Research Article

Comparative Effects of Industrial, Semi-Industrial and Artisanal Soybean Meal on Growth Performance and Economic Efficiency of Cobb 500 Broiler Chickens

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Abstract | In Burkina Faso, poultry farming faces challenges in providing adequate feed and therefore needs modernization to meet animal protein requirements. This study aimed to compare the effects of locally produced soybean meal (produced using industrial or semi-industrial processes) on broiler chicken performance. A total of 225 Cobb 500 broiler chicks were used. The experimental design was a completely randomized design with three diets and three replicates. The chickens were randomly assigned to different diets containing the same percentage of soybean meal: industrial soybean meal (diet 1), semi-industrial soybean meal (diet 2), and artisanal soybean meal (diet 3). At the end of the 42-day trial, the data on zootechnical parameters were analyzed. The results showed that chickens fed with diet 1 had a statistically significantly higher average body weight (1.4 kg) ($p < 0.05$) than chickens fed with diet 2 (1.3 kg) and diet 3 (1.3 kg). From an economic perspective, chickens fed with diet 2 had a higher profit margin (0.69 USD) than those fed with the other two diets. However, at 35 days of rearing, chickens fed with diet 1 showed the best profit margin (0.62 USD). This study suggests that industrial soybean meal is beneficial during the starter and growth phases, while semi-industrial soybean meal is recommended during the finishing phase. Similar study should conducted with these types of soybean meal on the zootechnical and economic performance of local breed chickens.

Keywords | Body weight, Diet, Feed, Soybean meal, Zootechnical parameters, Burkina Faso

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INTRODUCTION

In the livestock sub-sector of Burkina Faso, the poultry industry represents one of the key components in terms of food security (MRAH, 2021). Poultry is the main source of animal protein for the growing population Given the demand for poultry products, broiler chickens, whose production cycle is very short, should be promoted (Mottet and Tempio, 2017). Furthermore, effective management of feeding techniques can reduce production costs and improve product quality (Herrero *et al*., 2014). However, the poor quality of feed ingredients constitutes a major obstacle to the development of poultry farming (Pousga *et al*., 2019). The main raw materials used as animal protein sources are fishmeal. These are generally imported at high costs (Abdeloahab, 2008). As for plant-based proteins, cottonseed meal and soybean meal are the most commonly used (Pousga *et al*., 2019). They are relatively affordable and of good quality. With a higher protein content than cottonseed meal, soybean meal can be used to improve broiler chicken nutrition and therefore increase their productivity. Consequently, the use of soybean meal in animal feed has increased in recent years (Vojtech *et al*., 2016). Local soybean meal production is carried out by industrial and semi-industrial units. Unfortunately, few studies have been conducted to evaluate the effect of soybean meal produced in these two types of units on broiler chicken performance. The main objective of this study was to contribute to improving broiler chicken feed in Burkina Faso through the rational use of domestically produced soybean meal. More specifically, it aimed to: (i) evaluate the zootechnical performance of broiler chickens fed with soybean meal produced in artisanal, semi-industrial and industrial processing units; and (ii) evaluate the economic performance of broiler chickens fed with the three different types of soybean meal.

MATERIALS AND METHODS

Study site

The study took place in the city of Bobo-Dioulasso in Burkina Faso, the capital of Houet Province. The number of broiler chicken in the municipality of Bobo-Dioulasso is estimated at 152,135 heads (MRAH, 2021). The experimental test was conducted on an experimental farm.

Material

A poultry house meeting all poultry farming standards, was used for the study. Upon arrival, the chicks were kept warm for one week using a gas heater (Proweltek, China). A total of 225 chicks were used. An Ethical approval was obtained from the University's ethics committee to conduct the study. The chicks' weights upon arrival were recorded using an electronic scale (Duronic, Romford, United Kingdom) with a measurement range of 200 g to 40 kg. A medical protocol was established and followed to prevent disease during the study. The subjects were vaccinated against Newcastle disease, Gumboro disease, and infectious bronchitis. They also received antibiotics for bacterial diseases, anti-stress medication, antiparasitic drugs, and vitamins.

Three diets, each incorporating soybean meal at the same rate but from different sources, were used. The diets consisted of soybean meal produced in modern industrial factories after oil extraction (industrial soybean meal), soybean meal produced in semi-industrial units after oil extraction (semi-industrial soybean meal), and soybean meal produced in artisanal units after oil extraction (artisanal soybean meal). Samples of the different soybean meal were analyzed at the laboratory of the International Research and Development Center for Livestock in Subhumid Zones, Burkina Faso (CIRDES). The analysis was performed in two stages: scanning using the NIR (Near-Infrared Spectrometry) method (Bastianelli, 2018) and prediction using equations. The instrument used was a Bruker Tango (Burker Corporation, Germany).

Experimental test

The trial was conducted from March 18 to May 2, 2025. For the first seven days, the 225 chicks were raised in a brooder and all received Galdus as a pre-starter feed produced by De Heus (Koudijs). The poultry house was divided into nine box of 3m^2. The design used was a completely randomized Fisher block with three treatments and three replicates, resulting in nine elementary pens. The 225 chicks were randomly assigned to the nine experimental boxes, with 25 birds per box. Each group was fed one of three experimental diets: diet 1 incorporating industrial soybean meal, diet 2 incorporating semi-industrial soybean meal, and diet 3 incorporating artisanal soybean meal.

Water and feed were provided ad libitum throughout the forty-two days of the experiment. Feed and water were offered twice a day (morning and evening). In each pen, the amount of water and feed rejected was weighed each morning. During the different phases: starter (days 8-14); grower (days 15-28) and finisher (days 29-42), the different formulations of the diets were submitted to the chickens for each stage (Table 1).

Table 1: Diets compostion.

Ingredients	Quantity (%)		
	Starter	Grower	Finisher
Corn	56.45	56.45	58.5
Wheat bran	5.4	5.4	7.07
Roasted soybeans	9.55	8.55	13.5
Soybean meal	18.5	14	8.71
Cotton meal	0	5	4
Fish meal	2.5	2.5	4
Blood meal	3	3.5	0
Oyster shell	1	1	1
Salt	0.20	0.25	0.3
Premix	0.25	0.25	0.25
DL-Methionine	0.25	0.25	0.18
Lysine	0.25	0.25	0.21
Ferrous sulfate	0	0.1	0.1
Dicalcium phosphate	2	2.4	2.18
Biacalcium	0.15	0.1	0
Total	100	100	100

Evaluation of zootechnical parameters

The chickens were weighed on days 7, 14, 21, 28, 35, and 42. Water and feed intake (consumed and refused) were recorded daily. The data collected during the trial allowed the monitoring and evaluation of zootechnical performance. Body Weight (BW), Average Daily weight

Gain (ADG), Feed Conversion Ratio (FCR), Mortality Rate (MR), Organ Weights (OW), and Carcass Yields (CY) were evaluated as described the following points.

Individual feed consumption (IFC) and water consumption (IWC)

The total amounts of feed consumed and water ingested were obtained by subtracting the amounts refused during the week from the total amounts distributed. Feed and water consumption per chicken per day was calculated by dividing the total amount of feed consumed or water ingested during the week by the number of chickens *(n)* and by 7.

$$IFC\ (g) = [(QFDw - QFRw)/n]/7$$

QFDw = Quantity of feed distributed during the week (g), QFRw = Quantity of feed refused during the week (g)

$$IWC\ (L) = [(QWDw - QWRw)/n]/7$$

QWDw = Quantity water distributed during the week (g), QWRw = Quantity water refused during the week (g).

Body weight (BW)

It is the ratio of the sum of the body weights of the individuals (BWi) of the same batch to the number (n) of the individuals in the batch.

$$BW(g) = (\Sigma BWi)/n$$

Average daily weight gain (ADG)

The ADG was calculated by dividing the one week weight gain (Y) of all subjects by the number (*n*) of subjects in the group and dividing the result by 7.

$$ADG\ (g/j) = [(Y)/n]/7$$

Feed conversion ratio (FCR)

It is calculated by dividing the average individual feed consumed (IFC) in g during a period per chicken by the average daily weight gain (ADG) in g during the same period.

$$FCR = IFC(g)/ADG\ (g)$$

Mortality rate (MR)

The MR in each batch was obtained by dividing the number of deaths (Nd) recorded during the breeding period by the total number at the start (*n*), then expressed as a percentage (%).

$$MR = (Nd/n) \times 100$$

Organ weight (OW) and carcass yield (CY)

OW was obtained by direct weighing on the scale. CY was calculated by taking the ratio of carcass weight (CW) to body weight at slaughter (BW), which is expressed as a percentage. The formula is CY = (CW/BW) x 100.

Economic evaluation

Except for feed costs, other factors influencing production costs, including labor, medication, and electricity, were considered constant and identical for the different treatment phases. Feed costs were estimated for each phase (pre-starter, starter, grower, and finisher) by evaluating the price per kilogram of each ingredient. This calculation was performed for each batch of chickens. The economic evaluation consisted of assessing the feed cost per chicken (FC); the selling price of the chicken (SP); and the gross margin (GM).

$$FC\ (USD) = FCR \times SP \times FP$$
$$SP\ (USD) = BW \times PPC$$
$$GM\ (USD) = PPC - PC$$

FCR = Feed conversion ratio, BW = Body weight (Kg), FP= Feed price (Kg), PPC = Price per Kg of chicken, PC= Production cost

Data analysis

Data processing was performed using R 4.3.3 software. The ANOVA method was used. The Kruskal-Wallis test at the 5% significance level was applied. Diagrams, tables, and graphs were created using Microsoft Excel 2016.

RESULTS

Nutritional value

The nutritional compositions of soybean meal are listed in Table 2. These compositions show that semi-industrially produced soybean meal has the highest protein content, between 45% and 52%, while the protein content of industrially produced soybean meal is between 43% and 44%. However, the fat content is higher in semi-industrially produced soybean meal, at nearly 15%, whereas in industrially produced soybean meal, it is less than 5%.

Individual feed consumption

Daily feed intake per chicken was 132.4 g for the diet 1, and 122.6 g and 119.7 g for diet 2 and diet 3, respectively. During the starter, grower, and finisher phases, chickens fed with the diet 1 consumed more feed than those fed with the other two diets. Statistical analysis showed a significant difference ($p < 0.05$) among treatments during the starter and grower phases (Table 3). During these phases, feed intake was significantly higher in chickens fed with diet 1 compared with those fed with diet 2 and diet 3.

Table 2: Nutritional value of industrial soybean meal.

Designation	Nutritional value of industrial soybean meal	Nutritional value of semi-industrial soybean meal	Nutritional value of artisanal soybean meal
Humidity	5%	6%	6%
Dry Matter	95%	94%	93.75%
Fat	5%	15%	15.73%
Crud protein	48.5%	44%	43%
Raw energy (kcal/kg)	4070	4063	4057

Source: Laboratory of CIRDES, 2025

Daily water consumption per chicken

Average daily water consumption per chicken increased (57.2 ± 0.81 mL) in the first week, to 322.5 ± 16.05 mL in the sixth week (Table 4). During this period, average consumption for diet 1 and diet 2 was numerically higher than that of diet 3. Analysis of variance revealed a significant difference ($p \leq 0.05$) between average water consumption in the second and fourth weeks of breeding.

Evolution of body weight

The body weights of the animals for each diet increased steadily from the first week to the sixth week. At the end of the pre-starter phase, the chicks had similar weights (147.81±0.32 g). However, the average body weight curves for diet 1 remained numerically higher than those for diet 2 and diet 3 throughout the breeding period. The average body weights per diet were not statistically different ($p > 0.05$) during the pre-starter and starter phases. Conversely, the Kruskal-Wallis test revealed a highly significant difference between the weights of the different diets ($p \leq 0.001$) during the growth and finishing phases. The average weight of diet 1 was higher than that of diet 2, which in turn had a higher average weight than diet 3. However, a slight regression of this difference in diet growth was observed from day 35 to day 42 (Figure 1).

Average daily weight gain

Average daily weight gain (ADG) was 15.38 ± 0.06 g during the first week, it was 30.06 ± 4.94 g during the sixth week for all diets. The differences between diets were significant depending on the week ($p \leq 0.05$). This difference is characterized, firstly, by higher ADG for diet 1 compared to diets 2 and 3 from the second to the fourth week. Subsequently, an equalization of ADGs was observed in the fifth week, followed by a progressive increase in ADGs for diet 3 compared to diets 2 and 1 in the sixth week (Figure 2).

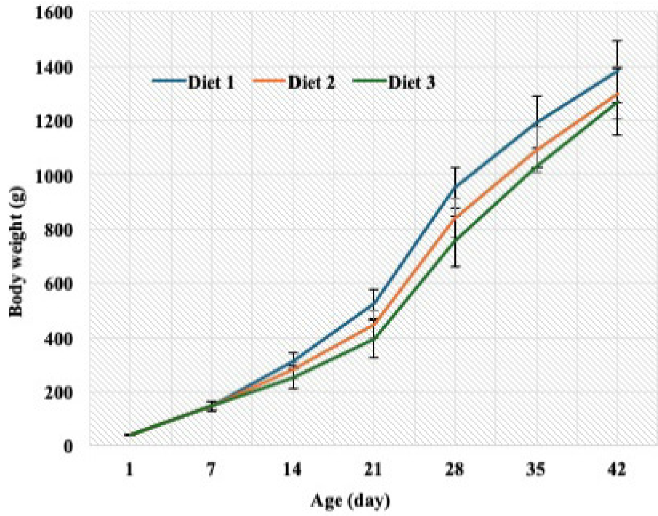

Figure 1: Body weight (g) of broilers according to age.

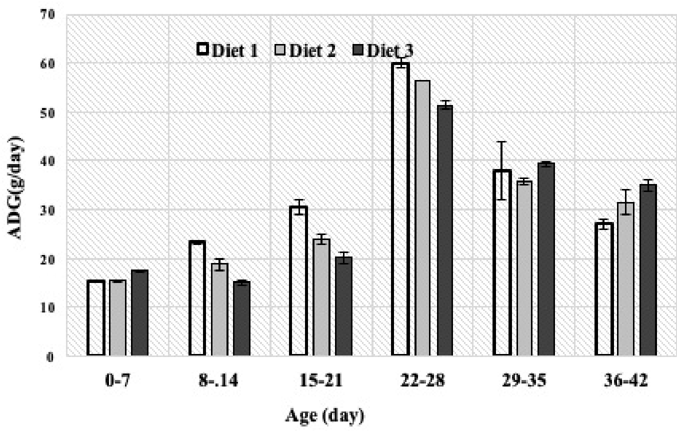

Figure 2: Average daily weight gain per chicken according to age.

Table 3: Average daily feed consumption per chicken.

Age (days)	Diets			Average	p-values	Significance
	Diet 1	Diet 2	Diet 3			
0-7	19 ± 0.20[a]	19.1 ± 0.40[a]	19.13 ± 0.21[a]	19.1	0. 77	NS
8-14	41 ± 2.76[a]	36.53 ± 1.28[ab]	33.80 ± 0.95[b]	37.1	0.03	S
15-21	68.80 ± 4.04[a]	58.26 ± 1.73[b]	52.43 ± 4.45[b]	59.8	0.04	S
22-28	101.66 ± 5.02[a]	89.49 ± 5.96[ab]	81.33 ± 6.28[b]	90.8	0.39	S
29-35	110.33 ± 8.25[a]	100.55 ± 5.55[a]	95.66 ± 7.37[a]	102.2	0.10	NS
36-42	132.40 ± 11.92[a]	122.56 ± 8.16[a]	119.66 ± 8.08[a]	124.9	0.25	NS

Data are presented as average ± Standard deviation. Values in the same row assigned the same letter are not statistically different at the 5% level according to the Kruskal-Wallis test. NS: Not Significant, S: Significant

Table 4: Average water consumption per chicken.

Age (days)	Diets			Average	p-value	Significance
	Diet 1	Diet 2	Diet 3			
0-7	57 ± 0.60[a]	57.3 ± 1.20[a]	57.4 ± 0.62[a]	57.2 ± 0.81	0.76	NS
8-14	123.83 ± 1.30[a]	108.16 ± 6.10[ab]	99.26 ± 8[b]	110.4 ± 5.13	0.04	S
15-21	191.10 ± 12.10[a]	162.66 ± 6.02[b]	144.30 ± 8.60[b]	166.0 ± 8.91	0.03	S
22-28	232.73 ± 13.24[a]	204.73 ± 1.12[b]	186.43 ± 3.92[b]	208.0 ± 6.09	0.03	S
29-35	279.20 ± 19.88[a]	254.90 ± 13.87[a]	241.23 ± 20[a]	258.4 ± 17.92	0.08	NS
36-42	340.80 ± 11.18[a]	317.33 ± 20.03[a]	309.30 ± 16.92[a]	322.5 ± 16.05	0.15	NS

Data are presented as average ± Standard deviation. Values in the same row assigned the same letter are not statistically different at the 5% level according to the Kruskal-Wallis test. NS: Not Significant, S: Significant.

Table 5: Mortality rate.

Age (day)	Diets			Average	p-values	Significance
	Diet 1	Diet 2	Diet 3			
0-7	4.04±0.37[a]	3.6±0.40[a]	4.01±0.20[a]	3.9±0.32	0.84	NS
8-14	0.00[a]	0.00[a]	1.35±0.02[a]	0.5±0.07	0.37	NS
14-21	1.33±0.02[a]	1.3±0.22[a]	1.36±0.02[a]	1.3±0.09	0.95	NS
21-28	0.00[a]	0.00[a]	0.00[a]	0.0±0.0	0.00	HS
28-35	1.35±0.02[a]	0.00[a]	0.00[a]	0.5±0.01	0.37	NS
35-42	1.36±0.03[a]	0.00[a]	0.00[a]	0.5±0.01	0.37	NS
Cumulated	8.08	4.913	6.72	6.6		

Data are presented as average ± Standard deviation. Values in the same row assigned the same letter are not statistically different at the 5% level according to the Kruskal-Wallis test. NS: Not Significant, S: Significant; HS: Highly Significant.

Feed conversion ratio

During the first two weeks, diet 1 showed a lower feed conversion ratio (FCR) than the other two diets. However, after the second week, these trends reversed. Diet 3 showed a lower FCR, followed by diet 2. Overall, the different diets had no significant effect ($p \geq 0.05$) on FCR (Figure 3).

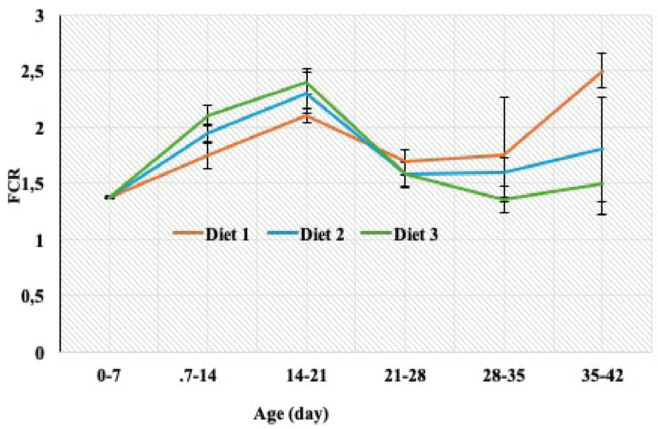

Figure 3: Feed conversion ratio of broilers according to age

Mortality rate

The cumulative mortality rate varied from 3.71% to 4.07% for the three diets. The mortality rate decreased numerically, with the highest values recorded during the first week. However, the cumulative mortality rate for diet 1 was numerically higher than those for diets 2 and 3. No significant difference was found ($p \geq 0.05$) (Table 5).

Organs weight and carcass yield

The carcass characteristics showed a highly significant difference between diets for several parameters ($p \leq 0.01$). Chickens fed diet 1 exhibited higher carcass, head, feet, heart, liver, empty gizzard, and intestinal weights compared with those fed diets 2 and 3 (Table 6).

Economic profitability

The production cost (feed cost and other expenses) per chicken at 42 days of age, the chicken revenue, and the gross margins earned for each diet are recorded in Table 7. The highest cost was recorded for diet 1 (3.78 USD). However, the gross margin obtained for diet 2 at the end of the test (0.69 USD) was higher than that of diet 1 (0.64 USD) and diet 3 (0.69 USD). Conversely, at 35 days, the gross margin of diet 1 was significantly higher than the other two diets, 2 and 3.

DISCUSSION

This study, like most, has limitations. These limitations primarily concern the quality of the chicks. Indeed, hatcheries in West Africa generally struggle to produce high-quality chicks. Consequently, day-old chicks are often not uniform in terms of starting weight. This could influence the quality of our scientific findings.

Table 6: Organs weight (g) and carcass yield (%).

Organs	Diets			Average	p-value	Significance
	Diet 1	Diet 2	Diet 3			
Head	108.53 ± 6.21[a]	91.71 ± 6.37[b]	87.54 ± 8.45[b]	95.9	$2.7\ 10^{-4}$	VHS
Chicken feet	32.13 ± 1.55[a]	27.93 ± 1.59[b]	26.89 ± 2.11[b]	29.0	$2.7\ 10^{-4}$	VHS
Heart	10.13 ± 0.83[a]	7.71 ± 0.79[b]	7.34 ± 1.13[b]	8.4	$1.7\ 10^{-4}$	VHS
Liver	57.1±0.005[a]	43 ± 0.005[b]	39.6 ± 0.007[b]	46.6	$2.7\ 10^{-4}$	VHS
Empty guizzard	62.12 ± 3[a]	53.99 ± 3.08[b]	51.97 ± 4.09[b]	56.0	$2.7\ 10^{-4}$	VHS
Carcass yield	75.70 ± 10.54[a]	69.82 ± 21.86[b]	68.83 ± 68.76[b]	71.5	$2.7\ 10^{-4}$	VHS
Carcass	1045.38 ± 50.5[a]	908.64 ± 51.6[b]	874.68 ± 68.76[b]	942.9	$2.7\ 10^{-4}$	VHS
Intestinal	83.69 ± 26.88[a]	81.92 ± 4.67[b]	70.20 ± 23.30[b]	78.6	0.47	NS
Rate	1.76 ± 0 0.08[a]	1.53 ± 0.8[a]	1.45 ± 0.11[a]	1.6	$2.7\ 10^{-4}$	VHS

Data are presented as average ± Standard deviation. Values in the same row assigned the same letter are not statistically different at the 5% level according to the Kruskal-Wallis test. NS: Not Significant, VHS: Very highly significant.

Table 7: Evaluation of economic profitability.

Cost and quantity	Diets		
	Diet 1	Diet 2	Diet 3
Quantity of feed consumed per chicken/phase (kg)			
Pre-start	0.133	0.134	0.134
Start	0.287	0.256	0.237
Groth	1.96	1.7381	1.6059
Finish	0.926	0.858	0.838
Cumulated	3.306	2.9861	2.8149
Price kg of diet/stage (USD)			
Pre-start	1.42	1.42	1.42
Start	0.62	0.59	0.59
Groth	0.58	0.54	0.54
Finish	0.53	0.48	0.48
Average price of diet	0.79	0.76	0.76
Cost of the diet/kg (USD)			
Pre-start	0.19	0.19	0.19
Start	0.18	0.15	0.14
Groth	1.14	0.94	0.87
Finish	0.49	0.41	0.40
Total cost of the diet/Chicken (USD)	2	1.7	1.6
Cost of chick	1,25	1.25	1.25
Veterinary care	0.18	0.18	0.18
Hen house depreciation	0.27	0.27	0.27
Litter	0.089	0.089	0.089
Total cost of fixed charges (USD)	1.78	1.78	1.78
Production cost (USD)	3.78	3.47	3.38
Average body weight	1.38	1.3	1.27
Price of kg body weight (USD)	1.78	1.78	1.78
Chicken price (USD)	4.42	4.17	4.07
Gross margin per chicken at 35 days (USD)	0.54	0.43	0.32
Gross margin per chicken at 42 days (USD)	0.64	0.69	0.69

The average daily feed intake per chicken from the three diets at 35 days was 102.18 g and 124.87 g at 42 days. This is higher than the 96.12 g/day, 99.80 g/day, and 89.69 g/day obtained respectively by Ouédraogo (2017), and Zongo (2019) at 35 days of age, as well as the 89.85 g/day/chicken reported by Negari *et al.* (2024) at 42 days of age. This result could be linked to the favorable environmental rearing conditions (temperature, ventilation, and humidity) in the Sudanian zone, as well as to the quality of the feed. However, at 35 days of age, feed consumption was lower than that observed by Zongo *et al.* (2024), which is 113.27 g/day/chicken. This result could be related to the quality of the chicks as well as the heat. At six weeks of age, the chickens fed with diet 1 had a statistically higher feed intake (132.4 g/day/chicken) than the other two diets (Diet 2 and Diet 3). This intake was also higher than 115 g/day (Dayon, 1997). This result reflects the positive effect of the feed incorporating industrially produced soybean meal on the feed intake of broiler chickens. This may be related to the higher protein content of the feed used, with a protein level between 42 and 52%. Indeed, the protein content of a feed can influence the birds' appetite and determine the amount of feed ingested (Larbier and Leclercq, 1992; Ahiwe *et al.*, 2018).

The average daily water consumption per bird across all three diets at 35 days of age was 160.02 mL and 187.0942 mL at 42 days of age. At 35 days of age, water consumption is close to that recommended by Larbier and Leclercq (1992) and Arbelot and Dayon (1997), which is 1.8 times the amount of feed consumed. However, this average water consumption is significantly lower than that, which is 2.8 times the amount of feed consumed at a temperature of 30°C, and also lower than the 329.59 mL/day/chicken obtained by Zongo (2016). The five-week-old chickens in diet 1 had a feed intake of 279.20 mL/day/chicken, statistically higher than the other two diets (2 and 3).

The average body weight of the chicks on the first day was

40.11 g, a result similar to those observed by Hien *et al.* (2012, 2018), and Zongo (2019), who obtained weights of 41.7 g, 42 g, and 43 g, respectively. At the end of the experimental study, the average body weight recorded for all diets was 1,380.51 g. This body weight is higher than the 1,130 g obtained by Arbelot and Dayon (1997) in Senegal and the 1,056 g by Zongo (2019) in Burkina Faso. This performance could be due to the high protein content of the three different soybean meal. Indeed, according to Tesseraud (1995), protein promotes muscle deposition during the growth phase. Chickens fed diet 1 had a higher average body weight than chickens fed diets 2 and 3. The fed diet 2 also showed a statistically higher average body weight than the fed diet 3. This could be explained by the more intense heating of the soybeans during oil extraction in industrial facilities. Indeed, the more the soybeans are heated, the more malleable they become, and the more complete the extraction process, thus releasing the oil and yielding more protein (Abdelouahab, 2008).

Chickens fed with diet 1 recorded an average daily weight gain (ADG) of 44.15 g between weeks 2 and 4. This is consistent with the results of Zongo *et al.* (2024). This could be explained by the chickens' growth stage, which corresponds to a high protein requirement. This need would be met by diet 1, whose industrial soybean meal had the highest protein content (48.5%). However, the reversal of trends observed during the last week (finishing phase), marked by a higher ADG in chickens fed diet 3 (35 g/day) compared to diets 1 and 2, could be explained by the high energy requirements of broiler chickens in the finishing phase (Alleman *et al.*, 1999). These requirements would be met by diets 3 and 2, which were richer in protein. Indeed, the protein requirements of chickens decrease, while their energy requirements increase (Kim *et al.*, 2022).

The feed conversion ratio (FCR) of the chickens in diet 1 (1.73) was lower than those in the other two diets during the second week, while the FCR of the chickens in diet 3 (1.73) was lower than those in the other two diets during the last week. This could be explained by the fact that during the first weeks (pre-starter), there is a greater need for protein than for energy, unlike the last weeks (finishing) where there is a greater need for energy than for protein (CIRAD-GRET, 2002). Furthermore, according to Mpouok (1999), an increase in energy levels generally leads to an improvement in the FCR.

The cumulative mortality rate of the different diets varied from 4.9% to 8.08%. The mortality rates of all diets are consistent with the standard indicated in the Agronomist's Handbook (2002) for hot climates (5-8%). However, the cumulative mortality rate of the different diets, with the exception of diet 2, is significantly higher than the acceptable standard recommended by Arbelot and Dayon (1997), which is 3 to 5%. This result could be explained by stress due to transport and handling (weekly weighing and vaccination).

The carcass weight (1045 g), foot weight (32.13 g), liver weight (57 g), and gizzard weight (62.12 g) for diet 1 were statistically greater compared to the other two diets (2 and 3). This result could be attributed to the higher protein content of diet 1, which promotes weight gain. Indeed, fat and protein contribute to improving carcass yield in broiler chickens (Abe *et al.*, 1998; Ciewe Ciaké, 2006). The carcass yield obtained for all diets (71.45%) falls within the 70-72% range indicated by CIRAD-GRET (2002).

The costs associated with raising chickens on diet 1 were the highest compared to the other diets. Thus, at 42 days, a chicken on diet 1 was less profitable compared to the other two diets. However, at 35 days, diet 1 was more profitable. This is directly related to the slightly higher quantity of feed consumed for diet 1 compared to the others and the high price of industrial soybean meal. However, the good energy content of diets 3 and 2 would have promoted good weight gain.

CONCLUSION

This study aimed to compare the zootechnical and economic parameters of broiler chickens fed diets incorporating industrially or semi-industrially produced soybean meal, in order to address the issue of protein in poultry feed. From an economic standpoint, diets incorporating semi-industrially produced soybean meal were more cost-effective, as their price per kilogram was lower. However, industrially produced soybean meal may be recommended during the starter and grower phases, while semi-industrially produced soybean meal appears more suitable during the finishing phase. Looking ahead, it would be beneficial for the scientific community to conduct a similar study comparing industrially and semi-industrially produced soybean meal to assess the zootechnical and economic performance of local breed chickens.

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NOVELTY STATEMENT

The authors state that the results of this study provide new insights into protein sources in broiler chicken farming.

AUTHORS CONTRIBUTION

AZ and RTZ designed the study, analyzed the data and wrote the first draft of the manuscript; MS collected the data; VMCB-Y supervised all the study.

Generative AI and AI assisted technology statement

The authors declare that no generative AI and AI assisted technology was used in the creation of this manuscript.

Conflict of interest

The authors have declared no conflict of interest.

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