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Research Article

Effect of *Khaya senegalensis* Bark on Zootechnical and Health Parameters in Local Chickens

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Abstract

Background and Objective: Sustainable poultry production increasingly explores the use of medicinal plants as preventive alternatives to synthetic additives. This study evaluated the effects of *Khaya senegalensis* bark powder on growth performance, carcass traits, hematological, biochemical and parasitological parameters in local chickens. **Materials and Methods:** A total of fifty eight-week-old chicks were used in the experiment and randomly divided into five groups. Birds were fed experimental diets containing 1% and 2% *Khaya senegalensis* bark powder for ten weeks. Four chickens from each group were randomly selected for sampling. Blood samples were collected in EDTA and plain tubes for hematological and biochemical analyses, while fecal samples were examined for parasitological evaluation. Statistical analysis was performed using Excel and GraphPad Prism (v5.0.1), applying One-Way ANOVA (Fisher's test) with significance set at $p < 0.05$. **Results:** The KSM-2% and KSF-2% groups showed significantly higher body weights ($p \leq 0.05$) compared with the control group. Hematological analysis indicated a significant decrease in white blood cell count (103.42 ± 1.62 ; $p < 0.05$) in the KSM-1% group. The GGT level was significantly reduced ($p < 0.05$) in the KSF-1% and KSF-2% groups (19.53 ± 0.56 and 17.6 ± 0.76 U/L, respectively) compared with the control group (25.5 ± 0.70 U/L). Parasitological analysis revealed that supplementation with *Khaya senegalensis* bark powder reduced fecal oocyst counts by 78-91%. **Conclusion:** *Khaya senegalensis* bark powder may be used as a natural dietary supplement in local chickens without adverse effects on internal organs and could serve as a promising alternative for improving poultry health and management.

Key words: Local chickens, *Khaya senegalensis*, bark, hematological, biochemical, parasitological

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Poultry production plays a fundamental role in food security due to its short production cycle and the fact that it remains an easily accessible source of animal protein. In 2024, poultry farming is dominated by local chickens, with 33.02 million local birds and an exploitation rate of 62.2%¹. Furthermore, Burkina Faso is dominated by traditional poultry farmers, with 71.87% compared to 2.78% intensive poultry farming¹. Traditional poultry farmers is small-scale poultry production carried out by households using family labour and cannot meet the needs of the population^{2,3}. However, this type of poultry farming faces several constraints: Food, budget and, above all, disease. There are many poultry diseases, including parasitic, bacterial and viral diseases, as well as stress-related disorders. Added to this are therapeutic failures² which lead to reduced production and high prophylaxis costs. These factors are a real hindrance to the development of poultry farming, resulting in significant economic losses⁴. To ensure the sustainable development of poultry farming, it would be appropriate to adopt natural and cost-effective prophylactic methods using locally available resources. Several authors have used medicinal plants for human and animal care. These plants contain a large number of molecules with potentially therapeutic pharmacological modes of action to which resistance has not yet developed^{5,6}. They are easy to prepare and administer and available at low cost. This is the case with *Khaya senegalensis*, a plant with antioxidant, antimicrobial, anti-inflammatory and anti-diarrhoeal properties. Indeed, the authors⁷ showed in their study that *Khaya senegalensis* leaf extract performed better in terms of final weight and that this plant can be administered to broiler chickens at 75 ml/L without any adverse effects on feed intake⁸. Also showed that the ability of n-butanol fraction extracts of *Khaya senegalensis* to cause weight gain was demonstrated in this study. Therapeutic and Safety Evaluation of Combined Aqueous Extracts of *Azadirachta indica* and *Khaya senegalensis* in Chickens Experimentally Infected with *Eimeria* Oocysts, showed that the combination of aqueous extracts of *K. senegalensis* stem bark and *A. indica* leaves reinforced the credibility of the traditional use of these plants in the treatment of coccidiosis⁹. Furthermore⁷, on Phytochemical screening of mahogany (*Khaya senegalensis*) bark aqueous extract as feed additive for broiler chicken production in Nigeria revealed that aqueous extract of mahogany bark (*Khaya senegalensis*) contains beneficial secondary metabolites capable of improving the growth and performance of broiler chickens. This work aims to use powdered of *Khaya senegalensis* as a preventive measure

(prophylaxis) and to study its effect on the haematological and biochemical parameters and microbiology of local chickens. Improving the growth of local chickens without excessive use of chemicals is therefore a major challenge for the sustainable development of traditional poultry farming.

MATERIALS AND METHODS

Location and study period: The study took place from 15 December, 2024 to 24 February, 2025 and was conducted at the BONI Nazi University animal house in the village of Nasso (11°12'N, 4°26'W) located approximately 15 km North-West of the town of Bobo-Dioulasso, in Western Burkina Faso. The climate in Bobo-Dioulasso is South Sudanese, with a dry season (October to April) and a rainy season (May to September).

Experimental compartment: For this experiment, the study was carried out in a building measuring 1.5 m long, 1.5 m wide and 1.6 m high, which is subdivided into five boxes, each measuring 1.5 m long, 1.5 m wide and 1.6 m high. The double-sloped building is 16 m long, 10 m wide and 4.5 m high. The roof is made of sheet metal (a metal alloy of zinc and aluminium) and the floor of concrete. The building is divided into three compartments and a feed storage area.

Experimental birds: A total of fifty local chickens aged 8 weeks and weighing an average of 282.9 g were used for the various trials over a period of ten 10 weeks. These chickens, composed of a mix of various local breeds, were produced at the farm of Nazi University Boni in Burkina Faso.

Collection of *Khaya senegalensis* (Desr.) A.Juss.: During the experiment the plant material used was the bark of *Khaya senegalensis*. This plant was collected at Nasso University, 15 km from Bobo-Dioulasso under the supervision of botanist Herman Ouba. The sample was washed, dried in the shade, pulverized and stored for analysis. A specimen was deposited at the herbarium of the Nazi BONI University after having been previously identified and authenticated by Professor Paulin OUOBA (plant Ecology Laboratory, Nazi BONI University).

Experimental study: One week before the arrival of the chickens, the pen and boxes used for this study were emptied, cleaned with soapy water and disinfected with bleach (2.5%). All rearing equipment was also washed and disinfected with bleach. Two days before the arrival of the hens, a second disinfection of the buildings was carried out by spraying with

a virunet. The day before their arrival, the various boxes were covered with a thick layer (about 5 cm) of wood shavings and then disinfected. A foot bath containing a disinfectant and a hand-washing facility were installed at the entrance to the building. Fifty (50) chicks were immediately divided into five batches of 10 chicks/m², after having undergone a physical examination to ensure their physical aptitude prior to sedentarisation.

Trial conduction: The experiment involved a total of 50 local chickens, 8 weeks old, with an initial average live weight of 282.9 g. The birds were evenly divided into five groups of 10 birds each, with each group housed in an individual cage that served as an experimental unit. The study involved testing the preventive supplementation of *Khaya senegalensis* bark powder in the diet at three different supplementation levels:

- **Control Group (T0):** A group of 10 subjects receiving a standard diet without supplementation (0%)
- **Test Group 1 (T1):** Two groups (replicates) of 10 subjects each, receiving a diet enriched with 1% *K. senegalensis* powder
- **Test Group 2 (T2):** Two groups (replicates) of 10 subjects each, receiving a diet enriched with 2% *K. senegalensis* powder

Feeding regimen: The experimental study was conducted over a period of ten weeks. At the start of the trial, each animal received a daily ration of 80 g of feed per 1 kg of body weight. Subsequently, the amounts distributed were adjusted weekly based on changes in the chickens' live weight. The feed amount per day per subject was calculated based on their body weight: $\text{Weight} \times 80 / 1000 \times \text{number of subjects} \times \text{number of days}$. The resulting feed amount was then multiplied by the percentage of the resource.

Feeding and watering programme: One-week acclimatisation period was carried out to allow the hens to get used to their new living conditions. Rations were distributed in plastic feeders. Feed was distributed every morning before 8 am and every evening at 2.30 pm. As much tap water as they wanted was distributed each morning in troughs. Throughout the experiment, the subjects were illuminated by natural light

Determination of growth parameters: The growth parameters were calculated using the calculation methods¹⁰.

Live weight: The average live weight is nothing other than the ratio of the sum of the weights of the individuals of a same batch by their number.

$$\text{Live weight} = \frac{\sum WI}{Nb}$$

- $\sum WI$: Sum of the weights of the individuals of the same batch
- Nb : Number of the batch

The mortality rate is the number of deaths on the workforce of the batch $\times 100$

Individual food consumption (IFC)¹⁰: Individual Food Consumption is used to assess the quantities of food consumed per animal over a specified period of time. It is calculated from the quantity of food distributed and that refused.

$$\text{CAI (g / subject / day)} = \frac{\text{QAD (g)} - \text{QAR (g)}}{\text{Duration of period (d)}} \times \text{Number of subjects}$$

- QAD : Quantity of feed distributed
- QAR : Quantity of food refused

Consumption index (CI)¹⁰: Consumption Index is the ratio between the average quantity of feed consumed over a given period and the average weight gain corresponding to this period.

- CI : Average amount of food consumed (in g)/Average weight gain (in days)

Average daily gain (ADG)¹⁰: Weights were taken per week to determine the average daily gain by dividing the weight gain during a period by the corresponding duration.

$$\text{ADG} = \frac{(P_{vf} - P_{vi})}{\text{Number of days}}$$

- P_{vi} : Initial average live weight
- P_{vf} : Final average live weight

Characteristics of the carcass and organs

Carcass yield (CR): At the end of the experiment, 20 chickens (4 birds/batch, 2 females and 2 males) were slaughtered for the study of carcass characteristics and other tests. The

chickens were bled by cutting the jugular vein in the neck, scalded with hot water and plucked manually. The live weights of the chickens before slaughter were measured, as were the weights of the hot carcasses. The internal organs (gizzard, heart, liver, spleen and testicles) were weighed separately for each subject and each feed treatment. Carcass yield (%) was calculated as the ratio of carcass weight to live weight at slaughter, expressed as a percentage. The carcass yield (CR) was determined using the following formula¹¹:

$$RC = \frac{\text{Empty carcass weight (in g)}}{\text{Live weight at slaughter (in g)}} \times 100$$

Determination of pH and temperature: The pH and temperature are the most frequently measured characteristic of fresh meat. It is determined by inserting an electrode into the muscle tissue¹².

Biochemical and haematological parameters: At the end of the experiment, 4 chickens were selected at random from each batch (2 males and 2 females). The sample was taken from the wing vein using a 5 ml syringe. The blood was collected directly into dry tubes and EDTA tubes, then transported in a cool box to the laboratory for haematology and biochemistry analyses. Hematological and biochemical analyses were performed using O2-ABX PENTRA C200 automated analyzers.

Identifying parasitological strains in local chicken droppings

Sampling: At the end of the experiment, 4 chickens were randomly selected from each batch (2 males and 2 females). The sample was taken from the cloaca with swabs (boxes). The droppings were collected and placed in a solution of potassium dichromate ($K_2Cr_2O_7$) for parasite analysis.

Parasitological analyses in the laboratory: First, the flotation liquid is prepared: a 30% saline solution (NaCl). The solution is dissolved on a magnetic plate. Then, for the test, 1 mL of dichromate solution is taken and diluted in 14 ml of the saline solution. The mixture is homogenised and sieved through a tea strainer to remove as much debris as possible. Before observation under the microscope, this same solution was diluted 1:10 in distilled water. Using a pipette, the solution was removed and filled into the two chambers of the Mac Master slide. The slide was read under a light microscope at the $\times 40$ objective after 10 to 15 min. The eggs were identified and counted in each column of the slide chamber. The number of

eggs per gram (OPG) and inhibition percentage of parasitemia were calculated as follows. The number of eggs per gram (OPG) of coccidia oocysts observed is calculated¹³ using the following formula:

$$OPG = \frac{N \times \text{Dilution factor}}{\text{volume}}$$

$$I(\%) = \frac{\text{Parasitemia control} - \text{Parasitemia test}}{\text{Parasitemia control}} \times 100$$

- N : Total number of oocysts
- V : Network volume of 0.3
- Dilution factor is 150
- I (%) : Percentage inhibition

Ethics committee: This work has been submitted to and approved by an ethics committee under number CCEA-UJKZ/2021-07.

Statistical analyzes: The means and standard deviations were determined using Microsoft Excel. GraphPad Prism software (version 5.0.1) was used. The One-Way ANOVA test (Fisher's test) was used for the statistical analysis of the various parameters studied. The difference is considered significant when $p < 0.05$.

RESULTS AND DISCUSSION

Effect of *Khaya senegalensis* on growth parameters and carcass characteristics in chickens

Effect on live weight (LW): The results of the live weight of the subjects according to the weeks are presented in Fig. 1. The addition of *Khaya senegalensis* to the chickens' diet did not slow down their weight gain. In fact, the treated groups showed similar progress to the control groups during all weeks of the experiment.

Effect on individual food consumption (IFC): The change in individual food consumption (IFC) in Fig. 2 shows that *Khaya senegalensis* powder did not prevent food intake in test subjects compared to controls throughout the experiment.

Effect on consumption index (CI): The effect of *Khaya senegalensis* bark on the feed conversion ratio of local chickens as a prophylactic is shown in Fig. 3 over time. A similarity in feed conversion ratio was observed in all groups from the first week to the seventh week.

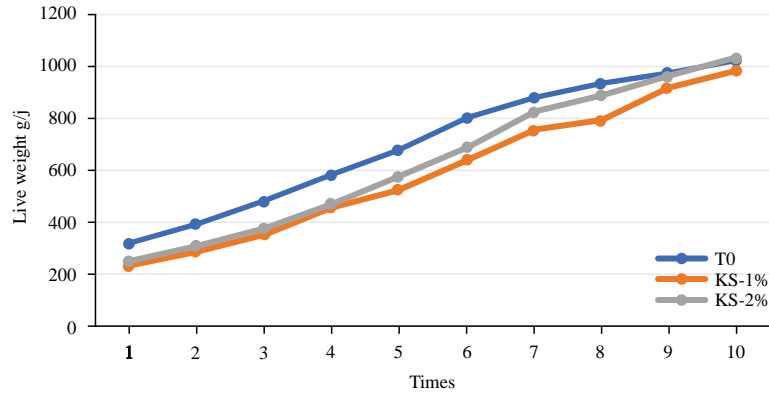


Fig. 1: Evaluation of the live weight of different subjects over time
 T0: Control 0% Ks, KS-1s%: *Khaya senegalensis* incorporated at 1% and KS-2%: *Khaya senegalensis* incorporated at 2%

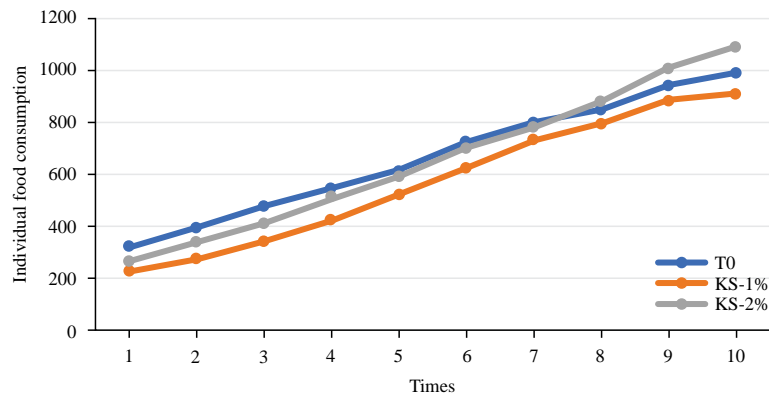


Fig. 2: Evolution of individual food consumption of different subjects over time
 T0: Control 0% Ks, KS-1s%: *Khaya senegalensis* incorporated at 1% and KS-2%: *Khaya senegalensis* incorporated at 2%

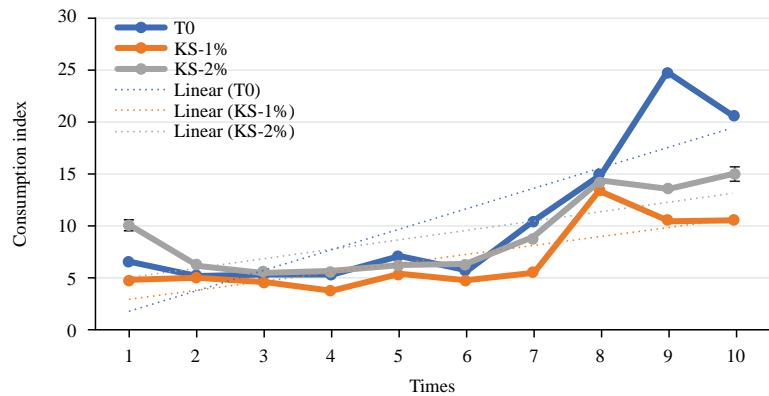


Fig. 3: Evolution of the consumption index of different subjects over time
 T0: Control 0%, KS-1%: *Khaya senegalensis* incorporated at 1% and KS-2%: *Khaya senegalensis* incorporated at 2%

Effect on average daily gain: Figure 4 shows the variations in weight gain of the chickens during the experiment compared to the controls. The inclusion of *Khaya senegalensis* in the chickens' diet did not compromise their ability to grow steadily.

Carcass characteristics: The results of the effect of prophylactic treatment with *Khaya senegalensis* on the carcass characteristics and organs of local chickens at the end of 10 weeks are shown in Table 1. The highest live weights were observed in the KSM-2% male group (1291.03 ± 110) and

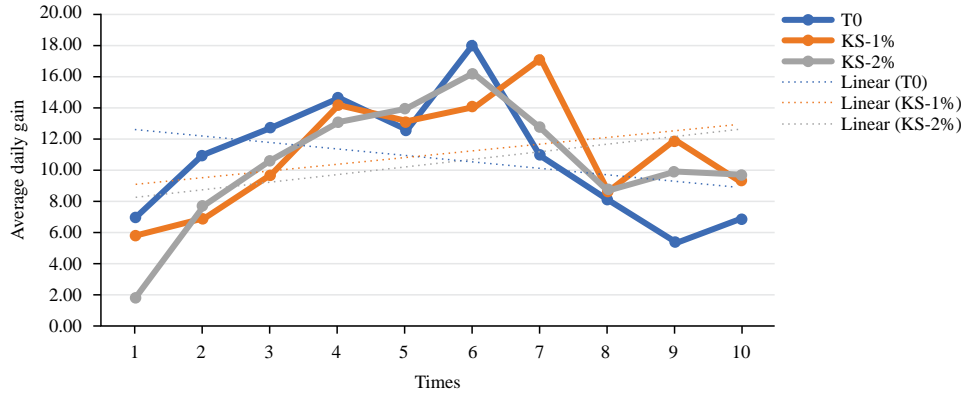


Fig. 4: Evolution of the average daily gain of the different subjects over time
 T0: control 0%, KS-1%: *Khaya senegalensis* incorporated at 1% and KS-2%: *Khaya senegalensis* incorporated at 2%

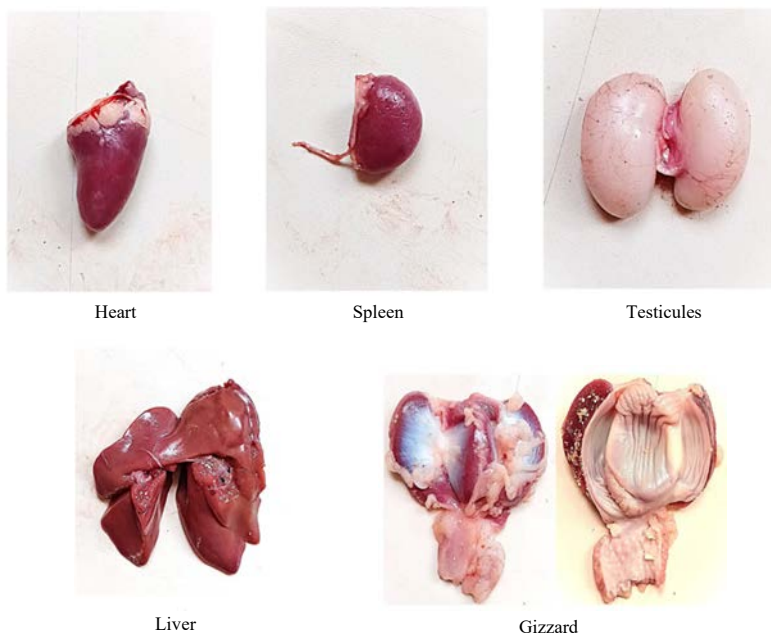


Fig. 5: Comparative representation of internal organ weights (heart, liver, gizzard, spleen and testicles) of local chickens fed diets supplemented with *Khaya senegalensis* bark powder

Table 1: Effect of *Khaya senegalensis* on the carcass and organ characteristics of chickens

Parameter	Prophylactic treatment	Males			Females		
		TM	KSM-1%	KSM-2%	TF	KSF-1%	KSF-2%
Carcass	Live weight (g)	1269.65±109.8	1190.93±49.8*	1291.03±110**	996±113.4	937.93±70.6*	1092.68±50.54***
	Carcass wt (g)	1121.45±113.3	1046.85±48.2***	1137.02±85.4*	886.45±97.08	822.95±62.8*	964.88±50.55***
	PCV (g)	911.95±87.4	848.45±39.0*	941.23±85.6**	696.85±118.2	653.19±51.3*	754.63±68.4***
	Dressing (%)	88.2±1.2	88±0.42 ^{ns}	88.2±1.3 ^{ns}	90±0.35	88±0.7 ^{ns}	88.4±0.8 ^{ns}
Internal organs (g)	Heart	5.8±0.98	5.65±0.53 ^{ns}	6.05±0.47 ^{ns}	3.95±0.35	4.43±0.68 ^{ns}	5.33±0.71 ^{ns}
	Liver	25.65±1.2	24.8±3.31 ^{ns}	26.08±4.65 ^{ns}	21.65±19.13	19.13±2.60 ^{ns}	26.1±4.47 ^{ns}
	Gizzard	30.95±2.3	31.35±6.36 ^{ns}	34.58±3.99 ^{ns}	33.35±1.48	27.95±4.27 ^{ns}	32±3.20 ^{ns}
	Spleen	2.75±0.07	2.5±0.54 ^{ns}	3±0.70 ^{ns}	2.1±5.86	2.3±0.34 ^{ns}	3.3±1.84 ^{ns}
	Testicles	3.35±1.2	6.3±3.57*	5.45±2.89*			
Physicochemical parameters	P ^H	5.88±0.09	5.51±0.26 ^{ns}	5.58±0.31 ^{ns}	5.98±0.04	5.23±13.17 ^{ns}	5.98±0.27 ^{ns}
	Temperature	30.25±0.91	31.17±0.93 ^{ns}	31.93±0.9 ^{ns}	29.86±0.22	29.40±12.33 ^{ns}	31.83±0.69 ^{ns}

Each result is the average of the three values obtained (n = 3). ns: Not significant, *: Significant with p<0.05, **: Very significant with 9-<0.01 and ***: Highly significant with p<0.001 compared to controls. TM: Control males 0% *Khaya senegalensis*, TF: Control femelle:0% *Khaya senegalensis*, KSF1%: Incorporation of 1% *Khaya senegalensis* into the diet of female groups, KSF2%: Incorporation of 2% *Khaya senegalensis* into the diet of female groups, KSM1%: Incorporation of 1% *Khaya senegalensis* in the diet of male groups and KSM2%: Incorporation of 1% *Khaya senegalensis* in the diet of male groups

Table 2: Effect of *Khaya senegalensis* on hematological parameters

Parameter	Males			Females		
	TM	KSM-1%	KSM-2%	TF	KSF-1%	KSF-2%
RBC ($10^9/\mu\text{L}$)	2.62±0.37	2.54±0.11 ^{ns}	2.61±0.26 ^{ns}	2.64±0.03	3.12±0.10 ^{ns}	2.15±0.47 ^{ns}
HGB (g/dL)	11.1±0.71	10.5±0.28 ^{ns}	10.33±0.85 ^{ns}	10.55±0.78	11.63±0.7 ^{ns}	9.28±1.92 ^{ns}
HCT (%)	34.55± 1.20	35.4±0.77 ^{ns}	34.95±0.08 ^{ns}	35.15±0.35	41.05±1.22 ^{ns}	33.63±1.75 ^{ns}
MCV (μm^3)	130.2± 0.71	138.6±1.11	132.78±1.61 ^{ns}	133.1±0.42	135 ±2.53 ^{ns}	135.5±1.08 ^{ns}
MCH (pg)	41.2±1.27	41.35±1.00 ^{ns}	39.5±0.67 ^{ns}	39.15±1.06	38.7±1.19 ^{ns}	44.15±0.90 ^{ns}
MCHC (g/dL)	31.2±0.28	29.90±1.01 ^{ns}	29.5±1.2 ^{ns}	31.15±0.49	29.23±0.92 ^{ns}	31.93±0.87 ^{ns}
IRD-CV (%)	8.8±0.0	9.35±0.54 ^{ns}	0.8±0.63 ^{ns}	8.55±0.63	9.73±0.56 ^{ns}	8.45±0.41 ^{ns}
IRD-SD (μm^3)	43±0.71	50.28±0.43*	39.78±0.51*	40.2±0.28	44.9±0.86 ^{ns}	44.35±2.39 ^{ns}
PLT ($10^3/\mu\text{L}$)	13±1.41	14.75±0.50 ^{ns}	15±1.41 ^{ns}	23.5±2.21	15.25±0.5 ^{ns}	31.25±1.5*
THT (%)	0.02±0.01	0.02±0.02 ^{ns}	0.015±0.00 ^{ns}	0.03±0.01	0.01±0 ^{ns}	0.025±0.01 ^{ns}
VMP (μm^3)	8.75±0.35	8.90±0.64 ^{ns}	8.78±0.31 ^{ns}	8.8±0.14	9.39±0.47 ^{ns}	8.65±0.33 ^{ns}
IDP (μm^3)	8.7±0.14	10.53±1.23 ^{ns}	10.25±0.86 ^{ns}	8.8±0.84	10.1±0.94 ^{ns}	11.55±0.00 ^{ns}
PL-CC ($10^3/\mu\text{L}$)	4.50±0.71	2.50±0.58 ^{ns}	4.25±0.43 ^{ns}	5.5±0.70	4.75±0.5 ^{ns}	8.75±0.5*
P-LCR (%)	28.9±0.99	31.5± 2.80 ^{ns}	25.47±0.59 ^{ns}	28.65±0.91	29.83±0.78 ^{ns}	27±0.11 ^{ns}
WBC ($10^3/\mu\text{L}$)	113±0.63	103.42± 1.62*	115.6±1.92	105±0.57	105.44±1.26 ^{ns}	104.54±2.61 ^{ns}
NEU	4.81±0.86	8.15±0.87*	9.69±0.39*	6.87±0.78	10.46±0.17**	2.49±0.41**
LYM	105.25±0.06	78.71±1.48**	100.43±0.3 ^{ns}	93.6±1.3	93.26±1.25 ^{ns}	94.65±0.23 ^{ns}
MON	1.10±0.54	0.34±0.03 ^{ns}	0.53±0.08 ^{ns}	0.14±0.04	0.94±0.86 ^{ns}	0.47±0.05 ^{ns}
EOS	1.14±0.12	0.72±0.07 ^{ns}	0.92±0.07 ^{ns}	0.35±0.02	0.49±0.42 ^{ns}	0.82±0.01 ^{ns}
BAS	1.19±0.08	0.79±0.04 ^{ns}	1.33±0.22 ^{ns}	1.13±0.07	0.77±0.56 ^{ns}	0.19±0.03 ^{ns}
GCI	0.05±0.04	0.05±0.04 ^{ns}	0.05±0.01 ^{ns}	0.05±0.0	0.30±0.43 ^{ns}	0.035±0.01 ^{ns}

Each result is the average of the three values obtained (n = 3). ns: Not significant, *: Significant with $p < 0.05$, **: Very significant with $p < 0.01$, ***: Highly significant with $p < 0.001$ compared to controls, TM: Control males 0% *Khaya senegalensis*, TF: Control female: 0% *Khaya senegalensis*, KSF-1%: Incorporation of 1% *Khaya senegalensis* into the diet of female groups, KSF-2%: Incorporation of 2% *Khaya senegalensis* into the diet of female groups, KSM-1%: Incorporation of 1% *Khaya senegalensis* into the diet of male groups and KSM-2%: Incorporation of 1% *Khaya senegalensis* in the diet of male groups, RBC: Red blood cells, HGB: Hemoglobin, HCT: Hematocrit, PLT: Platelets, WBC: Globules blancs, MCV: Cell volume, MCH: Mean cell haemoglobin, MCHC: Mean cell haemoglobin concentration, NEU: Neutrophil, LYM: Lymphocytes, EOS: Eosinophil and BAS: Basophil

the KSF2% female group (1092.68 ± 50.53) compared to the control group (1269.65 ± 109.8 ; 996 ± 113) ($p < 0.001$). The highest yield values were recorded in the KSF-2% female group (89 ± 0.9) and the female control group (89 ± 0.3). In the male group, the values were similar: KSM-1% (88 ± 0.4) KSM-2% (88.1 ± 1.3) compared to the control group (88.3 ± 1.2). This figure 5 shows that the introduction of *Khaya senegalensis* into the diet of the subjects over the long term had no significant effect on the internal organs (heart, gizzard, liver, spleen and testicles). A significant increase in testicular weight was observed in the KSM1% and 2% (6.3 ± 3.57) (5.45 ± 2.89) compared to group control (3.35 ± 1.2). Furthermore, the physicochemical parameters compared to the different male and female control groups did not have any indicative effects.

Effects on chicken mortality: The incorporation of powder from the bark of *Khaya senegalensis* did not cause mortality in the subjects.

Biological parameters

Hematological parameters: The effect of *Khaya senegalensis* powder on haematological parameters is illustrated in Table 2. These analyses show that adding 1% and 2% *Khaya senegalensis* powder to the diet of chickens (males and females) had no significant effect on red blood cells,

haemoglobin, haematocrit, Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH), Mean Corpuscular Haemoglobin Concentration (MCHC), white blood cells, lymphocytes, monocytes, basophils and eosinophils compared to the control group. However, a significant variation in MCV was observed in the KSM-1% chicken groups, i.e. (138.6 ± 1.11). Similarly, a significant variation was reported in platelet counts in the groups that received KSF-2% (31.25 ± 1.5). In the KSM-1% group, there was a slight but significant decrease in white blood cells (103.42 ± 1.62) $p < 0.05$. With regard to the number of neutrophils, the values were high in the KSM-1%, KSM-2% and KSF-1% groups, i.e. 8.15 ± 0.87 ; 9.69 ± 0.39 , (10.46 ± 0.17), respectively. Meanwhile, the KSF-2% group showed a significant decrease in neutrophils (2.49 ± 0.41) compared to the corresponding controls. The same was true for lymphocytes in the KSM-1% group (78.71 ± 1.48) compared to the control.

Biochemical parameters: The results of the biochemical parameters are shown in Table 3. The results show that the KSM-1% test group showed a significant increase in AST (219.15 ± 0.1 U/L) and a significant decrease in ALT (1.95 ± 0.05 U/L) compared to the control group (200.3 ± 0.4 U/L and 4.45 ± 0.63 U/L, respectively). The KSF-1% test group showed a significant decrease in AST levels (188.02 ± 0.45 U/L) and a significant increase in ALT levels

Table 3: Effect of *Khaya senegalensis* on biochemical parameters

Parameter	Males			Females		
	TM	KSM-1%	KSM-2%	TF	KSF-1%	KSF-2%
TGO (U/L)	200.3±0.42	219.15±0.1*	196.65±1.5 ^{ns}	200.5±0.56	188.02±0.45*	196.36±0.95 ^{ns}
TGP (U/L)	4.45±0.63	1.95±0.05***	5.2±0 ^{ns}	4.3±0.28	10.13±0.25***	3.6±0.32 ^{ns}
T. BILIRUBIN (U/L)	2.24±0.84	1.4±0.18 ^{ns}	1.865±0.39 ^{ns}	1.44±0.10	1.94±0.2 ^{ns}	2.05±0.03 ^{ns}
D. BILIRUBIN (umol/L)	0.46±0.07	0.48±0.22 ^{ns}	0.73±0.22 ^{ns}	1.46±0.04	0.83±0.0 ^{ns}	1.32±0.05 ^{ns}
TOTAL PROTEIN (g/L)	28.7±0.70	28.4±0.28 ^{ns}	27.2±1.03 ^{ns}	34.75±0.35	40.48±0.15***	32.2±0.15 ^{ns}
CREATININE Enz (umol/L)	6.3±00	6.3±00 ^{ns}	6.3±00 ^{ns}	6.3±00 ^{ns}	6.3±00 ^{ns}	6.3±00 ^{ns}
ALP (U/L)	718.05±0.07	664.6±0.05***	1412.58±1.05**	910.5±0.70	1288.53±1.05***	786±0.6*
GGT (U/L)	26.5±0.70	30.23±0.15 ^{ns}	27.33±0.45 ^{ns}	25.5±0.70	19.53±0.56*	17.6±0.76**
UREA (umol/L)	0.58±0	0.63±0.09 ^{ns}	0.65±0.09 ^{ns}	0.58±00	0.59±0.01 ^{ns}	0.6±0.02 ^{ns}
MAGNESIUM (umol/L)	0.81±0.02	0.87±0.03 ^{ns}	0.85±0.01 ^{ns}	0.90±0.12	0.85±0.0 ^{ns}	0.76±0.02 ^{ns}
GLUCOSE PAP (umol/L)	11.95±0.48	13.05±0.57	13.76±0.44	12±0.55	14.48±0.36	13.03±0.58
CALCIUM AS (mg/dl)	10.34±0.19	10.36±0.25 ^{ns}	10.18±0.27 ^{ns}	10.94±0.20	10.13±0.54 ^{ns}	9.92±0.08
ALBUMIN (g/L)	12.35±0.70	12.48±0.69 ^{ns}	11.55±0.62 ^{ns}	14.3±0.14	15.53±0.05	12.48±0.15

Each result is the average of the three values obtained (n = 3). ns: not significant, *: Significant with p<0.05, **: Very significant with p<0.01, ***: Highly significant with p<0.001 compared to controls, TM: Control males 0% *Khaya senegalensis*, TF: Control femelle: 0% *Khaya senegalensis*, KSF1%: Incorporation of 1% *Khaya senegalensis* into the diet of female groups, KSF2%: Incorporation of 2% *Khaya senegalensis* into the diet of female groups, KSM1%: Incorporation of 1% *Khaya senegalensis* in the diet of male groups, KSM2%: Incorporation of 2% *Khaya senegalensis* in the diet of male groups, ALAT: Alanine aminotransferase, ASAT: Aspartate transaminases, ALP: Alkaline phosphatases and GGT: Gamma-Glutamyl Transferase

Table 4: Evaluation of *Khaya senegalensis* on parasite analyses

Parameter	Males			Females		
	TM	KSM-1%	KSM-2%	TF	KSF-1%	KSF-2%
Number of oocysts counted in both chambers	12	5	1	14	7	3
Number of oocysts/g of feces	6000	2500	500	7000	3500	1500
Inhibition (%)	0	58	91	0	50	78

KSF1%: Incorporation of 1% *Khaya senegalensis* into the diet of female groups, KSF-2%: Incorporation of 2% *Khaya senegalensis* into the diet of female groups, TM: Control Males 0% *Khaya senegalensis*, TF: Control Femelle: 0% *Khaya senegalensis*, KSM-1%: Incorporation of 1% *Khaya senegalensis* in the diet of male groups and KSM2%: Incorporation of 2% *Khaya senegalensis* in the diet of male groups

(10.13±0.25 U/L) compared to the corresponding control values (200.5±0.56 U/L and 4.3±0.28 U/L, respectively). Alkaline phosphatase (ALP) levels showed a significant decrease in the KSM-1% groups and a significant increase p<0.001 in the KSM-2% group, with respective mean values of 664.6±0.05 U/L and 1412.58±1.05 U/L compared to the control group, respectively 718.05±0.07 U/L. As for the KSF-1% and KSF-2% groups, the ALP level was elevated p<0.001 in KSF-1% with a mean value of 1288.53±1.05 U/L and a significant decrease with a mean value of 786±0.6 U/L compared to the control group 910.5±0.70 U/L. Furthermore, the GGT level decreased significantly p<0.05 in the KSF-1% and KSF-2% groups, respectively 19.53±0.56 and 17.6±0.76 U/L compared to the control group 25.5±0.70 U/L. While the total protein level increased significantly in the KSF-1% group, compared to the control group, *Khaya* extract did not influence the following parameters: T. bilirubin, D. bilirubin, creatinine, urea, total protein, glucose, magnesium, calcium and albumin, compared to the controls.

Parasitological analyses: This Table 4 presents the results of parasitological analyses based on the number of oocysts found in the feces of male and female chickens, according to the different percentages of *Khaya senegalensis* in their diet.

6,000 oocysts/g of feces, compared to 2,500 oocysts/g for the group receiving a 1% extract (KSM-1%) and 500 oocysts/g for the KSM-2% group. A similar pattern was observed in females, with 7,000 oocysts/g for the controls, 3,500 oocysts/g for KSF-1% and 1,500 oocysts/g for KSF-2%.

DISCUSSION

Analysis of zootechnical parameters, including live weight, individual feed intake, feed conversion ratio and average daily gain, shows that long-term incorporation of *Khaya senegalensis* powder into chicken feed did not reduce feed intake. Indeed, the subjects that received *Khaya senegalensis* continued to consume their rations regularly, with overall weight gain comparable to that of the control group. This suggests that *Khaya senegalensis* powder had no negative effect on appetite and didn't cause food rejection, even at the highest doses. Hence the better carcass weights and live weights p<0.05 observed in the groups that received 2%. This could be explained by the fact that the powder reduced coccidia by 91%, resulting in higher growth in this group and this could be compounded by the low presence or absence of anti-nutritional factors responsible for reduced feed intake in chickens^{7,14}. Hematological markers provide information on

infection, inflammation, anemia and liver toxicity. However, it appeared that *Khaya senegalensis* powder didn't influence the hematological parameters of chickens, such as red blood cells, hemoglobin, hematocrit, MCV, MCHC, MCH, white blood cells, lymphocytes, monocytes, basophils and eosinophils compared to controls at different doses (1% to 2%). Furthermore, *Khaya senegalensis* did not induce any adverse effects on erythrocyte indices. However, a variation in the number of MCV was observed in males. Indeed, a low or high MCV indicates abnormalities in red blood cell size and generally reveals liver disease, iron deficiency, infection, or a nutritional problem. However, in our study, the mean corpuscular volume values of 138.6 were within the normal range (90-140 fL)¹⁵. The maintenance of normal erythrocyte values shows that the plant could have good hematological tolerance of the bioactive compounds (limonoids and flavonoids) present in the *Khaya senegalensis* genus, indicating its safety^{16,17}. White blood cells are the body's first line of defense against infectious microorganisms. In our study, White Blood Cells (WBC) remained within physiological limits in most groups $p < 0.05$, with the exception of the KSM1% group, where a significant decrease was observed. This decrease could be linked to an immune response to an infection, particularly the presence of coccidiosis identified in this batch, which could also explain the decrease in lymphocytes observed¹⁸. As for neutrophils, the addition of the powder to their feed showed an increase in certain tests reflecting a stimulation of innate immunity ($p < 0.01$) in chickens by *Khaya senegalensis* powder. The high platelet count in chickens shows that 2% *Khaya* powder improves platelet production by enhancing coagulation and immune response in females at a high dose. Indeed, *Khaya senegalensis* powder could be beneficial for laying hens by, limiting their risk of hemorrhage. In addition, this reaction could improve hemostatic mechanisms and also prepare the body against infestations and inflammation thanks to the antioxidants contained in this plant¹⁹.

The liver enzymes ALT, AST, GGT and PAL are important for determining proper liver function⁸. The inclusion of 1% and 2% *K. senegalensis* in the test group showed an increase in AST levels at 1% and a decrease at 2% in chickens. According to the normal range ((70-220 U/l) reported^{20,21} the values in the study comply with the standards, suggesting that *Khaya senegalensis* plants did not influence this marker. On the other hand, the ALT level was lower in KSM1%, showing that the plant may have hepatoprotective activity. Some authors^{22,23} showed in their study that the aqueous extract of *Khaya senegalensis* had a hepatoprotective effect.

Generally, ALP is a liver marker. Elevated serum ALP levels could indicate hepatic stimulation related to the effect of the plant⁸. The addition of the plant showed a 1% increase in total protein in females. This significant increase indicates stimulation of hepatic synthesis and improved humoral immunity²⁴. Bitter tonic plants are known to stimulate immunity⁸.

The results shows of the parasitic effect of *Khaya senegalensis* in chickens. At doses of 1% and 2%, a significant reduction in the number of oocysts in feces was observed compared to the control group. These results are consistent with the antiparasitic activities of *Khaya senegalensis* extracts, which inhibit the proliferation of coccidia responsible for coccidiosis by 78% to 91%^{9,23,25}.

CONCLUSION

The dietary inclusion of *Khaya senegalensis* bark powder (1% and 2%) in local chickens had no adverse effects on growth performance, feed utilization, carcass traits, or internal organ development. Hematological and biochemical parameters remained largely within physiological ranges, indicating overall safety of the plant at the tested levels. In addition, a marked reduction in fecal coccidial oocyst counts confirmed its strong anticoccidial potential. Overall, *Khaya senegalensis* bark powder can be considered a promising natural feed additive for improving poultry health and supporting sustainable poultry production.

SIGNIFICANCE STATEMENT

This study demonstrates that *Khaya senegalensis* bark powder can safely enhance poultry production by improving growth performance and significantly reducing coccidial infection in local chickens. The findings highlight its potential as a low-cost, plant-based alternative to synthetic additives and anticoccidial drugs, supporting sustainable and eco-friendly poultry farming practices in traditional production systems.

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