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RESEARCH ARTICLE

Effects of Dietary Inclusion of *Mucuna pruriens* Seeds on Zootechnical Performance and Economic Profitability of Cobb 500 Broiler Chickens

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Broiler chickens, *Mucuna pruriens* seeds, profitability, zootechnical performance

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Abstract

Background and Objective: The search for local and cost-effective alternatives to conventional protein sources, including roasted soybeans, soybean meal, cottonseed meal and fish meal, remains important for improving the sustainability and profitability of poultry production in Burkina Faso. This study aimed to evaluate the effects of incorporating boiled and shelled *Mucuna pruriens* seeds (GMP-bd) into broiler diets on zootechnical performance, carcass characteristics, hematocrit levels and economic profitability.

Materials and Methods: A 49-day feeding trial was conducted using 300 one-day-old Cobb 500 broiler chicks with an average initial body weight of 40 g. The chicks were assigned to a randomized Complete Block Design (RCBD) comprising three blocks of 100 chicks each. Each block was subdivided into four dietary treatments, with 25 chicks per treatment, receiving isoenergetic and isoproteic diets containing 0, 2.5, 5, or 7.5% boiled and shelled *M. pruriens* seeds, respectively. The GMP-bd was incorporated as a partial substitute for roasted soybeans. Zootechnical performance, including weight gain, feed intake, feed conversion ratio and mortality, as well as carcass characteristics, internal organs, hematocrit levels and economic profitability, were evaluated.

Results: The incorporation of GMP-bd into the diets improved weight gain, with a significant difference ($p<0.05$) between the control group and the group receiving 7.5% GMP-bd, with the latter showing greater weight gain. The inclusion of GMP-bd did not significantly affect ($p>0.05$) overall feed intake, feed conversion ratio, or mortality rate. Similarly, no significant differences ($p>0.05$) were observed among dietary treatments in carcass characteristics, internal organ weights, or hematocrit levels. Economic analysis showed that net profit per chicken increased with GMP-bd inclusion and was highest at the 7.5% inclusion level, reaching 748.13 FCFA per chicken.

Conclusion: Boiled and shelled *Mucuna pruriens* seeds can be incorporated into broiler diets at inclusion levels of up to 7.5% as a partial substitute for roasted soybeans without adversely affecting feed intake, feed conversion ratio, mortality, carcass characteristics, internal organs, or hematocrit levels. The 7.5% inclusion level was associated with improved weight gain and the highest net profit per chicken, indicating its potential as a locally available and economically viable protein resource for broiler production in Burkina Faso.

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INTRODUCTION

By 2050, the global human population is projected to reach between 9.4 and 10.1 billion people[1]. This population growth is driving increasing demand for food, particularly in sub-Saharan African countries, where combating malnutrition and food insecurity remains a major challenge[2,3]. This demographic trend, coupled with rapid urbanization, is placing considerable pressure on meat production, particularly poultry production, which continues to play an essential role in meeting dietary needs[4,5]. Poultry meat plays a dominant role in global meat consumption, accounting for approximately 40% of total meat consumption in 2023[6].

Poultry production is an important component of Burkina Faso's livestock sector, with the national poultry population, including chickens and guinea fowl, estimated at 35,422,628 birds in 2020[7]. However, approximately 98% of the poultry meat supply is derived from traditional poultry farming, while semi-intensive and intensive production systems account for only about 2% of total production[8]. Consequently, modern poultry farming, particularly broiler production, which is characterized by a short production cycle and relatively low land requirements[9,10]. represents a strategic means of increasing the availability and accessibility of animal protein. Unfortunately, the sector continues to face major constraints, including high feed costs, which account for approximately 65-70% of total broiler production costs[11]. Indeed, nearly 95% of feed costs are attributable to energy and protein sources, particularly maize and soybean, which constitute the principal components of broiler diets[12].

In an effort to reduce feed costs and improve poultry productivity, several studies have explored the use of unconventional feed resources, including the leaves of *Moringa oleifera* and *Azolla pinnata*, as well as the seeds of *Vigna unguiculata*, among others[13,14]. However, relatively few studies have investigated *Mucuna pruriens* seeds as an alternative protein source for broiler chickens.

With this in mind, the objective of the present study was to evaluate the effects of incorporating *Mucuna pruriens* seeds into broiler diets on the zootechnical performance and economic profitability of Cobb 500 broiler chickens. *Mucuna pruriens* was selected because of its widespread local availability, adaptability to national climatic conditions and nutritional properties comparable to those of soybean. From an agronomic perspective, it can produce approximately 3-4 metric tons of seeds per hectare, depending on agroecological conditions[13].

This forage legume produces seeds rich in protein (25-30%), starch (39-41%) and essential amino acids, including lysine and methionine and is already used in animal feed for ruminants and pigs, as well as for soil fertilization[16-18]. The seeds also contain bioactive compounds, including alkaloids, flavonoids and polyphenols, which may confer antioxidant and cholesterol-lowering properties and potentially contribute to improved poultry health and meat quality[19,20]. However, their relatively high concentrations of L-DOPA (3,4-dihydroxy-L-phenylalanine) and other antinutritional compounds, including tannins, phytates and trypsin inhibitors, limit their direct use in broiler diets[22,23]. These antinutritional factors can be reduced through processing methods such as soaking, cooking, fermentation and roasting[9,24,25]. Accordingly, in the present study, *Mucuna pruriens* seeds were boiled, hulled and subsequently dried before incorporation into the experimental diets.

MATERIALS AND METHODS

Materials

Description of the study area: The study was conducted at the Center for the Promotion of Poultry Farming and the Breeding of High-Performance Animals (CPAMAP) from January to February 2026. The facility is located northeast of Ouagadougou, the capital city of Burkina Faso.

Plant material: *Mucuna pruriens* seeds were used as the plant material in this study. The seeds were produced in the rural commune of Bieha, located approximately 135 km south of Ouagadougou.

Animal material: Three hundred (300) one-day-old Cobb 500 broiler chicks, with an average initial body weight of 40 g, were used in the experiment. The chicks were supplied by the TAPSOBA et Frères hatchery, located approximately 30 km from Ouagadougou.

Poultry house and experimental pens: The experiment was conducted in a permanent poultry house measuring 10×5 m, corresponding to a total floor area of 50 m^2. The floor was cemented and the building had a roof without skylights and an overhang of 1.40 m. The poultry house was oriented along an east-west axis, with openings on the northern and southern façades. It was divided into 12 experimental pens, each measuring 3 m^2 (2×1.5 m), using wire mesh supported by wooden boards to a height of 2 m.

Other farming equipment: The following equipment was used during the experiment:

- Feeders suitable for chicks and adult chickens
- 3- and 10-L siphon-type drinkers
- One electronic scale with a precision of 1 g for weighing the chickens
- Two drums, each with a capacity of 200 L, for water storage
- One smartphone for photographic documentation
- Two charcoal stoves for heating the poultry house

Methods

Preparation of the poultry house and equipment: The poultry house selected for the experiment was thoroughly prepared before the introduction of the chicks. It was washed and disinfected and then left vacant for 15 days. Wood-chip litter, with an initial depth of approximately 10 cm, was disinfected before being placed in the poultry house and was regularly replenished throughout the rearing period to maintain appropriate hygienic conditions. Drinkers, feeders and other equipment were also washed and disinfected before the arrival of the chicks and periodically throughout the experimental period.

Treatment of *Mucuna pruriens* seeds: The *Mucuna pruriens* seeds were subjected to a boiling treatment. After an initial washing to remove impurities, the seeds were boiled in water for 60 min after the water reached boiling point. They were subsequently shelled and sun-dried before being incorporated into the experimental diets.

Experimental design: Three hundred (300) Cobb 500 broiler chicks were assigned to a randomized Complete Block Design (RCBD) comprising three blocks of 100 chicks each. Each block was subdivided into four dietary treatments, with 25 chicks assigned to each treatment. Each block received one of four (4) isoenergetic and isoproteic experimental diets:

- T0%: Control diet without *Mucuna pruriens* seeds
- T2.5%: Diet containing 2.5% *Mucuna pruriens* as a partial substitute for roasted soybeans
- T5%: Diet containing 5% *Mucuna pruriens* as a partial substitute for roasted soybeans
- T7.5%: Diet containing 7.5% *Mucuna pruriens* as a partial substitute for roasted soybeans

The batches were constituted to ensure that there were no significant differences in the initial mean body weights of the chicks among the experimental groups. The experimental diets were administered sequentially during the starter, grower and finisher phases, with appropriate dietary transitions between phases (Fig. 1).

Formulation of experimental diets: Four isoenergetic and isoproteic diets were formulated based on the nutritional composition of the ingredients used. The diets were formulated to meet the nutritional requirements of the chicks during the different stages of rearing (Table 1).

Conduct of the experiment on Cobb 500 broiler chickens: The experiment was conducted over a period of 49 days using three hundred (300) Cobb 500 broiler chicks. The experimental diets were formulated and administered according to three (3) rearing phases: the starter phase (days 1-14), grower phase (days 15-28) and finisher phase (days 29-49). Continuous lighting was provided throughout the experimental period.

Feed was distributed twice daily, at 8:00 a.m. and 4:00 p.m., after being weighed. Any uneaten feed was collected and weighed to determine feed consumption. Water was provided ad libitum throughout the experimental period. The birds were weighed individually upon arrival and subsequently once a week on a fixed day and at a fixed time, before the distribution of feed and water.

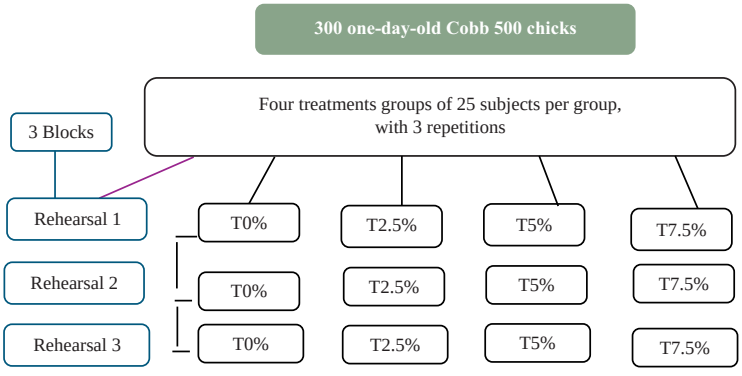


Fig. 1: Diagram of the experimental design

Table 1: Formulation of the experimental diets fed to the chicks

	Starter formulas (1-21 days)				Growth-Finishing Formulas (22-49 days)			
Ingredients	Control	Mp 2.5%	Mp 5%	Mp 7.5%	Control	Mp 2.5%	Mp 5%	Mp 7.5%
Corn	55.3	55.3	55.3	55.3	58	58	58	58
Wheat bran	5.4	5.2	4.9	4.6	4.3	4.2	3.8	3.6
Soybeans	9.35	6.85	4.35	1.85	12.5	10	7.5	5
Mucuna	0	2.5	5	7.5	0	2.5	5	7.5
Soybean meal	17	17	17	17	14	14	14	14
Cotton seed meal	0	0	0	0	0	0	0	0
Fish meal	5	5	5	5	4	4	4	4
Blood meal	3	3.1	3.25	3.4	2	2	2.2	2.3
Oyster shells	1	1	1	1	1	1	1	1
Vegetable oil	0.1	0.2	0.35	0.5	0.7	0.8	1	1.1
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Flesh premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
DL methionine	0.35	0.35	0.35	0.35	0.2	0.2	0.2	0.2
Lysine	0.35	0.35	0.35	0.35	0.2	0.2	0.2	0.2
Dicalcium Phosphate	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Biacalcium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Vitamin mix	0.05	0.05	0.05	0.05	0	0	0	0
Total	100	100	100	100	100	100	100	100
Calculated nutritional values ME (kcal/kg)								
EM (Kcal/Kg)	3028.38	3021.59	3018.78	3015.97	3117.50	3109.78	3110.95	3104.16
Crude protein (%)	23.21	23.17	23.16	23.15	21.32	21.3	21.29	21.25
Crude fat (%)	4.95	4.80	4.70	4.60	6.06	5.91	5.86	5.71
Lysine (%)	1.61	1.61	1.60	1.60	1.36	1.35	1.35	1.34
Methionine (%)	0.73	0.73	0.72	0.72	0.56	0.55	0.55	0.54
Calcium	1.33	1.34	1.36	1.37	1.28	1.29	1.30	1.31
Phosphore t (%)	0.73	0.90	1.07	1.24	0.68	0.85	1.02	1.19

Mp: Mucuna pruriens seeds and ME: Metabolizable energy

At the end of the experiment, chickens were randomly selected from each batch for blood sampling to determine hematological and biochemical parameters. Blood samples were collected from the wing vein using dry tubes and tubes containing EDTA as an anticoagulant.

Following blood collection, 02 chickens were randomly selected from each batch, giving a total of 24 chickens, for carcass evaluation. The selected birds were weighed, slaughtered, scalded in hot water, plucked and eviscerated. Carcass evaluation consisted of weighing the carcasses and the major internal organs.

For disease prevention, the chicks were vaccinated against the major viral diseases affecting broiler chickens, including Newcastle disease, Gumboro disease and infectious bronchitis.

Measurement of zootechnical parameters in cobb 500 broiler chickens: Several zootechnical and production parameters were evaluated, including Individual Feed Intake (IFI), average daily weight gain (ADWG), feed conversion ratio (FCR) and Mortality Rate (MR). Carcass characteristics, carcass yield, internal organ weights and yields, as well as hematological and biochemical parameters, were also determined.

$$\text{IFC}=\frac{\text{Amount of feed distributed per day-amount of feed rejected per day}}{\text{Number of birds}}$$

IFC : Individual Feed Consumption

$$\text{ADWG (g/day)}=\frac{\text{Weight gain over a period}}{\text{Duration of the period (days)}}$$

ADWG : Average daily weight gain

$$\text{FI}=\frac{\text{Amount of feed consumed over a period}}{\text{Weight gain during the same period}}$$

FI : Feed intake

$$\text{MR (\%)}=\frac{\text{Number of deaths}}{\text{Total initial population}}\times 100$$

MR : Mortality rate

$$\text{CY (\%)}=\frac{\text{Carcass weight}}{\text{Live weight at slaughter}}\times 100$$

CY : Carcass yield

$$\text{ROW}(\%) = \frac{\text{Organ weight}}{\text{Live weight of the subject}} \times 100$$

ROW : Relative organ weight

Evaluation of hematological and biochemical parameters: Hematological and biochemical parameters were determined through laboratory analysis of blood samples. Hematological parameters included complete blood count, hematocrit, hemoglobin concentration and other relevant indicators, while biochemical parameters included total protein, glucose, cholesterol, serum enzyme activities and other relevant biochemical indicators.

Economic profitability analysis: The economic analysis was based on feed production costs and the selling price of live chickens, which was set at 1,500 FCFA/kg of live weight. Since other production costs, including chick purchase, health monitoring, bedding, charcoal and other related expenses, were consistent across all treatment groups, the feed cost for each treatment was considered the principal variable distinguishing the experimental groups. Feed costs were calculated based on the following components:

- The purchase prices of the raw materials used in feed formulation
- the estimated cost of *Mucuna pruriens* seeds, including the costs associated with cooking, drying and hulling

The following economic parameters were determined for each treatment using the formulas provided below: feed cost per chicken, revenue per chicken, net margin per chicken, net margin per kilogram of live weight, Net Surplus Margin (NSM) and production cost per kilogram of live weight.

$$\text{Feed cost per chicken (FCFA)} = \text{Total feed consumption} \times \text{Price per kg of feed}$$

$$\text{Revenue per chicken (FCFA)} = \text{Live weight of chicken} \times \text{Price per kg of live weight}$$

$$\text{Net margin per chicken (FCFA)} = \text{Revenue per chicken} - \text{Total production cost per chicken}$$

$$\text{Net margin per kg of live weight (FCFA/kg)} = \frac{\text{Total revenue-total production cost}}{\text{Total live weight (kg)}}$$

Data processing and statistical analyses: Data were entered and processed using Microsoft Excel 2019. The results are expressed as mean±standard error of the mean (SEM). Statistical analyses were performed using R software (version 4.1.1). Differences among treatment groups were assessed using one-way analysis of variance (ANOVA), followed by Tukey's post hoc multiple comparison test when significant differences were detected. Differences were considered statistically significant at $p<0.05$.

RESULTS

Feed intake of broiler chickens: The results presented in Table 2 show that the inclusion of *Mucuna pruriens* seeds in the diets did not significantly affect ($p>0.05$) overall feed intake during the experimental period. The recorded mean daily feed intakes were 63.04±0.44 g for the control group, 63.22±0.32 g for the 2.5% treatment, 65.44±1.24 g for the 5% treatment and 65.82±1.37 g for the 7.5% treatment. Although the overall differences were not statistically significant, a slight increase in feed intake was observed with increasing levels of *Mucuna pruriens* seed inclusion. During the starter phase (weeks 1-2) and at certain points during the grower and finisher phases (weeks 4 and 6), no significant differences were observed among the treatments ($p>0.05$). However, feed intake was significantly higher ($p<0.05$) in weeks 3, 5 and 7, particularly in birds receiving the 5 and 7.5% inclusion levels, compared with the control group.

Effect of dietary inclusion of *mucuna pruriens* seeds on body weight of broiler chickens: Figure 2 illustrates the changes in live body weight of broiler chickens according to dietary treatment. Body weight increased progressively throughout the experimental period in all treatment groups. Birds fed diets containing *Mucuna pruriens* seeds generally exhibited higher final body weights than those receiving the control diet. At the end of the experiment (day 49), the mean live body weights were 2,011±4.51 g for T7.5%, 1,995.67±1.45 g for T5%, 1,910.67±6.74 g for T2.5% and 1,893.33±0.33 g for T0% (control). An increasing trend in final body weight was observed with increasing levels of *Mucuna pruriens* seed inclusion in the diets.

Effect of dietary inclusion of *mucuna pruriens* seeds on average daily gain of broiler chickens: Table 3 presents the Average Daily Weight Gains (ADWG) of the chickens according to age and treatment. The inclusion of *Mucuna pruriens* seeds had a variable effect on ADWG across the different rearing phases. During the starter phase (weeks 1-2) and finisher phase (weeks 6-7), no significant differences in ADWG were observed among the treatments ($p>0.05$). In contrast, during the grower phase (weeks 3-5), the inclusion of *Mucuna*

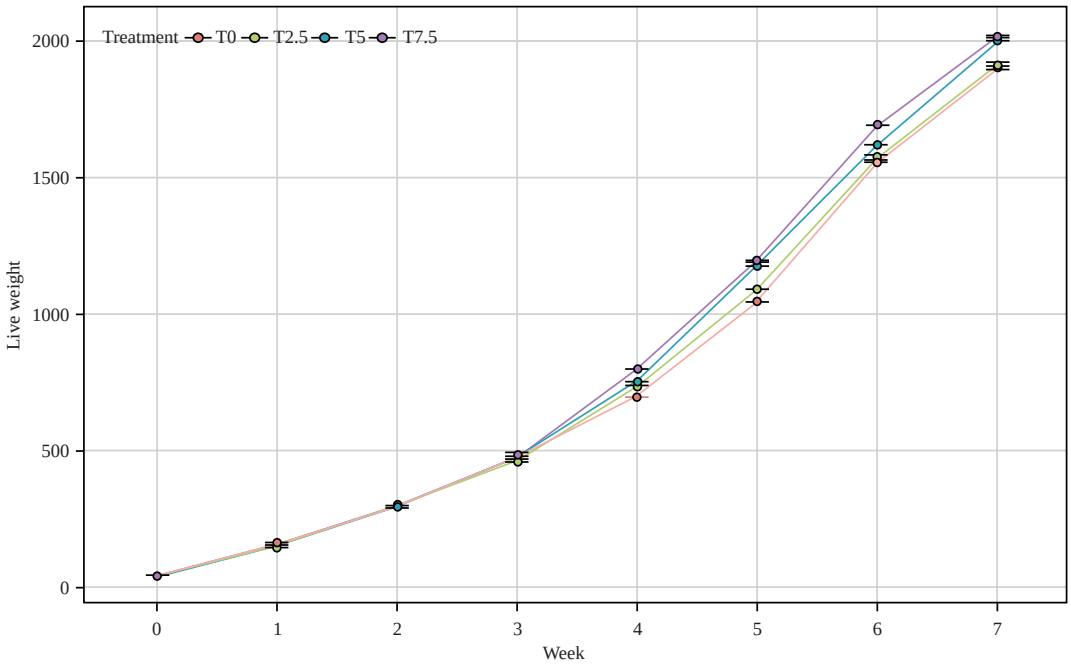


Fig. 2: Changes in live body weight by treatment group

Table 2: Effect of *Mucuna pruriens* seed inclusion on feed intake in broiler chickens

	Treatments					
	Age in weeks	T0%	T2.5%	T5%	T7.5%	p-value
Individual food consumption (CAI)/week	Week 1	18.12±0.32	17.28±0.52	16.86±0.62	16.72±0.14	0.18920
	Week 2	32.35±0.77	31.81±0.48	32.64±0.69	31.11±1.02	0.25850
	Week 3	32.76±0.48^{b}	34.25±0.40^{ab}	35.57±0.15^{ab}	36.17±1.23^{a}	0.0337*
	Week 4	56.28±0.69	58.20±2.96	61.11±2.10	62.85±2.67	0.2510
	Week 5	83.95±2.14^{ab}	81.37±1.98^{b}	87.27±0.58^{ab}	92.60±2.43^{a}	0.0164*
	Week 6	109.16±0.97	105.45±1.54	105.49±1.53	104.71±1.31	0.1687
	Week 7	109.65±0.23^{b}	112.92±0.83^{ab}	113.27±1.25^{ab}	115.83±1.83^{a}	0.0384*
Global CAI		63.04±0.44	63.22±0.32	65.44±1.24	65.82±1.37	0.1557

Data are expressed as Mean±standard error, Statistical significance relative to the control is indicated as follows: *p<0.05, **p<0.01, ***p<0.001 and NS: p>0.05

Table 3: Effect of *Mucuna pruriens* seed inclusion on the average daily weight gain of broiler chickens

		Treatments				
	Semaines	T0%	T2.5%	T5%	T7.5%	p-value
Average daily/weekly earnings	Week 1	16.77±0.29^{a}	15.08±0.41^{b}	15.97±0.25^{ab}	16.40±0.36^{ab}	0.0352*
	Week 2	19.16±0.64	21.71±0.87	19.57±0.54	20.29±0.50	0.1001
	Week 3	24.59±0.58^{b}	23.10±0.55^{b}	27.24±0.21^{a}	25.38±0.82^{ab}	0.0066**
	Week 4	31.52±0.67^{c}	38.53±1.09^{b}	36.76±0.46^{b}	45.33±0.31^{a}	0.0000***
	Week 5	49.71±0.52^{b}	49.95±0.13^{b}	59.35±1.77^{a}	56.24±0.96^{a}	4^{e-04}***
	Week 6	72.95±0.55^{a}	69.00±1.14^{a}	60.55±2.36^{b}	71.10±0.84^{a}	0.0011**
	Week 7	48.62±0.42	48.76±1.36	50.70±3.16	46.14±0.68	0.3968
Global GMQ		37.62±0.10^{b}	38.02±0.09^{b}	38.59±0.43^{b}	40.13±0.09^{a}	3^{e04}***

Data are expressed as mean±standard error, Statistical significance relative to the control is indicated as follows: *p<0.05, **p<0.01, ***p<0.001 and NS: p>0.05

pruriens seeds resulted in a highly significant increase in ADWG compared with the control group (p<0.001). This improvement was particularly pronounced in birds receiving diets containing 5% and 7.5% *Mucuna pruriens* seeds.

Over the entire production cycle, the mean ADWG values were 37.62±0.10 g/day for the control group, 38.02±0.09 g/day for the 2.5% treatment, 38.59±0.43 g/day for the 5% treatment and 40.13±0.09 g/day for the 7.5% treatment.

Table 4: Effect of *Mucuna pruriens* seed inclusion on feed conversion ratio of broiler chickens

		Treatments				
	Weeks	T0%	T2.5%	T5%	T7.5%	p-value
Consumption index/week	Week 1	1.08±0.04	1.15±0.03	1.06±0.05	1.02±0.02	0.1616
	Week 2	1.59±0.09	1.47±0.08	1.67±0.06	1.54±0.08	0.412
	Week 3	1.33±0.01	1.49±0.03	1.30±0.01	1.43±0.10	0.1083
	Week 4	1.79±0.05^{a}	1.51±0.05^{bc}	1.66±0.05^{ab}	1.39±0.07^{c}	0.0031**
	Week 5	1.69±0.06^{a}	1.63±0.04^{ab}	1.47±0.04^{b}	1.65±0.03^{ab}	0.0336*
	Week 6	1.49±0.01^{b}	1.53±0.04^{b}	1.75±0.07^{a}	1.47±0.03^{b}	0.0075**
	Week 7	2.26±0.02	2.32±0.08	2.25±0.14	2.51±0.03	0.1847
Global IC		1.67±0.01	1.66±0.00	1.70±0.04	1.64±0.04	0.5945

Data are expressed as mean±standard error. Statistical significance relative to the control is indicated as follows: *: p < 0.05; **: p < 0.01; ***: p < 0.001; NS: p > 0.05.

Table 5: Effect of *Mucuna pruriens* seed inclusion on mortality in broiler chickens

		Treatments			
	Weeks	T0%	T2.5%	T5%	T7.5%
Mortality Rate (%) /Week	Week 1	7.45±3.99	2.78±1.39	1.39±1.39	1.39±1.39
	Week 2	1.59±1.59	0.00±0.00	2.84±1.42	0.00±0.00
	Week 3	1.52±1.52	0.00±0.00	0.00±0.00	1.45±1.45
	Week 4	0.00±0.00	1.45±1.45	1.39±1.39	0.00±0.00
	Week 5	0.00±0.00	0.00±0.00	1.45±1.45	0.00±0.00
	Week 6	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
	Week 7	0.00±0.00	0.00±0.00	1.52±1.52	0.00±0.00
Global Mortality Rate		9.33±4.81	4.00±2.31	8.00±2.31	2.67±2.67

Data are expressed as mean±standard error. Statistical significance relative to the control is indicated as follows: *: p < 0.05; **: p < 0.01; ***: p < 0.001; NS: p > 0.05.

Overall ADWG increased progressively with increasing levels of *Mucuna pruriens* seed inclusion, with a highly significant difference (p<0.001) observed for the 7.5% treatment compared with the control group.

Effect of dietary inclusion of *Mucuna pruriens* seeds on feed conversion ratio of broiler chickens: The mean Feed Conversion Ratios (FCR) of the chickens according to dietary treatment are presented in Table 4. Statistical analysis showed that the inclusion of *Mucuna pruriens* seeds did not significantly affect FCR during the starter phase (weeks 1-3) or at the end of the experimental period (week 7) (p>0.05). In contrast, a highly significant improvement in FCR was observed during the grower phase (weeks 4-5) (p<0.01), during which birds receiving diets containing *Mucuna pruriens* seeds exhibited lower FCR values than those in the control group. However, when considered over the entire experimental period, FCR did not differ significantly among the dietary treatments (p>0.05).

Effect of dietary inclusion of *mucuna pruriens* seeds on mortality of broiler chickens: The mortality rates recorded during the experimental period are presented in Table 5. Mean mortality rates ranged from 2.67±2.67% in the group receiving 7.5% *Mucuna pruriens* seeds to 9.33±4.81% in the control group. The highest mortality rates were recorded during the starter phase (weeks 1-2) across all dietary treatments.

Effect of dietary inclusion of *Mucuna pruriens* seeds on carcass and internal organ characteristics of broiler chickens: The carcass and internal organ characteristics of the broiler chickens are presented in Table 6. The inclusion of *Mucuna pruriens* seeds did not significantly affect most carcass and internal organ characteristics compared with the control group (p>0.05). However, carcass yield decreased significantly with increasing levels of *Mucuna pruriens* seed inclusion (p<0.01). The highest carcass yield was recorded in the control group, with a mean value of 69.45±0.81%, followed by the 2.5% treatment (67.25±0.63%), the 5% treatment (67.06±0.34%) and the 7.5% treatment (65.55±0.54%).

Effect of dietary inclusion of *Mucuna pruriens* seeds on hematocrit level of broiler chickens: The results presented in Table 7 show that the inclusion of *Mucuna pruriens* seeds in the diets did not significantly affect hematocrit levels. No significant differences were observed among the experimental groups (p>0.05).

Economic evaluation: The feed costs, revenue from chicken sales and profit margins, including gross and net margins,

Table 6: Effect of *Mucuna pruriens* Seed Inclusion on Carcass and Internal Organ Characteristics of Broiler Chickens

	Treatments				
Parameters (n = 24)	T0% (n = 6)	T2.5% (n = 6)	T5% (n = 6)	T7.5% (n = 6)	p-value
Live weight	1859.17±75.27	1857.00±57.06	1978.50±39.02	1959.33±62.17	0.3489
Carcass weight	1292.33±59.90	1250.17±48.17	1326.33±23.52	1283.17±34.39	0.6777
Heart weight	9.00±1.00	10.83±1.30	10.83±0.79	11.67±1.02	0.3489
Liver weight	37.67±2.51	34.83±1.83	37.83±1.45	40.50±3.11	0.4129
Gizzard weight	39.83±3.12	37.17±2.18	43.50±1.41	41.00±3.03	0.3818
Spleen weight	2.33±0.42	2.17±0.31	2.17±0.17	2.20±0.37	0.9798
Carcass yield	69.45±0.81^{a}	67.25±0.63^{ab}	67.06±0.34^{b}	65.55±0.54^{b}	0.002**
Heart proportion	0.48±0.04	0.58±0.06	0.55±0.03	0.60±0.05	0.3094
Liver proportion	2.02±0.10	1.87±0.08	1.91±0.07	2.06±0.11	0.4438
Gizzard proportion	2.13±0.09	1.99±0.06	2.20±0.05	2.08±0.09	0.3028
Spleen proportion	0.12±0.02	0.12±0.01	0.11±0.01	0.11±0.01	0.8873

Data are expressed as mean±standard error. Statistical significance relative to the control is indicated as follows: *p<0.05, **p<0.01, ***p<0.001 and NS: p>0.05

Table 7: Effect of *Mucuna pruriens* seed inclusion on hematocrit levels of broiler chickens

	Hematocrit Rate		
Treatments	n = 20	Average±SEM	p-value
T0%	5	34.8±2.78	
T2.5%	5	34.6±7.09	0.9889
T5%	5	36.0±7.01	
T7.5%	5	37.6±9.12	

Data are expressed as mean±standard error. Statistical significance relative to the control is indicated as follows: *: p < 0.05; **: p < 0.01; ***: p < 0.001; NS: p > 0.05.

Table 8: Effect of *Mucuna pruriens* seed inclusion on profit margins of broiler chickens

	Diets treatments			
Parameters	Control	Mucuna 2.5%	Mucuna 5%	Mucuna 7.5%
Total amount of food consumed (g)	3088.96	3097.78	3206.56	3225.18
Price per kilogram of feed	281.93	280.68	279.43	278.18
Feed intake/chicken	870.87	869.48	896.01	897.18
Total production cost	165399.7	165074.7	164749.7	164424.7
Selling Price per kg of Live Weight	1500	1500	1500	1500
Global Selling Price per kg of Live Weight	193119.66	206352.36	206551.85	220204.5
Unit selling price of chicken	3000	3000	3000	3000
Revenue/chicken	2839.99	2866	2993.50	3016.5
Gross Profit margin/chicken	1922.03	1986.43	1947.08	2009.22
Net accounting margin/chicken	567.65	707.30	612.32	747.61

recorded for each treatment are presented in Table 8. The results showed relatively high gross feed margins per chicken across all treatments, ranging from 2,102.82 to 2,130.52 FCFA per chicken. The treatment containing 7.5% *Mucuna pruriens* seeds produced the highest net margin per chicken, at 748.13 FCFA/chicken, compared with 568.21 FCFA/chicken for the control group.

Compared with the control group, additional positive net margins of 139.61, 44.66 and 179.92 FCFA per chicken were obtained for the T2.5, T5 and T7.5% treatments, respectively. Furthermore, the production cost per kilogram of live weight decreased progressively with increasing levels of *Mucuna pruriens* seed inclusion, reaching its lowest value in the T7.5% treatment, at 1,119.78 FCFA/kg of live weight.

DISCUSSION

The inclusion of varying levels of boiled and hulled *Mucuna pruriens* seeds (GMP-bd) in isoenergetic and isoproteic diets for broiler chickens did not significantly affect (p>0.05) feed intake or feed conversion ratio.

The inclusion of boiled and hulled *Mucuna pruriens* seeds (GMP-bd) in the diets resulted in a highly significant (p<0.001) increase in weight gain during the growth and finisher phases, with the magnitude of the response increasing with the inclusion level. This improvement in weight gain may be attributed, at least in part, to the effectiveness of the heat treatment applied to the seeds, which may enhance protein digestibility and amino acid bioavailability in the intestine[24,26,27]. Our findings are consistent

with those of Zungu *et al.*[5], who reported that the inclusion of ≤10% *Mucuna pruriens* seeds in broiler diets did not adversely affect growth performance. However, our results differ from those of Aboh *et al.*[28], who observed a reduction in weight gain at inclusion levels above 12.5% *Mucuna pruriens* seed meal. The decline in performance at higher inclusion levels may be associated with the presence of antinutritional compounds in *Mucuna pruriens* seeds, including trypsin inhibitors, tannins, phytates and more specifically, L-DOPA[9]. These compounds may interfere with nutrient utilization and consequently impair growth performance at high inclusion levels. Tannins can reduce protein digestibility, whereas phytates can decrease the bioavailability of certain minerals and nutrients. L-DOPA may also interfere with nutrient digestion and absorption, potentially contributing to reduced growth performance[25].

The carcass yields obtained in this study, ranging from 65.55 to 69.45%, were within the range reported by Missoko *et al.*[29] under different experimental conditions. However, carcass yield decreased significantly ($p<0.01$) with increasing levels of *Mucuna pruriens* seed inclusion compared with the control group. This reduction may be related to differences in nutrient utilization associated with the dietary inclusion of *Mucuna pruriens*, particularly if antinutritional compounds limit the absorption or utilization of nutrients required for muscle deposition[30]. Our findings are similar to those of Aboh *et al.*[28], who reported deterioration in carcass and internal organ characteristics at inclusion levels above 12.5% *Mucuna pruriens* seed meal. In contrast, our findings differ from those of Zungu *et al.*, who reported that inclusion of ≤10% *Mucuna pruriens* seeds in broiler diets did not adversely affect carcass or internal organ characteristics.

The inclusion of GMP-bd in the diets resulted in a highly significant ($p<0.001$) increase in overall ADWG during the growth phase compared with the control group. Over the entire experimental period, ADWG increased with increasing levels of *Mucuna pruriens* seed inclusion. Mean ADWG increased from 37.62±0.10 g/day in the control group to 40.13±0.09 g/day in the T7.5% treatment, with the latter showing a significant improvement. These findings indicate that the 7.5% inclusion level was associated with the highest overall growth rate among the treatments evaluated. However, our results differ from those of Missoko *et al.*[29], who reported that inclusion of *Cajanus cajan* seed meal reduced the growth rate, expressed as ADWG, of Cobb 500 broiler chickens in proportion to the inclusion level.

In the present study, the mortality rates were 9.33±4.81% in T0%, 4.00±2.31% in T2.5%, 8.00±2.31% in T5% and 2.67±2.67% in T7.5%. The absence of a significant difference among treatments indicates that mortality was not significantly affected by dietary treatment. These findings are consistent with those of Diarra *et al.*[31], who reported mortality among broilers receiving experimental diets in which sorghum and soybean meal replaced corn and fish meal, respectively, at different inclusion levels. The relatively high mortality observed during the starter phase may have been associated with the general vulnerability and adaptation of young chicks to the experimental conditions, rather than necessarily resulting from the inclusion of GMP-bd. Furthermore, analysis of the hematological profile, particularly hematocrit levels, revealed no significant differences among treatments ($p>0.05$). These findings are consistent with those reported by Zungu *et al.*[5] and subsequently by Mthana and Mthiyane[32], who found that the inclusion of small amounts of detoxified *Mucuna pruriens* seeds in broiler diets did not adversely affect bird health or mortality.

From an economic perspective, the reduction in feed cost per kilogram observed with the inclusion of *Mucuna pruriens* seeds may be attributed to the partial replacement of more expensive conventional protein ingredients, particularly soybean. *Mucuna pruriens* represents a locally available resource that is not commonly consumed directly by humans, has a relatively low cost, contains substantial amounts of protein (23-43%) and provides an energy value comparable to that of soybean[33]. Our findings are consistent with those of Houndonougbo *et al.*[34], who reported a reduction of 12-20 FCFA/kg in feed cost compared with the control diet in ISA Brown laying hens fed diets containing dried cassava (*Manihot esculenta*) leaves. Furthermore, the inclusion of *Mucuna pruriens* seeds had a positive economic effect on the net margin per chicken, which may be explained primarily by the reduction in feed costs and the resulting improvement in profitability. The highest net margin was obtained with the 7.5% treatment. This inclusion level also resulted in a significant reduction in production cost per kilogram of live weight compared with the control, indicating greater economic efficiency. These findings corroborate those of Missoko *et al.*[29], who reported that incorporating seed meal from the RDC cultivar of *Cajanus cajan* into broiler diets at inclusion levels of up to 14% reduced production costs.

CONCLUSION

This study demonstrated that boiled and hulled *Mucuna pruriens* seeds can be used as a partial substitute for roasted soybeans in broiler chicken diets. The results showed a highly significant improvement in weight gain and average daily gain during the growth and finisher phases in birds receiving diets

containing 7.5% *Mucuna pruriens* seeds compared with the control group. Furthermore, the inclusion of GMP-bd at 7.5% did not adversely affect feed intake, feed conversion ratio, hematocrit levels, or most carcass and internal organ characteristics. This inclusion level was also associated with improved net margins and reduced production costs per kilogram of live weight. Therefore, boiled and hulled *Mucuna pruriens* seeds can be incorporated into Cobb 500 broiler diets at a level of up to 7.5% as a partial substitute for roasted soybeans without adversely affecting zootechnical performance or economic profitability.

Further studies should:

- Evaluate the effects of incorporating *Mucuna pruriens* seeds at inclusion levels higher than 7.5% in broiler diets to determine the optimal inclusion level
- Investigate roasting as an alternative processing method for *Mucuna pruriens* seeds to assess its potential for facilitating their use on a larger scale

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