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STUDY OF FACTORS LINKED TO THE VARIATION IN RENTABILITY IN THE FARMING OF BROILER CHICKENS IN NORTHEAST ALGERIA

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ABSTRACT

Obtaining good zootechnical performance in broiler chicken farming requires continuous and regular zootechnical and sanitary monitoring throughout the breeding period to increase its rentability. Our work carried out at the level of private broiler chicken farming in Eastern Algeria with the objective of comparing zootechnical performance during the breeding period with that obtained under the optimal conditions of strain ISA 15. Whose controlled and compared parameters show: a very high mortality rate- a very low weight evolution- a higher consumption index.

1. INTRODUCTION

1. Poultry have acquired their economic importance as suppliers of eggs and meat, whose principle of broiler farming is essentially the production of a large quantity of meat in the shortest possible time with low feed consumption [1, 2].
2. This is achieved through a data recording system in which parameters such as feed quantity, mortality rate and body weight play a very important role [3].
3. In recent decades, the increase in the zootechnical performance of broilers and their productivity has been considerable. Thanks to concomitant advances in breeding methods, nutrition, genetics and veterinary medicine. This progress is reflected in a significant reduction in the age at slaughter, the main determinant of the sensory quality of the meat [4].
4. In all livestock production and particularly in poultry, productivity, livestock profitability and product quality are determined by the health and well-being of birds during the farming cycle [5].

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5. Farming management depends on several parameters (environmental conditions), which act directly or indirectly, alone or in combination, on the state of health and zootechnical performance of birds.

- *Study Objectives*

Our present study will focus on the following points:

- Assess the actual level of zootechnical performance recorded in the farming of broilers in the El Tarf region against the standard values provided by breeders.
- Identify the factors which determine the level of technical performance.

2. MATERIALS AND METHODS

A. Presentation of the Study Region

The region of El Taref is bordering Tunisia (120 km of border), it extends over an area of 300,000 ha, bordered to the north by the Mediterranean Sea, to the east by Tunisia, to the west by the Wilaya of Annaba and to the south by the Wilaya of Souk-Ahras and Guelma, it includes 07 daïras and 24 municipalities (according to the Agricultural Services Department, 2009). The study is being conducted in the municipality of El Besbes.

Figure-1. Geographical location of the Wilaya of El Tarf

Source: the Agricultural Services Department (Wilaya d'El Taref), 2009

2.1. Farming Duration

The breeding period is 08 weeks, divided into three periods:

- The start-up period: from 1 to 10 days.
- The growth period: from 11 to 40 days.
- The finishing period: from 41 days to slaughter.

3. MATERIELS

3.1. Livestock Buildings

The animals are raised in closed or obscure rearing buildings located among a group of 4 buildings that make up the broiler rearing centre. They are designed away from the wind and oriented parallel to the North-South axis.

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The total surface area of each building is 1380m2 (115m x 12m) (Figure 2).

Figure-2. Livestock buildings.

Source: figure taken from the study site

The ground of the buildings is cemented or concreted. The walls are made of double-walled aluminium foil whose interior is filled with glass wool which is used to insulate the buildings. As for the roof, it is of the double slope type, made of corrugated zinc and having a projecting part on each side used to clear rainwater. The buildings have 4 doors, one at the entrance to the building, a large one downstream in the width direction, a small one that communicates between the SAS and the living area and another one next to it in the length direction of the henhouse. They are equipped with lateral ventilation trapdoor-type openings that extend along the length of the buildings (108m on one side and 68m on the other side where the pad coolling is located), 26 extractors, including 10 lateral extractors distributed evenly on both sides along the length of the building and 16 others installed on the ceiling and two humidifiers (pad-coolling) distributed on both sides.

The livestock buildings are equipped with a diesel boiler with thermostat for the room heating system (Figure 3), a water system for automatic watering (siphoid drinking troughs) connected to two tanks with an individual capacity of 50 litres, installed in the SAS. Each of the two tanks supplies 2 rows of water troughs located inside the building and each consisting of 50 siphoid water troughs (a total of 4 rows for 200 water troughs/building).

Figure-3. Gasoil heater with thermostat.

Source: figure taken from the study site

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The livestock buildings are equipped with an electrical power supply system for lighting, i.e. a number of 108 homogeneous 75-watt lamps distributed over 4 electrical supply lines over the entire living area. Its light intensity is automatically adjustable (1 to 5 watts/m2) from a control cabinet installed on the SAS.

Finally, for hygienic reasons, all buildings are equipped with foot bath installed at their entrances. In addition, it should be noted that there is an autoluve and a manoluve at the main entrance to the breeding centre.

3.1.1. Farming Equipment

The equipment used per building during the period of our work is made up of:

- a diesel oil boiler for room heating.
- 180 1st age circular type feeders (plates).
- 180 plastic siphoid-type 1st age drinking troughs, with a capacity of 3 litres.
- 2nd age feeder of the 4 linear distribution chains type, each 108m long, arranged in parallel in the longitudinal direction of the building and connected to a 10kg capacity hopper or scale. The latter is fed directly from the feed storage silo by means of a worm screw. Each of the supply chains has 144 plates with an individual capacity of 5kg and dosing units, for a total equivalent number per building of 576 plates.
- 200 2nd stage siphoid-type drinking troughs with a capacity of 1.5 litres, distributed over 4 rows of 50 water troughs each.
- 1 mercury thermometer placed in the environment (at the height of the chickens' backs).
- an electrical mechanism that automatically stops the distribution of the food.

The distribution of livestock equipment as a whole is well done (Figure 4).

Figure-4. Farming equipment in the building

Source: figure taken from the study site

3.1.2. Animals

A total of 36,000 chickens (18,000 subjects for each building) were involved in our monitoring. These animals are of Hubbard-ISA15 strain, received and placed on the same day they are born (D1).

They are delivered by the hatchery of the Annaba saltworks and come from breeding stock originating from France but bred in Algeria.

3.1.3. Lighting and Temperature Program

- **Lighting program:** As demonstrated in Table 1, only one lighting program was applied to the two buildings (No. 1 and 2).

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Table-1. Enlightenment and luminous program

Age (day)	Lighting duration	Length and time of darkness	
		Day	Night
1-8	24	-	-
9-10	22	12h-13h	00h-01h
11-15	20	11h-13h	23h-01h
16-21	18	11h-14h	23h-02h
22-26	16	11h-15h	23h-03h
27-35	18	11h-14h	23h-02h
36-40	20	11h-13h	23h-01h
41-45	22	12h-13h	00h-01h
46- slaughter	24	-	-

Source: Table was constitute from program applied in the study sites

Table-2. The light intensity of the different breeding periods.

Breeding period	Intensity (watt/m²)
Start-up	5 watt/m²
Growth	2 watt/m²
Finition	1watt/m²

Source: Table was constitute from program applied in the study sites

-The Temperature

Also a thermometer located at the height of the chickens' backs records the temperatures listed in Table 3, and applied in both buildings.

Table-3. Ambient parameter (temperature).

Age (Day)	Ambient heating
	Temperature in the living area
1-3	31-33°c
4-7	31-32°c
8-14	29-31°c
15-21	27-29°c
22-24	24-26°c
25-28	22-24°c
29-34	19-22°c
35- slaughter	17-19°c

Source: Table was constitute from program applied in the study sites

3.1.4. The Nutrition

Food is Manufactured at the Unit Level

The feed used consists of: Corn, Soybean meal, Soybean meal, from flour mills, and dietary supplements such as: Limestone, phosphates, Salt, Amino Acid, Trace elements, Poly vitamins, Antioxidants, Anticoccidants, Growth Factor (Antibiotics).

Table-4. La composition des aliments.

Composition of starter feed: % by weight	Composition of growth feeds: % by weight	Composition of finishing feeds: % by weight
Corn 61% Soybean meal 29.7% From flour mills 5%. Limestone 0.6%. Phosphate 1.67% D.L. methionine 0.03% Mineral Vitamin Complex -anti-stress 1% Mineral Vitamin Complex -DC 1%.	Corn 62% Soybean meal 26% From flour mills 8.5%. Limestone 0.90%. Phosphate 1.60% Mineral-Vitamin Complex - D.C 1%.	Corn67% Soybean meal 18%. From flour mills 12%. 1% limestone 1% Phosphate 1% finish Mineral-Vitamin Complex

Source: Table was constitute from program applied in the study sites

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3.1.5. The Prophylaxis Program

Prophylactic measures taken are based on cleaning premises, using preventive products and following a rigorous vaccination schedule.

As a preventive measure, the use of vitamins and antibiotics in drinking water is recommended.
A vaccination schedule was established by the administration and followed by the centre's veterinarian.

Table-5. Le programme de vaccination du poulet de chair utilisé

Age (Days)	Pathological affection	Vaccine	Administration mode
1sr Day	New Castle	Poulvac HB1	nebulization
	infectious bronchitis	H 120	nebulization
7th Day	Gumboro	Gumbol	Drinking water
14th Day	Gumboro	IBDL	Drinking water
18 th Day	New Castle	SOTA	Drinking water
23 th Day	infectious bronchitis	H 120	Drinking water
34 th Day	New Castle	SOTA	Drinking water

Source: Table was constitute from program applied in the study sites

A- Experimental Protocol

The experimental scheme adopted is simple and organized as follows:
Two batches of flesh day-old chick animals are kept separately in two different rearing buildings.
Each building contains 18,000 subjects, and the same programs usually used by the meat production unit of the former ORAVIA have been applied to these batches.

The two farms were monitored weekly: almost all the parameters characterising the farm and its management were recorded thanks to direct observations.

For this study, we will select the main parameters that have a direct impact on the profitability of a broiler farm:

- The mortality rate.
- Food consumption.
- Average live weight and GMQ (average daily gain).
- The feed conversion rate (consumption index).

A- Mortality Rate

The mortality rate is an important factor in profitability since it influences both the consumption index and the cost price. It reflects the decline in the workforce over time and its resistance to aggression. The mortality rate expressed as a Percentage (%) is calculated from the following formula:

MR (%) = Number of dead animals / Number of animals set up X 100.

The calculation of the number of employees present was followed by daily records of the deaths recorded.

B- Density (Subject /M2)

The population density has been calculated, it also has a direct influence on the space available to poultry.

C- The Average Body Weight

Weighing is carried out at the end of each week on a scale, on a sample of 30 subjects, and is given by the following formula:

Average body weight = Net weight of a sample / Total sample size.

D- Weight Gain

It is the difference between the final weight (w_1) and the initial weight (w_0) at a given period of the breeding phase. Calculated by the following formula:

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Weight gain (g) = w_1 - w_0

w_1: final body weight of the chicken. **w_0:** initial body weight of the chicken.

E- Food Consumption

The amount of food consumed will be calculated by the following formula:

Amount of food consumed (g / subject / day) = Consumption total food/residual staff.

The quantities consumed after the reduction of the rejected feed quantities at the end of each day were calculated in comparison to those initially distributed, knowing that the quantities distributed are calculated in advance.

Feed refusals were calculated from a weighing of a sample of 20 hoppers taken at random from different locations throughout the building.

F- The Consomption Index

This index is the ratio used to evaluate feed efficiency; it corresponds to the quantity of feed made available to the animal on the quantity of the product obtained... The feed consumption index is calculated from the following formula:

IC = Amount of food consumed in a week (Kg) / Weight gain per subject in the same week (Kg).

4. RESULTS AND DISCUSSION

4.1. The Mortality Rate

The mortality rates recorded at the level of broiler farms 1 and 2 are illustrated by the following

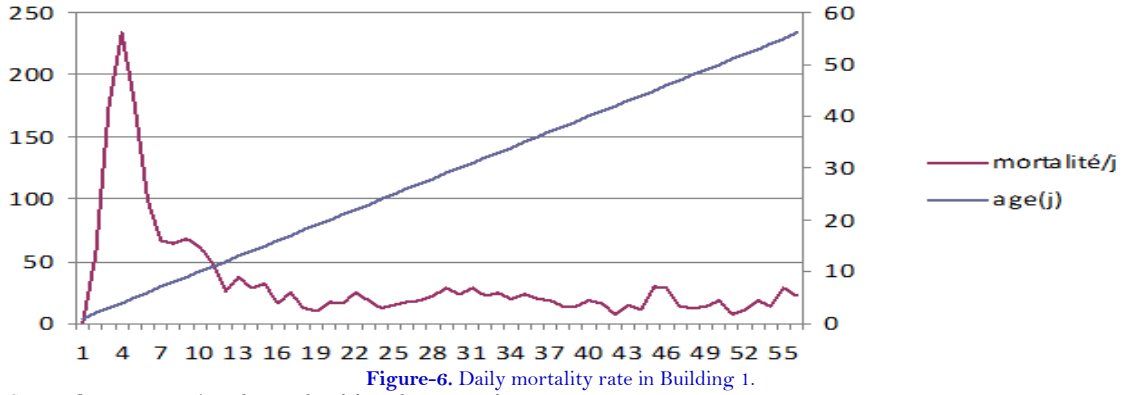

Figure-6. Daily mortality rate in Building 1.

Source: figure was constitute from analyzed data of current study

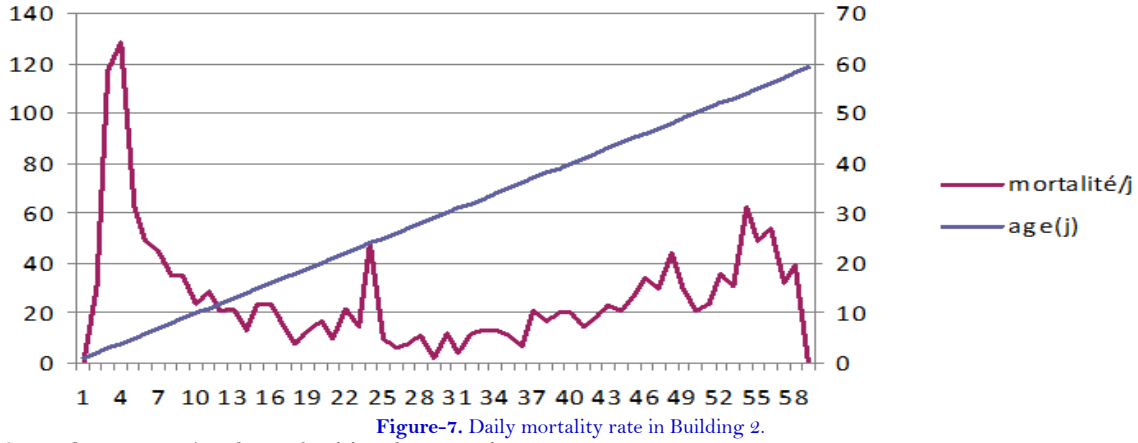

Figure-7. Daily mortality rate in Building 2.

Source: figure was constitute from analyzed data of current study

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During the first week, chick mortality in both farms was high: 741 subjects (4.11%) in the building (1) and 388 (2.15%) subjects in the building (2).

The mortality rate considered acceptable for batches of broilers is 0.5% per week. Over the entire cycle, the mortality rate is set at 4% for an 8-week breeding cycle, and 4.5% for a 9-week cycle (and this rate should not exceed 1% over the entire first week) [6].

This mortality can be explained by:

- Stress of transporting from hatchery to breeding complex (poor condition of transport trucks) [7].

- The handling of chicks during unloading and placement is also an additional source of very high stress, especially on the weakest subjects [8].

- Poor healing of the umbilicus, complicated by omphalitis despite the treatment introduced [9].
- Under normal conditions, the morality peak for the ISA strain is observed during the first week of life when the mechanism of thermoregulation of chicks is not yet developed [4].
- During the 2nd week, mortality was remarkably low after the chicks had adapted to the rearing conditions.
- On the other hand, from the 3rd week onwards, there will be a sudden increase in mortality in Building 2, which will decrease but with a considerable rate of increase from the 7th week onwards, similar to that of the 3rd week. ; The same results are observed but to a lesser degree in Building 1 following:

- The appearance of caecal Coccidiosis, Mycoplasmosis and Colibacillosis.
- In addition to boiler breakdowns during this period, which results in the accumulation of subjects, especially at night.
- The appearance of abdominal ascites, which was favoured by the high density of the batches.
- Recommended mortality rates should not exceed 5-6% over the entire band cycle [10]; While the mortality rate in Building 1 is 10.77% and 8.91% in Building 2.

- Despite the measures taken in terms of: staff organisation, control of environmental conditions and livestock management, these results can be explained by:

- The poor bacteriological quality of the chicks received (chicks carrying mycoplasma) and which sometimes become stunted or poorly formed.

- Pathologies (mycoplasmosis, colibacillosis, coccidiosis) [11].

Figure-8. Mortality of chicks during transport.
Source: figure taken from the study site

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4.2. Livestock Variables

The zootechnical balance of the 2 farms is presented in the following table:

Table-9. Presentation of equipment ratios at the level of the 02 farms

	Farming (1)	Farming (2)	Mean	Norm	Standard deviation
Slaughter age (day)	56	58	57	49	- 8
Chicken/Feeder space (cm)	0.94	1.06	1.00	7.5	- 6.5
Chicken/Flush space (cm)	1.1	0.9	1	1.22	- 0.2
Density (Subject / M2)	13.39	13.39	13.39	10	-3.39
Litter (cm)	10	10	10	10	0

Source: table was constitute from analyzed data of current study

The analysis of the reduced data in Table 09 shows that the average slaughter age of broilers in the range of 56 to 58 days. These averages, however, remain higher than the breeding time of "standard" broilers.

The animals' access to the feeders is 0.94cm and 1.06cm respectively in farm 1 and 2. Access to water troughs is 1.1cm and 0.9cm in farm 1 and 2 is very limited compared to the standards of 7.5cm/chicken for feeders and 1.2cm/chicken for water troughs.

The density in breeding 1 and 2 is very high (13.39 subjects/m2) compared to the breeding standards (10 subjects/m2). This is a favourable factor for the development of coccidian [12].

Figure-9. Very high density in building 1.
Source: figure taken from the study site

Figure-10. The access of animals to water troughs is very limited at building level 2.
Source: figure taken from the study site

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4.3. Evolution of Live Weight as a Function of Age

Table-10. Evolution of the weight of chickens in the farm (1) in relation to the standards of the strain.

Age (Week)	Average body weight (g)	
	Breeding (1)	Strain standards
01	120	170
02	240	447
03	515	871
04	840	1375
05	1200	1918
06	1555	2480
07	1900	3020
08	2250	3504

Source: table was constitute from analyzed data of current study

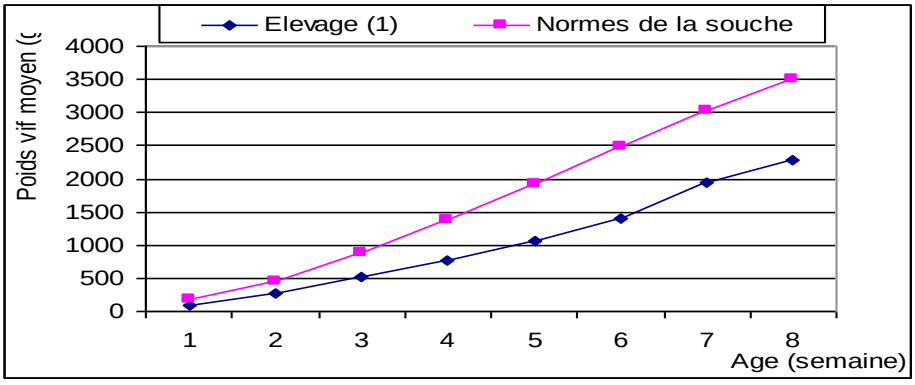

Figure-11. Evolution of the weight of chickens in the farm (1) compared to the standards of the strain
Source: figure was constitute from analyzed data of current study

Table-11. Evolution du poids des poulets dans l'élevage (2) par apport aux normes de la souche.

Age (Week)	Average body weight (g)	
	Breeding (2)	Strain standards
01	95	170
02	241	447
03	488	871
04	820	1375
05	1170	1918
06	1500	2480
07	1880	3020
08	2120	3504

Source: table was constitute from analyzed data of current study

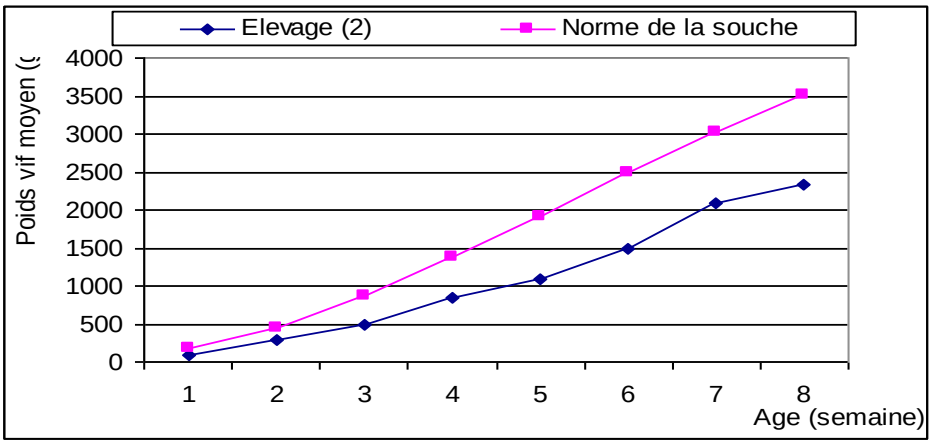

Figure-12. Evolution of the weight of chickens in the farm (2) in relation to the standards of the strain.
Source: figure was constitute from analyzed data of current study

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At the beginning the average weight of the chicks is 37g / chick in the breeding 1 and 40g / chick, a little low compared to the standard of the strain which is 42g. It can be seen that the evolution of weight in the two farms between the 1st and 8th week was very low compared to the standards of the ISA 15 strain. Chickens in both farms (1) and (2) have: very slow growth, characterised by significant heterogeneity during the rearing cycle, with an average live weight on delivery (56 days) of 2250g for the farm (1) and 2120g for the farm (2). According to the technical standards of the farm concerned, at 49 days the live weight reaches 3020g. The technical performance goals are not achieved. This is due to the low quality of the chicks, the weight of the chicks received, the heterogeneity of the batch received and throughout the cycle, and health problems (colibacillosis, mycoplasmosis, coccidiosis) [13].

4.4. Food Consumption and Consumption Index

Feed consumption during the rearing cycle within the farm has been subject to a more detailed analysis. Reading the table, it highlights a trend towards under-consumption, during the growth phase of chickens; offset, however, by over-consumption of food in finishing, correlated with the lengthening of the breeding cycle and the waste induced by the inconsistency in the conduct of feeding programmes.

Table-12. Feed consumption and chicken consumption index

Age (week)	Food consumption			Consumption Index (I.C)		
	Breeding (1) (g/ subject /D)	Breeding (2) (g/subject/D)	Standard of the strain	Breeding (1)	Breeding (2)	Standard of the strain
01	16	16	22.57	1.4	1.37	1.21
02	32	33	57.00	1.86	1.82	1.44
03	63	66	93.43	2.62	2.62	1.54
04	74	73	119.57	2.41	2.13	1.66
05	108	105	153.71	2.90	2.70	1.98
06	155	150	177.85	3.62	3.84	2.21
07	214	205	197.28	4.73	4.46	2.56
08	235	225	210.85	4.80	4.45	3.05

Source: table was constitute from analyzed data of current study

At the level of, the I.C. are higher, because they fluctuate in a value going to 4.45 and show, in addition, a significant variability (The normal average consumption index must be 1.95 on the 56th day according to the standards of the strain [14]). These relatively high averages are to be compared with:

- Extension of the breeding cycle beyond the required economic threshold (49 days) [15].
- The significant waste of food.
- The excessive mortality rate during the finishing phase, which strongly affects consumption (overestimation of the remaining workforce) [16].

In fact, it should be noted that, given the difficulties in estimating actual food consumption, consumption index are overestimated since they incorporate waste losses and errors in estimating the actual weight of feed bags used by farmers [17].

5. CONCLUSION ET PERSPECTIVES

The livestock buildings in the study area are characterized by:

- Poor environmental conditions, particularly the neglect of hygiene rules.
- Stress of animals, especially during transport.
- Food distribution is irregular.

The solutions that can be considered to reduce these welfare problems are as follows:

- Encourage farms with average stocking densities.

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- Control ambient conditions such as ambient temperature, ventilation, humidity, toxic gases, litter quality.

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