% of soybean meal by the *Tridax procumbens* powder; **ALT**: alanine aminotransferase; **AST**: aspartate aminotransferase the means between the classes of the same line followed by different letters differ significantly with the threshold of 5%.

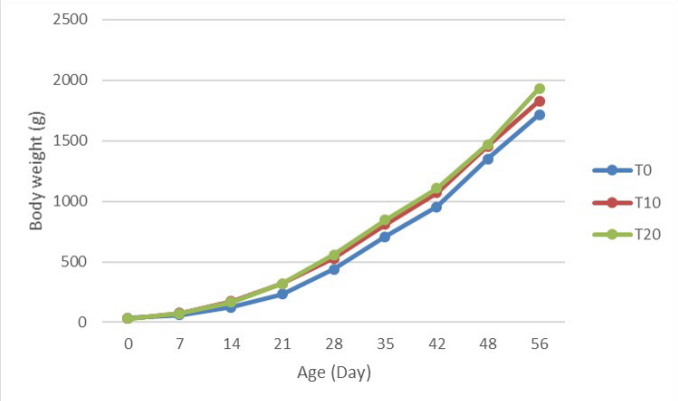

Figure 1: variation curve of the average weight of chickens

average daily gain (ADG) and Consumption Index (CI) obtained at the end of the experiment are presented in Table 3. The quantity of ingested feed has not varied irrespective of the group (p> 0.05). It is the same for the final average weight, average daily gain and the CI, the respective values were similar from one treatment to another (p> 0.05). However, ADG and final average weight tend to rise but very weakly with the incorporation rate of *T. procumbens*. Similarly feed efficiency decreased slightly with increasing substitution. Figure 1 shows the variation curve of the average weight of chickens with the time and according to different groups. At the beginning of the experiment, the average weight of the birds was: 34.10 ± 3.28g; 31.87 ± 2.23g and 32.35 ± 2.56g respectively for group T0, T10 and T20**.** At the end of the experiment, the weight reached 1823.62 ± 337,77g for group T0; 1828.38 ± 358,55g for group T10 and 1933.25 ± 440,57g for group T20.

Biochemical Parameters of Broilers

Biochemical parameters of the chickens fed with the powder of *Tridax procumbens* incorporated in different percentages in the staple feed are shown in Table 4. Only the creatinine has not changed from one group to another. Blood glucose was significantly high and similar to the level of the T0 and T10 group while it was lower at group T20 (p <0.05). This trend was observed both at 28 days than 56 days of age. At 28 and 56 days of age, the concentration of urea in the blood and that of alanine transaminase were higher for the group T0. These concentrations were lower

Table 5: Carcass characteristics of broiler chickens

Carcass characteristics	Groups			Test of significance
	T0	T10	T20	
Body weight before killing (g)	2658.08 ± 370.81[a]	2660.00 ± 387.02[a]	2742.33 ± 442.82[a]	NS
eviscerated carcass was weight (g)	2205.33 ± 355.25[a]	2162.50 ± 329.00[a]	2238.00 ± 380.74[a]	NS
Yield of eviscerated carcass (%)	82.79 ± 2.35[a]	81.24 ± 1.45[a]	81.55 ± 2.50[a]	NS
Weight of chicken ready to cook (g)	1904.416 ± 306.39[a]	1861.08 ± 298.30[a]	1915.83 ± 339.39[a]	NS
Yield of chicken ready to cook	71.48 ± 2.2[a]	69.83 ± 1.9[a]	69.75 ± 2.6[a]	NS
% of abdominal fat	0.97 ± 0.008[a]	0.70 ± 0.006[a]	0.50 ± 0.004[a]	NS
% of gizzard	1.75 ± 0.003[a]	1.72 ± 0.002[a]	1.80 ± 0.002[a]	NS
% liver	2.08 ± 0.003[a]	2.18 ± 0.002[a]	2.18 ± 0.003[a]	NS
% kidneys	0.73 ± 0.001[a]	0.70 ± 0.001[a]	00.69 ± 0.001[a]	NS

NS: Non Significant (p>0.05); **T0**: Control feed without addition of *Tridax procumbens* powder; **T10**: Feed containing a substitution rate of 10% of soybean meal by the *Tridax procumbens* powder; **T20**: Feed containing a substitution rate of 20% of soybean meal by the *Tridax procumbens* powder; The means between the classes of the same line followed by different letters differ significantly with the threshold of 5%.

Table 6: Organoleptic qualities of the breast meat of Hubbard broilers

Parameter	Groups			Test of significance
	T0	T10	T20	
Flavor	2.86±0.83	2.87±0.97	2.9 ± 0.89	NS
Juiness	2.93±0.96	3.10±0.86	2.98±0.99	NS
Tenderness	3.68±0.90	3.40±0.90	3.4 ± 0.98	NS
Global acceptation	3.21±0.94	3.20±1.00	3.1 ± 0.92	NS

NS: P> 0.05; **T0**: control feed without addition of *Tridax procumbens* powder; **T10**: Feed containing a substitution rate of 10% soybean meal by the *Tridax procumbens* powder; **T20**: Feed containing a substitution rate of 20% soybean meal by the *Tridax procumbens* powder; Averages in the same row followed by different letters are significantly different at the 5% threshold.

and similar for Groups T10 and T20 (p <0.001). Similar variations to those observed for the concentrations of urea and alanine transaminase were also observed for the concentration of aspartate aminotransferase (AST) (p <0.01)

Carcass Characteristics of Broiler Chickens

The carcass characteristics of chickens fed with *Tridax procumbens* powder incorporated in different percentages in the feed are presented in Table 5. The yield of the eviscerated carcass was 82.79 ± 2.35% for group T0; 81.24 ± 1.45% for group T10; and 81.55 ± 2.50% for group T20. The percentage of abdominal fat was 0.97 ± 0.008% for group T0; 0.70 ± 0.006% for chickens of group T10; and 0.50 ± 0.004% for chickens of T20 group. The liver percentage was 2.08 ± 0.003% for chickens of group T0; 2.18 ± 0.002% for chickens of group T10 and 2.18 ± 0.002% for chickens of group T20. The percentage of kidneys was 0.73 ± 0.001 for chickens of group T0; 0.70 ± 0.001 for chickens of group T10; 0.69 ± 0.001 for chickens of group T20. No significant difference was observed for these parameters regardless of the group (p>0.05).

Organoleptic Qualities of the Breast Meat of Hubbard Broilers

The jury appreciation notes regarding flavour, juiciness, tenderness and the general acceptance of the meat of chickens subjected to the different treatments are shown in Table 6. The flavour was 2.86 ± 0.83; 2.86 ± 0.83; 2.92 ± 0.89 for the groups T0, T10, and T20, respectively. The scores for juiciness were 2.93 ± 0.96 for T0, 3.10 ± 0.86 to 2.98 ± 0.99 T10 and T20. The tenderness was 3.68 ± 0.90; 3.40 ± 0.90; 3.44 ± 0.98 respectively in chickens of groups T0, T10 and T20. No significant differences were observed for different organoleptic parameters regardless of the group (p>0.05).

DISCUSSION

Major Secondary Metabolites Present in the Powder of *Tridax procumbens*

The phytobiotics are commonly used in broiler breeding to improve growth performance and quality and preserving of meat (Windisch et al., 2008; Brenes and Roura, 2010). The use of these phytobiotics in poultry is related to the wide variety of secondary metabolites responsible for their biological activities (Guardia et al., 2011). In this study, the phytochemical screening performed on the *Tridax procumbens* powder reveals the presence of proteins, saponins, mucilages, sterols and terpenes, tannins, reducing compounds, alkaloids, polyphenols, flavonoids, anthocyanins , leuco anthocyanins. Phytochemical screening results are consistent with those reported by Abubakar et al. (2012) in Nigeria. These results are also consistent with those reported by Terrumun et al. (2012) except that anthraquinone have been reported in *Tridax procumbens* powder by these authors in Nigeria. This difference in the chemical composition of *Tridax procumbens* powder used in our study may be

related to the different agro-ecological zones in relation to climate and environmental factors as notified Kubmarawa et al. (2007).

Food Consumption, Weight Gain, Average Daily Gain and Feed Efficiency in Hubbard Broiler Chicken

The production parameters have not varied significantly from one group to another. However, the final average weight and ADG increased slightly with the rate of incorporation of *Tridax procumbens* powder. Regarding the feed efficiency, the values obtained were slightly lower with increasing degree of substitution. The protein content of the dried *Tridax procumbens* plant and its antioxidant properties reported by Ikewuchi et al. (2009) could justify the production parameters obtained with different substitution rates. These results suggest that *Tridax procumbens* can be used as a substitute for soybean meal without negatively affecting the growth parameters of Hubbard breed broilers.

Biochemical Parameters of Broilers Hubbard

The substitution of soybean meal at 20% by *Tridax procumbens* powder contributed significantly to the reduction of blood sugar levels in the Hubbard broiler. This can be explained by the effects of hypoglycemic activity of *Tridax procumbens* reported by Bhagwat et al. (2008). Creatinine did not change whatever the *Tridax procumbens* powder incorporation rate. Moreover, the urea concentration in the blood decreased in chickens fed with *Tridax procumbens* powder. This testifies the nontoxic effect of different level of incorporation of *Tridax procumbens* used in this study on renal function in the Hubbard broiler, because according Casseleux (2007), in renal insufficiency, both renal parameters such as creatinine and urea increase, which is not the case in this study. In this study, concentrations of aspartate aminotransferase (AST) and alanine aminotransferase (ALT) showed an increase with the soybean meal substitution rate by powder of *T. procumbens*. According to Kaneko and Cornelius (1980), the increase in AST levels can translate the toxic effect of the powder of *Tridax procumbens* on liver parenchymal cells and other non-hepatic cells.

Carcass Characteristics in Hubbard Broiler Fed with *Tridax procumbens*

The incorporation in broiler feed of *Tridax procumbens* powder had no significant effects on carcass yield regardless of the substitution level. Abdominal fat has not changed significantly. However, a slight decrease in the percentage of fat level with increasing substitution rate was observed. Plants, especially *Tridax procumbens*, are known for their hypoglycaemic effect and this may explain the slight decrease of fat level observed. The percentages of kidney and liver are identical for all the treated groups. This suggests that this plant had no effect on these organs. According to Ahemefule et al. (2006), the weight of some internal organs such as the kidneys and liver are clues that can be used in animal feeding experiments as evidence of toxicity. Indeed, these organs are recognized for their detoxification property of the body. Increasing in their weight is common in cases of poisoning linked to xenobiotic as highlighted McGeown (2003). In addition, no abnormal consistency nor abnormal colour were observed in these organs, which demonstrates the nontoxic effect of different soybean meal substitution rate by the powder of *Tridax procumbens.*

Organoleptic Qualities of the Breast Meat of Broiler Chicken

No significant differences were noted in terms of flavour, juiciness, tenderness and general acceptance of chicken meat of different groups. Although there is no significant difference, the values of flavor and juiciness in the treated groups are slightly higher than in the control group. By contrast, the meat of T10 and T20 groups of chickens were slightly softer than the control group. This can be attributed to the low post-mortem pH values obtained for the meat of groups T10 and T20. This corroborates the observations made by Maltin et al. (2003) and Jelenikova (2008) who reported that the meat having a lower pH is softer than that which has a higher pH. Given the results of the taste test, *Tridax procumbens* can replace soybean meal without negatively affecting the organoleptic qualities of the meat of broiler chickens.

At the end of this study, it appears that production parameters did not varied significantly in experimental chickens.

The results showed that the powder of *Tridax procumbens* can validly replace soybean meal without altering the characteristics of broilers meat. We suggest for future studies: the assessing of the nutritional value of the *Tridax procumbens* powder and studying of the antimicrobial and anti-stressful activities of this plant in chickens.

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CONFLICT OF INTEREST

No conflict of interests are declared by authors for the contents in the manuscript.

AUTHOR'S CONTRIBUTION

Ahossi PK designed the experiment while Dougnon JT looked after the scientific quality of the experience. Kiki

PS and Houessionon JM performed statistical analysis and translation in English.

REFERENCES

- Abdelouahab O (2008). Le soja dans l'alimentation du poulet de chair aspects qualitatif et quantitatif. Thème de Magister en médecine vétérinaire. Constantine. Pp. 98.
- Abubakar A, Ogbadoyi EO, Okogun JI, Gbodi TI, Ibikunle GF (2012). The identification of putative antitrypanosomal compounds in *Tridax procumbens* extracts. Int. J. Med. Aromat. Plants. 2(1): 185-194.
- Ahemefule FO, Edeuok GO, Usman A, Amaefule KU, Obua BE, Oguike SA (2006). Blood biochemistry and hematology of weaner rabbits fed sundried, Ensiled and fermented cassava peel based diet. Pakistan J. Nutr. 5 (3): 248-253. http://dx.doi.org/10.3923/pjn.2006.248.253
- Bhagwat DA, Killedar SG, Adnaik RS (2008). Anti-diabetic activity of leaf extract of *Tridax procumbens*. Int. J. Green. Pharm. 2: 126-128. http://dx.doi.org/10.4103/0973-8258.41188
- Brenes A, Roura E (2010). Essential oils in poultry nutrition: Main effects and modes of action. Anim. Feed Sci. Technol. 158: 1-14. http://dx.doi.org/10.1016/j.anifeedsci.2010.03.007
- Casseleux G (2007). Détermination des valeurs usuelles biochimiques et hématologiques du chiot âgé de 0 à 8 semaines. Doctoral dissertation, École vétérinaire de Maisons-Alfort. 129 p.
- Chen WH, Ma XM, Wu QX, Shi YP (2008). Chemical constituent diversity of *Tridax procumbens*. Can. J. Chem. 86(9): 892- 898. http://dx.doi.org/10.1139/v08-097
- Frankič T, Voljč M, Salobir J, Rezar V (2009). Use of herbs and spices and their extracts in animal nutrition. Acta argiculturae Slovenica. 94(2): 95–102.
- Grashorn MA (2010). Use of phytobiotics in broiler nutrition – an alternative to feed antibiotics? J. Anim. Feed Sci. 19: 338–347.
- Guardia S, Konsak B, Combes S, Levenez F, Cauquil L, Guilgroup JF, Moreau-Vauzelle C, Lessire Juin M, Gabriel HI (2011). Effect of a natural phytobiotic blend and stocking density on growth performance and digestive microbiota of broiler chickens. In prep in Anim. Feed Sci. Technol.
- Hernandez F, Mardrid J, Garcia V, Orengo J, Megias MD (2004). Influence of two plant ex-tracts on broiler performance, digestibility, and digestive organ size. Poult. Sci. 83:169-174. http://dx.doi.org/10.1093/ps/83.2.169
- Houghton PJ, Raman A (1998). Laboratory handbook for the fractionation of natural extracts, New York, Ed Chapman and Hall. Pp.208.
- Ikewuchi CJ, Ikewuchi CC, Igboh Ngozi M (2009). Chemical profile of *Tridax procumbens* Linn. Pakistan J. Nutr. 8(5): 548-550. http://dx.doi.org/10.3923/pjn.2009.548.550
- Institut National de la Statistique et de l'Analyse Economique INSAE (2008). Rapport annuel d'activité.15 p.
- Jelenikova J, Pipek P, Staruch L (2008). The influence of ante-mortem treatment on relationship between pH and tenderness of beef. Meat Sci. 80 (3): 870-874. http://dx.doi.org/10.1016/j.meatsci.2008.04.004
- Kaneko JJ, Cornelius CE (1980). Clinical Biochemistry of Domestic Animals, 3rd ed. Academic Press, New York. Pp. 41–376.
- Kubmarawa D, Ajoku GA, Enwerem NM, Okorie DA (2007). Preliminary phytochemical and antimicrobial screening of 50 medicinal plants from Nigeria. Afr. J. Biotechnol. 6(14): 1690-1696.
- Laurenson P (2002). Détermination des paramètres zootechniques de la pintade locale dans la région du Borgou. Mémoire pour l'obtention du diplôme d'Ingénieur: Faculté des Sciences Agronomiques de Gembloux, Université de Gembloux, 81 p.
- Leroy PL, Lebailly P (1999). Conséquences de l'infestation des productions animales sur la santé animale et humaine. Acte du séminaire sur les enjeux de l'amélioration génétique sur la santé animale en Afrique Sub-saharienne. 8-10 septembre.
- Maltin C, Balceerzak D, Tilley R, Delday MM (2003). Determinants of meat quality: Tenderness. Proc. Nutr. Soc. 62: 337-347. http://dx.doi.org/10.1079/pns2003248
- McGeown JG (2003). Physiologie: L'essentiel (7ième Ed). Maloine: Paris. Pp. 226-229.
- Petit E (1991). Manuel d'aviculture en Afrique. Paris Rhone – Mérieux. Pp. 74.
- Satish AB, Tushar SK (2012). Phytochemical and pharmacological potential of *Tridax procumbens* Lin. IJABR. 2(3): 392-395.
- Terrumun A, T-Anyiin, Kolapo AD (2012). Phytochemical Screening of a Vended Antimalarial: Malatreat. Pp. 92-102.
- Windisch WM, Schedle K, Plitzner C, Kroismayr A (2008). Use of phytogenic products as feed additives for swine and poultry. J. Anim. Sci. 86:140-148. http://dx.doi.org/10.2527/jas.2007-0459