

Tridax procumbens Effects on Lesions, Haematology and Eggs Production of Hens Affected by Fowlpox

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Authors' contributions

This work was carried out in collaboration between all authors. Author TMK provided the case, and supervised the work. Author TJD managed the literature searches and wrote the draft of the manuscript. Author JSEG contributed to the correction of the draft. Author CB designed the figures. All authors read and approved the final manuscript.

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ABSTRACT

The powder of *Tridax procumbens* was added to hens' food to assess its effects on fowlpox lesions, hematological parameters and zootechnic parameters. Five batches of ten hens each were installed either in control or in treatment groups. The powder of *Tridax procumbens* was added to hens' food using various proportions and different experimental periods. The scabs disappeared on the crests and on wattle of hens fed with *Tridax procumbens*. The number of red blood cells, haemoglobin content (Hb), average contents in haematocrit (Ht), average corpuscular concentration in haemoglobin (ACCH) and average corpuscular content in haemoglobin (ACcH) increased while the number of leukocytes decreased. Compared to the control batch, the laying rate increased in the four experimental batches during the first 28 experimental days, when the conversion index decreased.

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1. INTRODUCTION

In West Africa and particularly in Benin, agriculture plays an important role in economics activities. Agriculture accounts for up to 36% of the Gross Domestic Product of Benin [1]. About 48% of the active population is involved in agricultural activities. Aviculture is a means of increasing animal proteins' production in West African countries, particularly in Benin, [2]. Hence, aviculture contributes to the increase in Gross Domestic Product and then plays a vital role in people employment [3]. Nevertheless, the major challenge of livestock sector is to deal with pathological diseases [4]. Among pathology occurring in aviculture, fowlpox, which is caused by poxviruses, is a major poultry pathology problem. The main healthy problems occurring because of fowlpox are high mortality rate in fowls, weakening of immune system that leads to opportunist infections and in finish huge economic losses for poultry farmer. Fowlpox induces pustular, benign and proliferative lesions of the skin and diphtheritic lesions on the mucous membrane of the digestive and respiratory passages [5,6]. The disease affects both domestic and free living birds in nature resulting in varying morbidity and mortality [7]. The diphtheritic form is usually more severe as it causes significant mortality and economic losses in affected flocks [8]. Despite the existence of vaccine to prevent fowlpox, diseases still occur because the vaccine Diftosec[®] generally used by poultry farmer was misused. Besides, Hexamine[®] that is used to treat fowlpox is no longer available in Benin. Hence, poultry farmers use many antibiotics and then induced antimicrobial resistances in rearing environments which increases the production cost. Then, endogenous solutions easily used for poultry farmers could be plant used in poultry food to stop fowlpox in poultry farm. *Tridax procumbens* is one of the useful plants which can be used. *Tridax procumbens* owns antimicrobial and nutritional potentiality [9]. This plant is used in traditional medicine to treat fever, typhoid fever, asthma, epilepsy and diarrhea [10,11]. In Benin, it is also used as forage for horned cattle and rabbits [12,13]. Containing average 34.57% proteins [14], *T. procumbens* could be used to improve zootechnic parameters in animals' breeding. The present study aims to assess the effects of the powder of *Tridax procumbens* on lesions and zootechnic parameters in ISA Brown layers suffering of fowlpox.

2. MATERIALS AND METHODS

2.1 Plant and Fowls Selection

Tridax procumbens was grown in natural conditions in the experimental field farm of Department of Animal Production and Animal Health of University of Abomey-Calavi. At the flowering stage and earlier on morning, *Tridax procumbens* was harvested. After harvesting, all the leaves were cut from the *Tridax procumbens*' stem. Leaves were spread on the iron sheets and dried in room condition for five days under a temperature of 30°C and hygrometry of 73%. At the end of the drying stage, all the leaves were transformed into powder using a blender that owns the following characteristics: model: QBL-20L40; Voltage: 230 V; Frequency: 50 Hz; Power: 300 W; Speed: 10000-13000 RPM; Cup Volume: 2000 ml.

A total of fifty ISA Brown layers at twenty three weeks age, naturally contaminated by fowlpox virus were used. Clinical symptoms measured were: Appearance of greyish scabs on their crests and wattle.

In five batches, each containing ten hens, different rates of *Tridax procumbens*' powder were served in food as described below:

- Batch 1:** hens shown clinical symptoms of fowlpox diseases and fed with 50 g of *Tridax procumbens*' powder per kg of food and per day for 28 days,
- Batch 2:** hens shown clinical symptoms of fowlpox diseases and fed with 50 g of *Tridax procumbens*' powder per kg of food and per day for 56 days,
- Batch 3:** hens shown clinical symptoms of fowlpox diseases and fed with 100 g of *Tridax procumbens*' powder per kg of food and per day for 28 days,
- Batch 4:** hens shown clinical symptoms of fowlpox diseases and fed with 100 g of *Tridax procumbens*' powder per kg of food and per day for 56 days,
- Batch 5 (control):** hens shown clinical symptoms of fowlpox diseases which did not received powder of *Tridax procumbens* in food.

2.2 Blood Sampling and Haematological Analyses

Blood samples were collected at the end of the experimentation from the axillary vein with Venojects® Single-Sample in tubes with *vacuum* containing anticoagulant (sodium citrate). Five hens were randomly selected per batch for blood sampling in order to establish the haemogram of the layers. The following parameters were measured: average contents in haematocrit (Ht), haemoglobin content (Hb), number of red blood cells, number of white blood cells, average globular volume (AGV), average corpuscular concentration in haemoglobin (ACCH), average corpuscular content in haemoglobin (ACcH) and the number of Platelets.

2.3 Zootechnic Parameters

Zootechnic parameters evaluated were: the laying rate, the conversion index (CI). The laying rate was calculated by using the ratio of number of eggs produced per number of laying hens. As for the conversion index, the ratio was calculated using the total quantity of food consumed by all the hens per weight of eggs laid by all the hens. The conversion index is therefore the quantity of food that is needed to produce 1 kg eggs.

2.4 Statistical Analyses

Statistix (version 8.0.) software was used for statistical analysis. Student t test was used to

compare means. Significance was set at $P < 0.05$. Figure was performed using Excel software.

3. RESULTS

3.1 Macroscopic Lesions

Fig. 1 shows the aspect of a hen naturally infected with fowlpox before the use of *Tridax procumbens*' powder. Figs. 2 and 3 show the hens' crests after the use of the powder of *Tridax procumbens*.

3.2 Haematological Parameters

Haematological parameters at the two periods of data collection (before and after introduction in food of *Tridax procumbens*' powder) are shown in the Table. Except for platelets, significant difference was observed from haematological parameters between the two periods of data collection (Table 1). The haematological parameters of hens in each batch were also compared to control ones at the end of experimentation (Table 1). Results obtained showed that the number of red blood cells, the haemoglobin content (Hb), the average contents in haematocrit (Ht), the average corpuscular concentration in haemoglobin (ACCH) and the average corpuscular content in haemoglobin (ACcH) were significantly higher than that of the control ones at the end of experimentation.



Fig. 1. Characteristic scabs of fowl pox before the use of the powder of *Tridax procumbens* in ISA Brown layers
a= fowl pox scabs

In contrast, the number of leukocytes decreased in comparison to the control ones at the end of experimentation (Table 1). Similar values of haemoglobin content from batch 1 to batch 4 were obtained. No significant difference was obtained from data collected from average contents in haematocrit, ACCH and ACcH in the

batches from 1 to 4. The number of leukocytes was significantly higher when the amount of 100g of *Tridax procumbens*' powder was given to fowls in comparison to results obtained from fowls of batches 1 and 2 (50 g of *Tridax procumbens*' powder).



Fig. 2. Absence of fowl pox scabs after treatment: 50 g of *Tridax procumbens*/kg of feed
b= Hen's crest without lesions

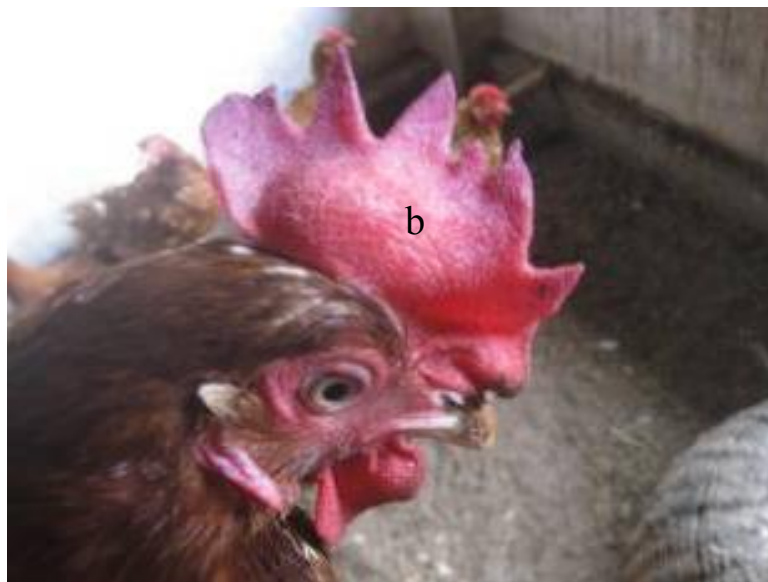


Fig. 3. Absence of fowl pox scabs after treatment: 100 g of *Tridax procumbens*/kg of feed
b= Hen's crest without lesions

Table 1. Haematological parameters before and after utilisation of the powder of *Tridax procumbens* in ISA Brown layers suffering from fowl pox

Batches	Amount of <i>T. procumbens</i> (g)	Period of treatment (days)	Platelets (million / mm ³)	Red blood cells (million/ mm ³)	Hb (g/dl)	Ht (%)	Leukocytes (million/mm ³)	ACcH	ACCH	AGV
Before application of <i>Tridax procumbens</i>	50	28	30.14±0.09 ^b	2385.80±21.75 ^b	10.30 ± 0.20 ^b	33.30 ± 1.20 ^b	22.60 ± 0.41 ^c	43.17± 1.39 ^b	30.98 ± 1.67 ^a	139.55±4.13 ^b
1 After application of <i>Tridax procumbens</i>			30.20±0.20 ^b	2999.40±0.89 ^c	13.56±0.55 ^c	39.90±0.17 ^c	20.40±0.89 ^a	45.2±0.18 ^c	33.98±0.09 ^c	133.02±0.57 ^c
Before application of <i>Tridax procumbens</i>	50	56	30.12±0.05 ^b	2386.60±22.41 ^b	10.18±0.12 ^b	33.5±1.25 ^b	22.38±0.41 ^c	42.65±0.47 ^b	30.40±1.25 ^a	140.35±0.32 ^b
2 After application of <i>Tridax procumbens</i>			30.40±0.42 ^b	3002.60±1.14 ^c	13.54±0.03 ^c	40.42±0.19 ^c	20.26±0.16 ^a	45.09±0.17 ^c	33.49±0.05 ^c	134.61±0.67 ^c
Before application of <i>Tridax procumbens</i>	100	28	30.12±0.08 ^b	2388.80±19.35 ^b	10.34±0.11 ^b	33.6±0.7 ^b	22.60±0.41 ^c	43.28±0.35 ^b	31.08±0.42 ^a	140.67±0.38 ^c
3 After application of <i>Tridax procumbens</i>			30.14±0.11 ^b	2999.41±0.89 ^c	13.46±0.06 ^c	39.96± 0.25 ^c	20.92± 0.71 ^a	44.87±0.25 ^c	33.67±0.35 ^c	133.22±0.57 ^c
Before application of <i>Tridax procumbens</i>	100	56	30.42±0.42 ^b	2403.60±28.71 ^b	10.15±0.15 ^b	33.2±0.32 ^b	22.52±0.85 ^c	42.35±0.35 ^b	31.24±0.25 ^a	135.66±0.62 ^b
4 After application of <i>Tridax procumbens</i>			30.50±0.50 ^b	2999±0.44 ^c	13.46±0.04 ^c	40.19±0.42 ^c	20.85±0.76 ^a	45.15±0.22 ^c	33.51±0.43 ^c	133.87±0.82 ^c
5 End of experimentation	0	56	29.8±0.22 ^a	2366±0.32 ^a	9.94±0.03 ^a	31.4±0.48 ^a	21.72±0.65 ^b	42.01±0.17 ^a	31.46±0.01 ^b	132.51±1.32 ^a

Values followed by different letters within the same column are significantly different ($P < 0.05$)

Hb: haemoglobin content, ACcH: Average Corpuscular Content in Haemoglobin, ACCH: Average Corpuscular Concentration in Haemoglobin, AGV: Average Globular Volume

3.3 Zootechnic Parameters of ISA Brown Layers

The laying rate and the Conversion Index are depicted in Figs. 4 and 5. Hens from batches 2 and 4 were fed respectively with 50 g and 100 g of *Tridax procumbens*' powder per kg of food and per day during 56 days. The laying rate observed during 56 days of experience increased in comparison to control ones. Hens from batch 1 and 3 were fed respectively with 50 g and 100 g of *Tridax procumbens*' powder per kg of food and per day during 28 days. The laying rate decreased after 28 days and become similar to the rate of controls.

About the conversion Index, the result showed that the value obtained from hens from batch 2 and from batch 4 decreased in comparison to control ones at 35 days of experimentation. Similar conversion Index was observed in batch 1 and in batch 3 in comparison to control ones.

4. DISCUSSION

4.1 Macroscopic Lesions

Macroscopic inspection showed the disappearance of scabs on the crests and wattle of hens fed with *Tridax procumbens*. OIE reported that the cutaneous form of fowlpox,

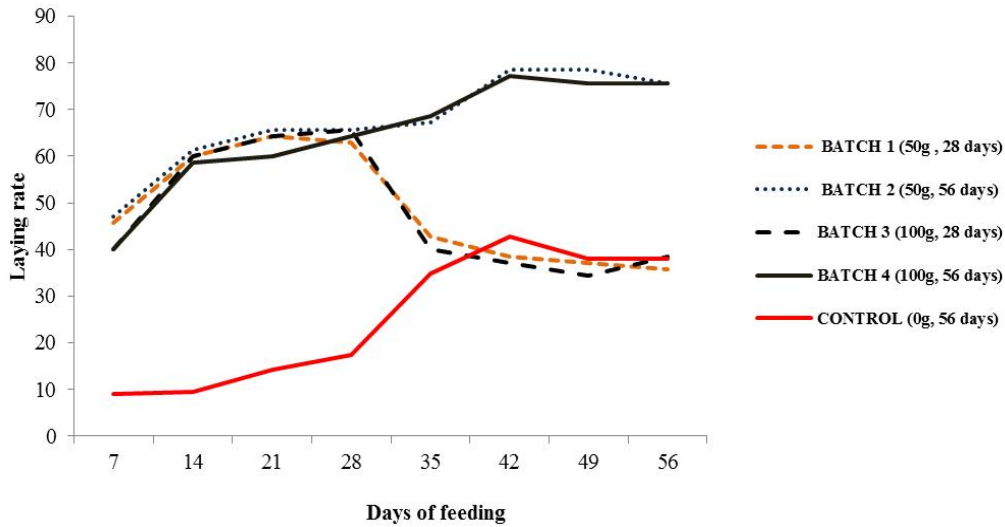


Fig. 4. Variation of laying rate in control and in hens fed with *Tridax procumbens*

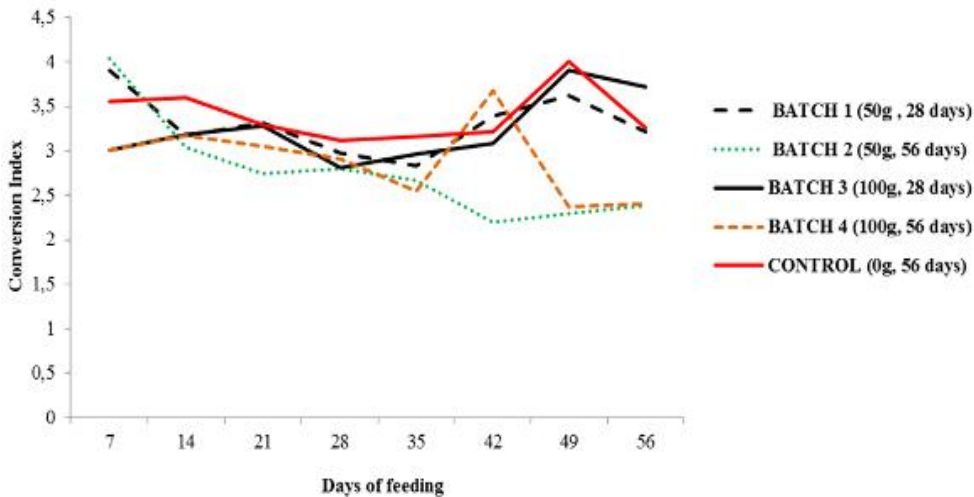


Fig. 5. Variation of conversion index in control and in hens fed with *Tridax procumbens*

which is the dry pox, was characterised by the development of proliferative lesions, ranging from small nodules to spherical wart-like masses on the skin of the comb, wattle and other non-feathered areas [15]. Sometimes it was observed an inflammation following by hyperplasia of the epidermis and desquamation of the degenerated epithelium that predisposes hens to secondary bacterial infections [16,17,18]. Usually, the mortality rate of the dry pox form is low in comparison to the diphtheritic form. Nevertheless in China, it's reported a novel type of fowl pox virus that led the birds to die within 10 days after appearance of first clinical signs [19].

4.2 Haematological Parameters

Improvement of health status was observed in hens after feeding of *Tridax procumbens*' powder. About haematological parameters, improvement of health status was observed with increase of the number of red blood cells, haemoglobin content, average contents in haematocrit, average corpuscular concentration in haemoglobin (ACCH), average corpuscular content in haemoglobin (ACCH) and the decrease of the number of leukocytes and average globular volume (AGV) in comparison to the control ones. The improvement of health status observed was induced by *Tridax procumbens*. Indeed, *Tridax procumbens* contains several chemical elements among which tannin, phenol, carbon hydrate and flavonoids [20,21]. Flavonoids and other phenolic compounds found in vegetables, fruits or medicinal plants are known to have potential antioxidant activity through a number of different mechanisms that prevent from diseases [22]. The proposed mechanisms for their action include (1) direct radical scavenging, (2) inhibition of enzymes such as NO-synthase, xanthine oxidase, cyclooxygenase and lipoxygenase, (3) iron chelation and (4) direct inhibition of lipid peroxidation [23]. The mechanisms of flavonoids that are known for its antimicrobial activity involved in inhibition of nucleic acid synthesis, cytoplasmic membrane function, and energy metabolism [24]. Some authors reported antiviral, antibiotic, insecticide and anti-inflammatory activities of *Tridax procumbens* [9]. However, the use of *Tridax procumbens*' powder in hens' food for a period of time more than 28 days may did not improve the status of red blood cells, haemoglobin content, average contents in haematocrit, Average Corpuscular Concentration in Haemoglobin and Average Corpuscular Content in Haemoglobin.

Similar value observed for each of those parameters and during the period of experimentation may be due to the phenolic compounds (phenolic monomers, polyphenols, tannins) that are considered to interfere with iron absorption by complex formation with iron in the gastro-intestinal lumen, making the iron less available for absorption [25,26].

4.3 Zootechnic Parameters

Fowlpox virus induced drop in egg production in this study. The same observation was reported by others authors [27,17]. According to these authors, fowlpox virus induced a drop in egg production in layers, reduced growth rates in broilers, blindness, and in some cases death. Another study also reported a drop of rate of 4% in layers suffering from fowlpox [28].

The use of *Tridax procumbens*' powder in fowls' food in this study has shown various performance of laying rate. An increase of laying rate was observed in batch 1, 2, 3 and 4 for a period of 28 days showing that consumption of *Tridax procumbens*' powder increased performance of eggs production. Therefore, this performance of eggs production decreased and became similar to control ones when hens stop to eat *Tridax procumbens*' powder as it was shown in Fig. 4. Ikewuchi et al. [14] reported for *Tridax procumbens* the nutrient components as follow: crude protein (34.57%, DW), total carbohydrate (51.26%, DW), total metabolizable energy value (397.59 kcal/100 g, DW), sodium (50.44 mg/100 g DW), potassium (31.92 mg/100 g DW) and calcium (20.96 mg/100 g DW). Taking into account these nutrient components of leaves of *Tridax procumbens*, decrease of performance of eggs production in batch 1 and 3 could be explained by lack of supply of protein, energy and mineral like sodium, potassium and calcium from *Tridax procumbens*' powder after 28 days for batch 1 and batch 3.

Nevertheless, consumption of *Tridax procumbens*' powder for a long period of time (56 days) involves a decrease of conversion index. The conversion index is related to the weight of eggs. Indeed, the weight of eggs produced by chickens fed in long period of time (56 days) with *Tridax procumbens*' powder was small compared to those fed with *Tridax procumbens*' powder in short period of time (0 to 28 days). It's reported that true amino acid availability decreased when tannin content in sorghum increased [29]. Even, all amino acids had a lower availability in high

tannin sorghum than in low tannin sorghum and medium tannin sorghum. Tannins have a higher affinity to form complexes with protein. It's observed that tannin significantly reduced egg production and feed efficiency [30]. In contrast, authors showed that egg specific gravity and shell thickness were adversely affected only at the lower level of protein. But egg weight and weight loss of hens were not affected by tannin. In this study, it was observed that eggs production was not affected by *Tridax procumbens*' powder which contained tannin and also protein, energy and several mineral like sodium, potassium and calcium. Hence, tannin did not affect eggs production. Nevertheless, tannin probably affect feed efficiency; this perhaps involves a decrease of conversion Index when *Tridax procumbens*' powder was consumed for a long period.

5. CONCLUSION

The use of powder of *Tridax procumbens* showed a beneficial effect on the health status of hens suffering from fowlpox. Improvement of health status led to improvement of laying rate, conversion index and haematological parameters in sick layers. Although *Tridax procumbens*' powder in hens' food improves their health status and egg production, its usage for a long period of time in contrary decrease eggs weight. Others studies may be performed to identify appropriate period and appropriate amount needed to improve the health status of hens, their egg production as well as the weight of the eggs.

CONSENT

It is not applicable.

ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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