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# RESEARCH ARTICLE

## COMPARATIVE STUDY OF THE ZOOTECHNICAL PERFORMANCE OF REDFLESHED CHICKEN AND KUROILER CHICKENS RAISED IN A TROPICAL ENVIRONMENT (IVORY COST)

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**ABSTRACT**

To address the shortage of broiler chicks on the Ivorian poultry market, some farmers are turning to self-production using whatever resources they have. However, the choice of breed has a significant impact on the quality of eggs and chicks. To help farmers make informed choices, this study was conducted on breeding stock of the Red flesh and Kuroiler breeds. Seventy breeding stock (48 females and 12 males) aged 6 to 7 months were used. Each group consisted of 6 roosters and 35 hens. The results showed that the laying rate of the Kuroiler breed (39.03 ± 4.96%) was significantly similar to that of the Red flesh breed (36.34 ± 4.96%). The eggs from Red fleshed hens were heavier (51.55 ± 0.52 g) and wider (40.93 ± 1.39 mm) than those from Kuroilers hens (50.96 ± 1.85 g; 40.31 ± 1.41 mm). Conversely, Kuroilers eggs were significantly longer ($p < 0.0001$) than those from red-fleshed hens (53.86 ± 1.86 mm and 53.27 ± 1.32 mm). Regarding egg size, the Red flesh hens exhibited significantly different average weights ($p < 0.05$) (42.86 ± 2.05 g for small eggs, 50.59 ± 2.64 g for medium eggs, and 58.98 ± 3.04 g for large eggs). The same observation was made with Kuroiler eggs, for which significantly different average weights ($p < 0.05$) were obtained (41.97 ± 2.40 g for small eggs, 50.37 ± 2.69 g for medium eggs, and 58.95 ± 3.04 g for large eggs). The fertility rate (88.63 ± 4.81%) and the average number of hatchable eggs (2.42 ± 0.27 eggs) of the Red flesh variety were significantly similar to those of the Kuroilers (90.54 ± 5.31% and 2.68 ± 0.35 eggs). Based on these results, only hatching performance allows us to determine the strain best suited to chick production in our tropical climate.



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# INTRODUCTION

The Ivorian economy. primarily based on agriculture. boasts remarkable performance in crop production (cocoa, coffee, pineapples, bananas, cashew nuts, cotton, sugar, food crops, etc.) but suffers from chronic deficits in livestock and fisheries production. Agriculture employs two-thirds of the active population (Ouattara, 2023) contributing 34% to total GDP and 66% to export earnings. Livestock farming remains a developing economic activity contributing approximately 4.5% to agricultural GDP and 2% to total GDP (MIRAH, 2022). Yet. livestock production is crucial for a country's food security. Indeed.it not only helps reduce nutritional deficiencies but also constitutes a significant source of income (MINADER, 2017). Among livestock, poultry production is a key component of the animal production system in Côte d'Ivoire. Indeed.the modern poultry sector has experienced significant growth. Chicken meat consumption increased from 1.47 kg/capita/year in 2012 to 2.62 kg/capita/year in 2019. representing a 78.23% increase. and egg consumption rose from 34 eggs/capita/year in 2012 to 45 eggs/capita/year in 2019, a 32.3% increase.

The sector exceeded the initial consumption target for chicken meat. estimated at 2 kg in 2021, by 31% (MIRAH, 2022). Unfortunately, poultry farming remains dominated by traditional practices. with 70% of poultry raised using traditional methods (MIRAH, 2022). Despite progress in poultry development. Côte d'Ivoire remains dependent on imports to meet its chick needs. The few hatcheries operating in the country struggle to fulfill orders from poultry farmers. This forces some farmers to start producing fertilized eggs and chicks. They also try. with limited success. to produce chicks using improved strains. which unfortunately do not yield better results. Yet. it is clear, that breeding stock is the key to successful chick production. According to Nacer (2017), raising breeding stock is a crucial step that must be mastered due to their demanding genetic potential in terms of nutritional needs and environmental conditions. Today. most poultry farmers are looking to identify the chicken breed that will yield the best results in terms of egg and chick production. The aim of this work is therefore to suggest to poultry farmers the potential breed that provides the best zootechnical results.

# MATERIAL AND METHODS

## Material

**Animal biological material:** The biological material consisted of 70 breeding birds (48 females and 12 males) aged 6 to 7 months. belonging to two chicken strains (Kuroiler and Red flesh). The Kuroiler breeders had an average live weight of 1.674 ± 0.18 kg for hens and 2.501 ± 0.34 kg for males. The Red flesh breeders had an average live weight of 2.184 ± 0.28 kg for females and 4.538 ± 0.49 kg for males. Each strain consisted of 29 females and 6 males.

**Food ingredients:** Yellow corn, soybean meal. meat concentrate (2.5%), red palm oil and shellfish powder were used to manufacture the feed. The corn and red palm oil were purchased at the market. The soybean meal and meat concentrate were purchased from a dedicated local distributor.

**Technical equipment:** The technical equipment used consisted of a handcrafted grinding mill for grinding food ingredients, a Digital Caliper brand electronic caliper (accuracy 0.2 mm and range of 150 mm) used to measure the size and diameter of eggs an Electronic Kitchen Scale SF400 brand electronic scale (maximum capacity of 10 kg and accuracy of 1 g) used to weigh poultry, eggs and food and an HTC1 brand digital thermometer-hygrometer (accuracy at the temperature and humidity level of 1°C and 5% respectively) for measuring temperature and humidity.

## Methods

**Formulation and preparation of experimental rations:** Based on the specifications provided by the meat concentrate manufacturer, a ration was formulated using corn and soybeans during the egg production phase. The preparation involved manually mixing the defined quantities of the various selected raw materials. First, a small amount of the 2.5% meat concentrate was mixed with the shellfish to obtain a homogeneous premix. The ingredients present in relatively large quantities (corn and soybeans) were then added to create a well-balanced feed mixture or ration.

**Determining temperature and humidity levels within livestock buildings:** Measurements were taken daily at 9 a.m. for at least 30 minutes in each of the two buildings using a thermo-hygrometer. This allowed for monitoring the variations in these parameters.

**Food and water distribution:** The same ration was fed to both breeding strains during the experimental setting. Feeders were cleaned daily before feeding. The feed was weighed on an electronic scale before being placed in the feeders. Tap water was provided in 5-liter siphon drinkers. The drinkers were washed with soap daily and rinsed before being filled. Water was dispensed manually.

**Determination of the live weight of the subjects:** The birds were weighed weekly before feeding. The purpose of these weighings was to ensure normal growth. All males were weighed. A random sample of 30% of the females (9 hens) was selected and weighed. The weighings were performed individually using electronic scales.

**Egg collection and weighing:** Egg collection was carried out daily from both breeding flocks. with two visits per day (morning and evening). Eggs intended for incubation were stored in batches inside the henhouse. Eggs intended for consumption were kept in cardboard trays outside the henhouse. Each day, the eggs were weighed. and their length and diameter were individually measured before being transported for incubation.

**Determination of zootechnical parameters**

**Laying rate:** The laying rate was determined according to the formula proposed by Cherifi (2008) as follows:

Laying rate = [Number of eggs laid / (Number of birds present × Number of days)] x 100

**Breakage rate:** It expresses the percentage of damaged eggs during the production period (Cherifi, 2008) and is calculated as follows:

Egg case rate = [Number of broken eggs / Number of eggs laid] x 100

**Raw hatching eggs per hen starting:** The gross hatching egg yield was calculated as follows (Cherifi, 2008): per starter hen. Gross hatching egg yield per starter hen = Total hatching eggs/ Number of starter hens

**Net hatching eggs per hen at the start:** This is the number of hatchable eggs produced per starting hen (Cherifi, 2008). Net hatchable eggs per starting hen = Net hatching eggs/ Number of starting hens

**Evaluation of the quality of outgoing eggs**

**Egg quality assessment:** The quality of the eggs was determined by their weight. size. and diameter. Weight was measured using electronic scales. All eggs were carefully placed on the electronic scale and weighed individually. Size and diameter were measured individually using digital calipers.

**Fertility rate:** After the eggs are placed in the incubators, they are candled on the 18th day of incubation. This candling is done with a torch in a darkened area. Finally, after observation, eggs with blood vessels are called fertilized eggs; eggs without blood vessels are called infertile eggs (Cherifi, 2008; Keambou et al., 2009). Fertility rate (%) = (number of fertile eggs / total number of eggs placed in incubation) x 100

**Data Collection and Processing:** Data was collected daily for 67 days. The collected data were processed using Excel 2016. This software allows for the creation of figures and tables. Statistical analysis of the data was performed using Statistica 7.1 software. Means were compared using the Wald-Wolfowitz test. with a significant level of 5%.

# RESULTS

**Abiotic breeding parameters:** Figure 1 presents the results for average temperature and humidity in the Red flesh and Kuroiler breeder houses. In both cases.the temperature followed the same pattern. Temperature ranged from 30.76°C to 37.59°C in the Red flesh house, while it fluctuated from 30.40°C to 37.82°C in the Kuroiler house. with respective averages of 33.13 ± 2.13 and 32.92 ± 2.34. No significant difference was observed between the temperature measured in the Red flesh house and that in the Kuroiler house. However.the humidity observed in the Red flesh house was significantly higher than that in the Kuroiler house. It varied from 56.86% to 71.57% in the Red flesh while it fluctuated from 56.86% to 70.86% in the Kuroilers' henhouse with respective averages of 65.87±5.00% and 66.07±4.90%.

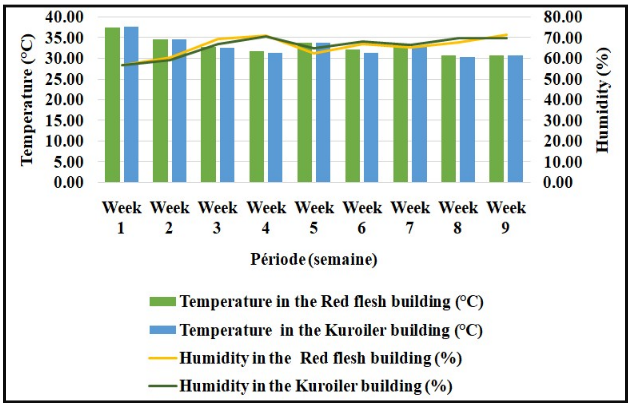


**Figure 1. Average temperature and humidity in livestock buildings**

## Zootechnical performance of breeding animals

**Average live weight of breeding stock :** Table I presents the results for the average live weights of the different strains. The average live weight of the Red flesh hens ranged from 2.18 ± 0.28 to 2.82 ± 0.30 kg and that of the Kuroilers hens ranged from 1.67 ± 0.18 to 2.08 ± 0.17 kg, with respective averages of 2.48 ± 0.25 kg and 1.93 ± 0.12 kg. A highly significant difference ($p < 0.001$) was observed between the average live weight of the Red flesh hens and that of the Kuroilers hens (1.93 ± 0.12 kg). For the Red Flesh variety, the average weight of males ranged from 3.54 ± 0.50 kg to 3.92 ± 0.44 kg, while that of Kuroiler males ranged from 2 ± 0.01 kg to 2.88 ± 0.51 kg, with respective averages of 3.69 ± 0.11 kg and 2.34 ± 0.32 kg. A highly significant difference ($p < 0.0001$) was observed between the average weight of Red Flesh and Kuroiler males.

## Laying performance

**Number of eggs depending on the time of day:** Figure 2 illustrates the number of eggs laid at different times of day. In the mornings.the number of eggs laid throughout the study period fluctuated between 2 and 13 eggs in the Red flesh. while it ranged from 5 to 16 eggs in the Kuroilers group, with respective averages of 7.22 ± 4.21 eggs and 9.78 ± 4.21 eggs. The highest egg counts for both strains were observed during the first week. In the evenings.the number of eggs laid was between 57 and 80 in the Red flesh and between 57 and 77 in the Kuroilers group. with respective averages of 63 ± 7.18 and 67.89 ± 7.99 eggs. No significant difference ($p>0.05$) was observed between the morning count (7.22 ± 4.21 eggs) in the Red flesh breed and (9.78 ± 4.21) in the Kuroilers breed. Similarly.the evening count (63 ± 7.18) in the Red flesh breed and (54.61 ± 7.99) in the Kuroilers breed showed no significant difference ($p>0.05$).

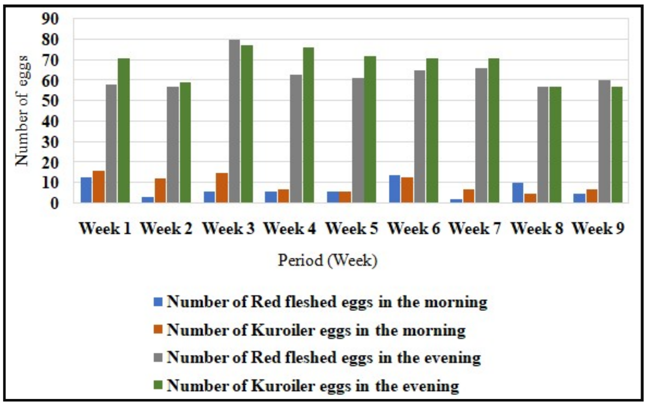


**Figure 2. Number of eggs depending on the time of day**

## Laying rate

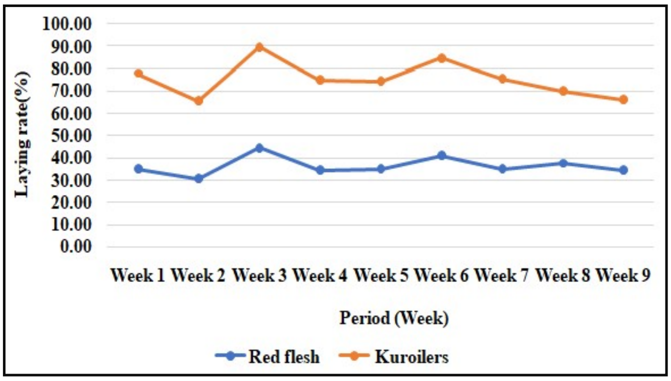


**Figure 3. Evolution of egg-laying rates of strains**

Figure 3 presents the laying rate results for the two strains. The results showed that the laying rates of the Red flesh and Kuroiler hens varied from 30.54% to 44.33% and from 31.53% to 45.32%. respectively. The laying rate curve for the Red fleshhens is below that of the Kuroiler hens. The laying rate of the Kuroiler strain is 39.03 ± 4.96%. while that of the Red fleshstrain is 36.34 ± 4.96%. No significant difference ($p > 0.05$) was observed between the laying rates of the Red fleshand Kuroiler hens.

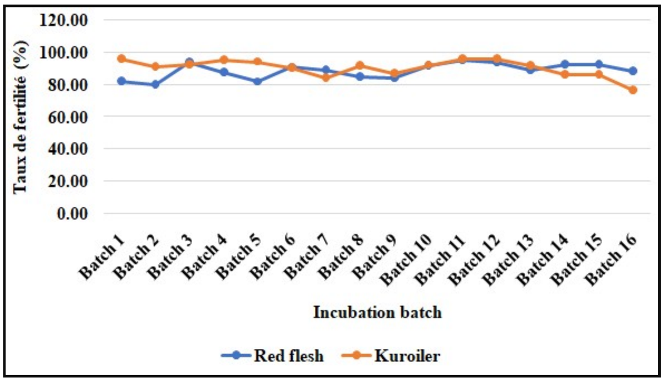


**Figure 4. Fertility rates of Red flesh and Kuroiler**

**Fertility rate:** Figure 4 presents the relative fertility rates of eggs from Red flesh and Kuroilers according to the batches. The results showed that the egg fertility rates of Red fleshand Kuroilers ranged from 80.00% to 94.45% and from 76.47% to 96.15%. respectively. The egg fertility rate of Kuroilers (90.54 ± 5.31%) recorded throughout the study period was higher than that of Red flesh (88.63 ± 4.81%).

**Table I. Average live weight of Redflesh andKuroilers breeders**

| Strains | Sexe | Week 1 | Week 2 | Week 3 | Week 4 | Week 5 | Week 6 | Week 7 | Week 8 | Week 9 | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Red flesh | Male | 3.54±0.49 | 3.62±0.50 | 3.92±0.44 | 3.78±0.39 | 3.61±0.54 | 3.65±0.61 | 3.71±0.62 | 3.70±0.67 | 3.72±0.67 | 3.69±0.11a |
| | Female | 2.18±0.28 | 2.45±0.73 | 2.19±0.16 | 2.24±0.26 | 2.71±0.24 | 2.78±0.22 | 2.82±0.30 | 2.53±0.36 | 2.41±0.37 | 2.48±0.25b |
| Kuroiler | Male | 2.50±0.34 | 2.71±0.58 | 2.41±0.43 | 2.88±0.51 | 2.38±0.54 | 2.04±0.33 | 2.00±0.01 | 2.05±0.07 | 2.08±0.04 | 2.34±0.32a |
| | Female | 1.67±0.18 | 1.85±0.17 | 2.01±0.22 | 1.90±0.21 | 1.91±0.16 | 1.94±0.17 | 1.94±0.21 | 2.05±0.17 | 2.08±0.17 | 1.93±0.12b |

Nb: Values bearing the same letter in the same column are significantly different (p <0.05)

**Table II. Evolution of broken egg rates for both strains over several weeks**

| | | Week 1 | Week 2 | Week 3 | Week 4 | Week 5 | Week 6 | Week 7 | Week 8 | Week 9 | Means and Standard Deviation |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Red flesh | Number of broken eggs | 0 | 2 | 4 | 1 | 4 | 6 | 4 | 9 | 5 | 3.89±2.71 |
| | Number of eggs laid | 71 | 62 | 90 | 70 | 71 | 83 | 71 | 76 | 70 | 73.78±8.24 |
| | Broken egg rate | 0 | 3.23 | 4.44 | 1.43 | 5.63 | 7.23 | 5.63 | 11.84 | 7.14 | 5.18±3.50a |
| Kuroiler | Nbre de casses | 0 | 0 | 1 | 1 | 4 | 5 | 4 | 6 | 1 | 2.44±2.30 |
| | Nbre d'œufs pondus | 87 | 71 | 92 | 82 | 80 | 89 | 82 | 66 | 64 | 79.22±10.06 |
| | Taux des œufs cassés | 0 | 0 | 1.09 | 1.22 | 5.00 | 5.62 | 4.88 | 9.09 | 1.56 | 3.16±3.13a |

Nb: Values bearing the same letter in the same column are significantly different (p <0.05)

**Tableau III. Average number of hatching eggs in the two strains**

| | | Week 1 | Week 2 | Week 3 | Week 4 | Week 5 | Week 6 | Week 7 | Week 8 | Week 9 | Means and Standard Deviation |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Red flesh | Number of eggs laid | 71 | 62 | 90 | 70 | 71 | 83 | 71 | 76 | 70 | |
| | Total hatching egg | 2.44 | 2.13 | 3.10 | 2.41 | 2.44 | 2.86 | 2.44 | 2.62 | 2.41 | 2.54±0.2a |
| | Hatching egg Net | 2.45 | 2.06 | 2.96 | 2.37 | 2.31 | 2.72 | 2.34 | 2.31 | 2.24 | 2.42±0.7a |
| Kuroiler | Number of eggs laid | 87 | 71 | 92 | 82 | 80 | 89 | 82 | 66 | 64 | |
| | Total hatching egg | 3 | 2.44 | 3.17 | 2.82 | 2.75 | 3.06 | 2.82 | 2.27 | 2.20 | 2.73±0.35a |
| | Hatching egg Net | 3 | 2.44 | 3.17 | 2.86 | 2.68 | 2.89 | 2.68 | 2.13 | 2.20 | 2.67±0.5a |

Nb :Les valeurs portant une même lettre sur la même colonne sont significativement différentes (p <0.05)

**Table IV. Metric characteristics of eggs**

| | | Week 1 | Week 2 | Week 3 | Week 4 | Week 5 | Week 6 | Week 7 | Week 8 | Week 9 | Means |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Weight (g) | Red flesh | 51.73 ± 5.33 | 51.11 ± 5.21 | 51.27 ± 6.16 | 51.67 ± 5.3 | 51.32 ± 5.64 | 51.96 ± 5.7 | 50.8 ± 5.06m | 52.56 ± 4.5m | 51.47 ± 5.18 | 51.55 ± 0.52b |
| | Kuroilers | 52.26 ± 5.39 | 50.45 ± 4.99 | 52.03 ± 5.2 | 50.7 ± 6.37 | 51.21 ± 5.85 | 52.20 ± 6.46 | 51.19 ± 5.13 | 51.81 ± 5.93 | 51.15 ± 5.25 | 50.96 ± 1.85a |
| Size (mm) | Red flesh | 54.33 ± 6.57a | 53.61 ± 3.3b | 49.81 ± 3.93abcdefg | 53.59 ± 3.35d | 53.55 ± 3.16e | 53.73 ± 3.07c | 53.44 ± 3.04f | 54.35 ± 3.09g | 53.68 ± 2.82 | 53.27 ± 1.32d |
| | Kuroilers | 53.52 ± 3.58a | 53.62 ± 3.13c | 54.14 ± 2.83d | 53.39 ± 4.17f | 48.75 ± 2.93acdfhkmn | 52.48 ± 4.33n | 53.19 ± 2.99m | 54.32 ± 3.56k | 53.10 ± 2.72h | 53.86 ± 1.86c |
| Diameter (mm) | Red flesh | 41.1 ± 1.50ab | 41.52 ± 1.35 | 37.26 ± 2.94bcdefgh | 41.65 ± 1.81d | 41.20 ± 1.48ek | 41.43 ± 1.55c | 41.18 ± 1.43fm | 41.67 ± 1.15agkm | 41.35 ± 1.37h | 40.93 ± 1.39a |
| | Kuroilers | 41.00 ± 1.49ab | 41.20 ± 1.43c | 41.66 ± 1.35bde | 41.54 ± 1.59g | 35.74 ± 1.49acdhkmn | 40.74 ± 3.21egnp | 41.58 ± 1.35mp | 41.23 ± 1.41k | 41.15 ± 1.5h | 40.31 ± 1.41a |

Nb: Values bearing the same letter on the same line are significantly different(p <0.05)

**Table V. Egg category of breeders according to strain**

| Category of eggs | Caracteristics | Red flesh | Kuroilers |
|---|---|---|---|
| **Smallegg** | Weight | 42.86±2.06**ab** | 41.97±2.40**ab** |
| | Size | 49.75±2.34 a | 50.03±2.42 b |
| | Diameter | 38.22±2.23 a | 39.10±1.99 b |
| **Medium egg** | Weight | 50.59±2.65 a | 50.38±2.69 b |
| | Size | 52.49±2.49**ab** | 53.57±2.88 **ab** |
| | Diameter | 40.79±1.81**ab** | 40.17±2.69**ab** |
| **Big egg** | Weight | 58.99±3.04 a | 58.95±2.25 b |
| | Size | 57.09±3.31 a | 56.99±3.10 b |
| | Diameter | 42.47±1.83**ab** | 42.00±2.04**ab** |

Nb**:** Values bearing the same letter on the same line are significantly different(p <0.05)

No significant difference (p>0.05) was observed between the egg fertility rates of Red fleshand Kuroilers.

**Breakage rate :** Table II shows the broken egg rate curves for the two strains. The results showed that the broken egg rate for Redflesh and Kuroiler hens ranged from 0 to 11.84% and from 0 to 9.09%. respectively. Regarding the overall broken egg rate.the rate for Redflesh (48.58 ± 3.50%) was higher than that observed for Kuroiler hens (28.46 ± 3.13%). Despite these smaller sample sizes.no significant difference (p > 0.05) was observed between the broken egg rate of Redflesh hens and that of Kuroiler hens.

**Gross hatching eggs and net hatching eggs per hen at the start :** Table III presents the results for the average gross and net hatching egg counts of the two strains. The results showed that the average gross hatching egg count ranged from 2.10 to 2.62 eggs for the Redflesh strain and from 2.20 to 3.17 eggs for the Kuroiler strain per starting hen. with respective means of 2.54 ± 0.28 eggs and 2.68 ± 0.35 eggs. No significant difference (p > 0.05) was observed between the average gross hatching egg count for the Redflesh and Kuroiler strains. As for the average number of net hatching eggs, these ranged from 2.07 to 2.97 eggs for Redflesh and from 2.07 to 3.17 eggs for Kuroilers per starting hen. with respective averages of 2.42 ± 0.27 eggs and 2.68 ± 0.35 eggs. There was no significant difference (p > 0.05) between the number of net hatching eggs in Redflesh and in Kuroilers.

**Egg quality assessment**

**Metric characteristics of eggs:** Table IV presents the results relating to the metric characteristics of the hens' eggs. The variables analyzed included egg weight, size, and diameter. In the Red flesh group, egg weight fluctuated between 50.80 ± 5.06 g and 52.56 ± 4.55 g, with a mean of 51.65 ± 5.51 g. Only the mean weights for week 7 (50.8 ± 5.06 g) and week 8 (52.56 ± 4.55 g) were significantly different (p < 0.05). Egg size varied from 49.81 ± 3.93 mm to 54.35 ± 3.09 mm, with a mean of 53.33 ± 3.97 mm. The size of the eggs in week 3 (49.81 ± 3.93 mm) was significantly smaller than those of the other weeks, which ranged from 53.44 ± 3.07 to 54.35 ± 3.09 mm. The diameter fluctuated from 37.26 ± 2.94 mm to 41.67 ± 1.15 mm, with a mean of 40.90 ± 2.21 mm. The diameter of the eggs in week 3 (37.26 ± 2.94 mm) was significantly smaller than that of the eggs in the other weeks, with a minimum value of 41.1 ± 1.5 mm and a maximum of 41.67 ± 1.15 mm. In Kuroilers hens, egg weight fluctuated between 48.49 ± 3.95 g and 54.18 ± 5.17 g, with a mean of 51.65 ± 6.01 g from week 1 to week 9. No significant difference was observed between the means (p > 0.05). Egg size varied from 49.24 mm to 55.36 mm, with a mean of 53.82 ± 3.58 mm. The size at week 5 (48.75 ± 2.93 mm) was significantly smaller (p < 0.05) than those of the other weeks, with values of 53.52 ± 3.58 mm, 53.62 ± 3.13 mm, and 54.14 ± 2.83 mm. The measurements for weeks 1, 2, 3, 4, 6, 7, 8, and 9 were 53.39 ± 4.17 mm, 52.48 ± 4.33 mm, 53.19 ± 2.99 mm, 54.32 ± 3.56 mm, and 53.10 ± 2.72 mm, respectively. The diameter fluctuated from 36.68 ± 2.53 mm to 41.52 ± 1.63 mm, with a mean of 40.9 ± 2.73 mm. As with the measurements for length, a significant difference (p < 0.05) was observed between the diameter in week 5 and that of the other weeks; the diameter in week 5 was smaller. The results of the overall metric characteristics of the Red Flesh and Kuroiler eggs show that Redflesh eggs had higher weights and diameters compared to Kuroiler eggs, with respective averages of 51.55 ± 0.52 kg; 40.93 ± 1.39 mm and 50.96 ± 1.85 kg; 40.31 ± 1.41 mm. Conversely, Kuroiler eggs showed a larger size compared to Redflesh eggs, with respective averages of 53.86 ± 1.86 mm and 53.27 ± 1.32 mm. No significant difference (p > 0.05) was observed for variables such as weight and size between the two strains. However, a highly significant difference (p < 0.0001) was observed between the egg diameters of the two strains.

**Egg category according to strain:** Table V presents the result of the categorization of eggs according to variables and chicken strain. There were highly significant differences (p<0.0001) between the weights, sizes, and diameters of the different egg categories (small eggs (35-45g), medium eggs (46-55g), and large eggs (56-65g)) from hens of both strains. Regarding the comparison between strains, a highly significant difference (p<0.0001) was observed between the average weights of small eggs from Red flesh hens (42.86 ± 2.06g) and Kuroilers (41.97 ± 2.40g). However, there was no significant difference (p>0.05) between the average size (49.75 ± 2.34 mm) and average diameter (38.22 ± 2.23 mm) of small eggs from Red flesh hens and Kuroilers hens, with the following figures being respectively 50.03±2.42mm and 39.10±1.99mm. Regarding average-sized eggs, a highly significant difference (p<0.0001) was observed between the average size (52.49 ± 2.49 mm) and the average diameter (40.79 ± 1.81 mm) of average eggs from Red Flesh chickens and Kuroilers chickens, which measured 53.57 ± 2.88 mm and 40.17 ± 2.69 mm, respectively. However, the average weights of average eggs from Red Flesh chickens and Kuroilers chickens did not show a significant difference (p>0.05), with respective averages of 50.59 ± 2.65 g and 50.38 ± 2.69 g.

# DISCUSSION

Ambient temperatures measured during the study period ranged from 30.76°C to 37.59°C in the Red Flesh group and from 30.40°C to 37.82°C in the Kuroilers group, with respective mean temperatures of 33.13 ± 2.13°C and 32.92 ± 2.34°C. No significant difference (p>0.05) was observed between the ambient temperature of the Red Flesh group and that of the Kuroilers group. This indicates that thermal conditions were almost uniform in the compartments. However, the temperature observations differed from those recorded (28.8°C and 34.7°C) by Sourokou (2014). This observed temperature difference could be explained by the season in which the work was carried out. Indeed, our work was carried out during the months of March and May, whereas that of Sourokou (2014) took place between December and February, a period of cooler weather. Regarding humidity, it varied from 56.86% to 71.57% in the red-fleshed birds and ranged from 56.86% to 70.86% in the Kuroiler chicken house, with respective averages of 65.87 ± 5.00% and 66.07 ± 4.90%. According to Alloui (2008), when humidity is high (above 70%), the dust particles released from the litter are fewer and therefore less pathogenic. Conversely, when it is below 55%, the litter can become very dusty and release numerous small, irritating particles. These high variations in humidity could be explained by insufficient ventilation in the different compartments. ITA (1973) recommends limits for relative humidity levels in summer (hot season) in broiler chicken housing of between 40 and 60%. The average weight of the Red flesh males ranged from 3.54 ± 0.50 kg to 3.92 ± 0.44 kg, while that of the Kuroiler males ranged from 2 ± 0.01 kg to 2.88 ± 0.51 kg.

These results show that the weight variation of the breeding males was low during the study. Indeed, to maintain this low variation, feed was provided only once a day. The objective of maintaining low weight variation in the males was to facilitate mating for the females. This same observation was made by De Reviers (1990), who conducted his studies on feed rationing in broiler-type roosters. He states that the tendency of broiler-type roosters to gain too much weight must be corrected by feed rationing so that they can reach their breeding potential. The laying rate of the Kuroiler strain (39.03 ± 4.96%) was higher than that of the Flesh Red strain (36.34 ± 4.96%). Our results are lower than those of Cherifi (2008), who obtained a laying rate of 57.62% in his studies on the zootechnical performance of several ISA BROWN breeding farms in Algiers. The low laying rates observed in our breeders could be explained by incomplete adaptation to rearing and environmental conditions. Furthermore, these low rates (57.62%) could be due to poor initiation of egg production in the breeders, as Cherifi (2008) suggests.

The broken egg rate of the Kuroiler strain (3.16 ± 3.13%) is lower than that of the Flesh Red strain, which is 5.18 ± 3.50%. No significant difference (p>0.05) was observed between the broken egg rate of Red flesh hens and that of Kuroilers hens. Indeed, the high broken egg rate of the Red flesh strain could be explained by shell fragility and the liveliness of the breeding stock. Our results differ from those of Samandoulougou et al. (2016).

According to their studies on the physicochemical and nutritional quality of eggs from local and improved breed hens in Burkina Faso, they state that the high number of broken eggs is due to the aging of the hens, which leads to a change in metabolism resulting in a reduced supply of mineral precursors to calcium carbonate. The average gross hatching egg production per hen (2.54 ± 0.28 eggs) of Broiler hens is lower than that of Kuroiler hens (2.68 ± 0.35 eggs). The same observation applies to net hatching eggs. The average net hatching egg production per hen (2.42 ± 0.27 eggs) of Red flesh hens is lower than that of Kuroiler hens (2.68 ± 0.35 eggs). This could be explained by an incomplete or difficult adaptation of the Red flesh strain to rearing conditions. However, the observations regarding the average gross and net hatching egg production of Red flesh and Kuroiler hens are lower than those recorded (138.63 ± 12.10 and 133.69 ± 12.44) by Cherifi (2008). This observed difference could be explained by the number of breeding birds and the duration of the study. Indeed, our work was conducted on 70 breeding birds over a period of one month and one week, whereas Cherifi's (2008) study was carried out on 46,274 breeding birds over three years. The eggs of the Kuroilers hens showed a larger size compared to the eggs of the Red flesh, with respective averages of 53.86 ± 1.86 mm and 53.27 ± 1.32 mm. No significant difference (p > 0.05) was observed for variables such as weight and size between the two strains. Our results differ from those of Guedou et al. (2018). According to their study.

The average egg weight of yellow AK variety hens (60 g) was significantly higher (p = 0.0002) than the average egg weights of Massawé EVDT and TZPB varieties (55.1, 54.6, and 53.2 g, respectively). This could be explained by the fact that hormone levels may affect egg formation, thus influencing the observed measurements. Bouvarel et al. (2010) confirmsthat egg weight depends primarily on factors related to the hen (genetic origin and especially age), but also on her diet during the laying period. Regarding the comparison between strains, a highly significant difference (p<0.0001) was observed between the average weights of small eggs from Red flesh hens (42.86±2.06g) and Kuroilers (41.97±2.40g).

A highly significant difference (p<0.0001) was also observed between the average egg sizes and diameters of Redfleshhens (52.49±2.49mm and 40.79±1.81mm) and Kuroilers (53.57±2.88mm and 40.17±2.69mm). A highly significant difference was observed between the average diameters of large eggs from Red flesh hens (42.47±1.83mm) and Kuroilers (42.00±2.04mm). Our results differ from those of Mantsanga et al. (2016). According to their studies, the average egg size ranged from 53 to 63g. This could be explained by a genetic difference between the strains. Their studies, which aimed to improve shell quality and egg size, showed that average egg size increased by 5.68%.

The results showed no significant difference (p>0.05) between the fertility rates of Red flesh and Kuroiler breeders. The fertility rate of Kuroiler breeders (90.54±5.31%) was higher than that of Red flesh(88.63±4.81%). Our results are slightly higher than those of Sanfo et al. (2012), who obtained a fertility rate of 82.7% in their study on laying performance. They suggest that a lower sex ratio could explain this rate. Indeed, our high fertility rates could be explained by not respecting the sex ratio. Introducing many roosters into the group allowed us to have enough fertilized eggs.

Regarding the quantitative characteristics of the Redflesh andKuroiler eggs, the Redflesh eggs exhibited higher weights and diameters compared to the Kuroiler eggs, with respective averages of 51.55 ± 0.52 g; 40.93 ± 1.39 mm and 50.96 ± 1.85 g; 40.31 ± 1.41 mm. These results are similar to those of Guedou et al. (2018). According to their findings, the average monthly egg weights, across all corn varieties, ranged from 53 g to 60 g. This could be explained by an insufficient amount of protein and amino acids ingested daily by the hens.

# CONCLUSION

This study, which aimed to compare the zootechnical performance of Red flesh and Kuroiler breeders, showed that the Redfleshstrain had a lower laying rate (36.34 ± 4.96%) than the Kuroilers (39.03 ± 4.96%). The broken egg rate of the Kuroiler strain (28.46 ± 3.13%) was lower than that of the Red flesh strain (48.58 ± 3.50%). The net number of eggs per hen at hatching was higher in the Kuroiler strain (2.68 ± 0.35 eggs) than in the Red flesh strain (2.54 ± 0.28 eggs). Regarding the quantitative characteristics of the Redflesh and Kuroiler eggs.Also, the fertility rate of Kuroiler breeders (90.54 ± 5.31%) was higher than that of Redflesh breeders (88.63 ± 4.81%). However, the eggs of the Redflesh hens had higher weights (51.55 ± 0.52 g) and diameters (40.93 ± 1.39 mm) compared to the eggs of the Kuroilers (50.96 ± 1.85 g; 40.31 ± 1.41 mm). For a more in-depth study, it would be desirable to extend the research to other areas over a longer period and with a larger flock to obtain more precise results.

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