Effects of drinking water acidifier's use on broilers *Gallus gallus domesticus (F. : Phasianidae)*

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ABSTRACT

The current study is a trial of incorporation of the pathocidal (acidifying) liquid in the drinking water of broilers in poultry farm in Antsirabe, Madagascar. The pathocidal liquid, has been incorporated into the drinking water of 100 broilers and the other batch of 100 chickens drink only water without the pathocidal liquid. Drinking water containing acidifier can promote better zootechnical performance in chickens. The aim of this study is to find out the benefit of using the acidifier in the drinking water of broilers. In this work, we determined the zootechnical parameters. Microbiological analysis of water samples with and without acidifier was done. Chicks who drink water with pathocidal liquid showed an average daily gain of 58g / day, significantly above that of chicks who drink water without pathocidal liquid which is 37g / day. The Consumption Index of chickens which take pathocidal liquid to the finish is 2.02 which is below the Consumption Index of chickens which take water without the acidifier which is 2.28. The zootechnical results show the prolificacy of the incorporation of the pathocidal liquid in the drinking water of broilers with the performances relatively close to the standard. These results made it possible to conclude a technical feasibility and a profitability of the exploitation with the pathocidal liquid.

Key words: *acidifier, broiler, pathocidal liquid, zootechnical parameters.*

I. INTRODUCTION

Poultry farming has become one of the sectors that have developed rapidly since the past decade. Over the past decade, it has increased by 23% in developed countries and 76% in developing countries (ALDERS R, 2005)

In the Malagasy context, the intensive type poultry sector showed its development around the 1990s. In fact, most intensive farming is carried out in the peripheral areas. Products sold on the market fail to meet consumer expectations both qualitatively and quantitatively (ANONYMOUS, 2004).

Unfortunately, the rise of this poultry farming is faced with obstacles due to the lack of systematic control by breeders. These problems are due to feed in general, more specifically the relationship between the quality of the water supplied to poultry and its production performance.

In addition, the consumption of good quality water is essential to optimize poultry production. The quality of drinking water for livestock is a matter of the utmost importance, as it can directly and indirectly affect the health and productivity of animals (UMAR S et al., 2014). This is why it was suggested to breeders an acidifying liquid to improve the purity of the water and increase the production.

II. MATERIALS AND METHODS

Materials

This study was performed on two hundred (200) chicks of the Arbor Acres strain. It is an excellent option due to their rapid growth rate and low feed cost. This is why the farm chose to breed this strain. The chicks are raised in a room of 20m x 10m so an area of 200m². It is composed of a window of 0.8m x 0.44m and a door of 1.62m x 0.75m, the walls are made from bricks covered with concrete.
The acidifier used is a liquid. It is a synergistic blend of organic and mineral acids: Formic acid - sodium formate acid salt (12%) - propionic acid - lactic acid - ortho-phosphoric acid - antibiofilm agent.
The laboratory equipment used is subdivided into glassware, small and large equipment. Selective and elective culture media allowed microbial cultures to be performed.

Methods

These 200 heads are weighed one by one to have the weight of these animals per day, in order to find their zootechnical performance evolutions. This operation is carried out every 7 days.
The crawl space is made two weeks before the reception of the chicks. During the crawl space, when the previous animals are gone, the manures are removed, wiped down and washed. The house where the animals lived, was left to dry completely for two days, then disinfected for the next fifteen days. Finally, two days before the reception of the chicken, the building is disinfected again. The disinfectants used are Fenosteryl, used fifteen (15) days before the chicken is taken 10ml per liter of water, and Macroclore 1000, used two (2) days before the chicken is taken, dosed at 10ml per liter of water.
Drinking water distributed to broilers must be clean and uncontaminated 24 hours a day. However, depending on the source of supply, the water may contain various minerals in excessive amounts or be contaminated with bacteria. So it is necessary to clean the drinking water of animals so that there are not various problems of animal health and products.
The two well water samples (sample I and sample II "treated water") were taken using the 5 L plastic drums. The cans are then stored in a cooler at a temperature of 8°C during their transport to the laboratory. On arrival at the laboratories, the water samples were subjected to microbiological and physicochemical analyzes.
For bacteriological analysis, any contamination of the water by ambient air and other contaminated objects is avoided. The cans are not completely filled to allow any aerobic microbes that would be in the water to survive until the time of analysis.
The analysis began on the day of the sample.
As for the physicochemical analysis, this involves determining the pH of two water samples in order to measure the acidifying power of the pathocidal liquid. Table 1 gives the different analyzes carried out on the two samples.
As zootechnical parameters studied, the average live weight is the ratio of the sum of the weights of individuals from the same lot by their number.
Individual food consumption makes it possible to assess the amounts of food consumed per animal over a specified period of time. It is calculated from the quantity of food distributed and that refused. The feed is dispensed at 3.30 in the evening and this lasts for 24 hours and the refused quantity of feed weighed before each new distribution.
The weekly measurements of the weights listed, made it possible to calculate the average daily gain by making the ratio of the weight gain during a period over the corresponding duration.

The Consumption Index (CI) is the ratio between the average amount of food consumed over a given period and the average weight gain corresponding to that period.

Table 1. Analysis carried out on drinking water samples from chickens

MICROBIOLOGICAL ANALYSES		
MICROORGANISMS	**CULTURE MEDIUM**	**STANDARD**
Revivable germs in 22 °C	Plate Count Agar (PCA)	ISO 4833
Revivable germs in 37 °C	Plate Count Agar (PCA)	ISO 4833
Escherichia coli	Eosine Methylen Blue (EMB)	NF V 08 053
Pseudomonas aeruginosa		ISO 13720:2010
Streptococcus D	SLANETZ et BARTLEY Agar	SLANETZ et BARTLEY
FSC spores	TSC Medium	ISO 6461-1
Salmonella sp.	Hektoen Enteric Agar (HEA) and Rappaport Vassiliadis Soja	NF V 08 052
PHYSICO-CHEMICAL ANALYSIS		
pH	**Potentiometric method**	

Source: Laboratories of IOI University Madagascar, 2020

The mortality rate is the ratio of the total number of dead chickens to the initial number of chicks, expressed as a percentage. In general, broiler farming is profitable if the mortality rate is ≤ 6%.

III. RESULTS AND INTERPRETATIONS

Results show that untreated well water has pH = 8 which means the water is slightly basic. From a hygienic point of view, given the exceeding of certain benchmarks, this untreated water with acidifier is not drinkable for chickens. Its microbiological quality is therefore not compliant.

The pathocidal liquid decreases the pH of the water to equal 3, this means that the treated water is very acidic. From a microbiological point of view, no germ exceeds the reference criteria. This suggests that microbiological quality of the acidified water meets the drinkability standard.

The results of the weight growth measurement are recorded and shown in Tables 2 and 3.

On the first day, the average live weight of the animals is 46g. In one week of age (precisely on the 7th day of age), the difference in mean weight on the chickens are opposite so for chickens that drink water with the pathocidal liquid is 152.875 g and 143.058 g in mean weight for chickens that drink clean water.

Table 2: Evolution of the growth of a hen which drinks water with pathocidal liquid

Age (day)	**Growth Evolution (g)**		
	Minimum	**Maximum**	**Average/hen**
0	40	50.5	46.61
7	128,58	180.79	152.875
14	350	495	424
21	525	760	632.3
28	844	1238	1053.2

35	1175	1705	1458.5
42	1505	2265	1892.5
45	2000	2600	2250

Source: Authors, 2020

Table 3: Evolution of the growth of the chicken which drinks water without pathocidal liquid

Age (day)	Growth Evolution (g)		
	Minimum	**Maximum**	**Average/hen**
0	40	50	46.57
7	115.89	159.47	143.058
14	230	430	362.5
21	525	700	624
28	803	1260	1015.5
35	1085	1840	1426
42	1570	2100	1814
45	1780	2400	2089.5

Source: Authors, 2020

The variation in weight is therefore between the 1st day of age and the 45 days of age. It was found that the growth of chickens that drink clean water is slower than that of chickens that drink water with the pathocidal liquid.

Tables 4 and 5 summarize the variation of the ADG obtained every seven (7) days of age on the farm.

Table 4: Evolution of the ADG of the chicken which drinks water with pathocidal liquid

Breeding phase	Age (week)	Live weights (g)	ADG (g/hen)
STARTING	0	46.61	
	7	152.875	15
	14	424	39
	21	632.3	30
FINISHING	28	1053.2	60
	35	1458.5	58
	42	1892.5	62
	45	2250	119

Source: Authors, 2020

According to this table, the minimum ADG is 15g and the maximum is 119g which gives an average ADG of 58g / day. The ADG decreases on the 21st and 35th days; this decrease is due to sudden climate change. However, on the 45th day, the chicken will gain its weight.

Table 5 : Evolution of the ADG of the chicken which drinks water without pathocidal liquid

Breeding phase	Age (week)	Live weights (g)	ADG (g/hen)
STARTING	0	46.57	
	7	143.058	14
	14	362.5	31
	21	624	37
FINISHING	28	1015.5	56
	35	1426	59
	42	1814	55
	45	2089.5	92

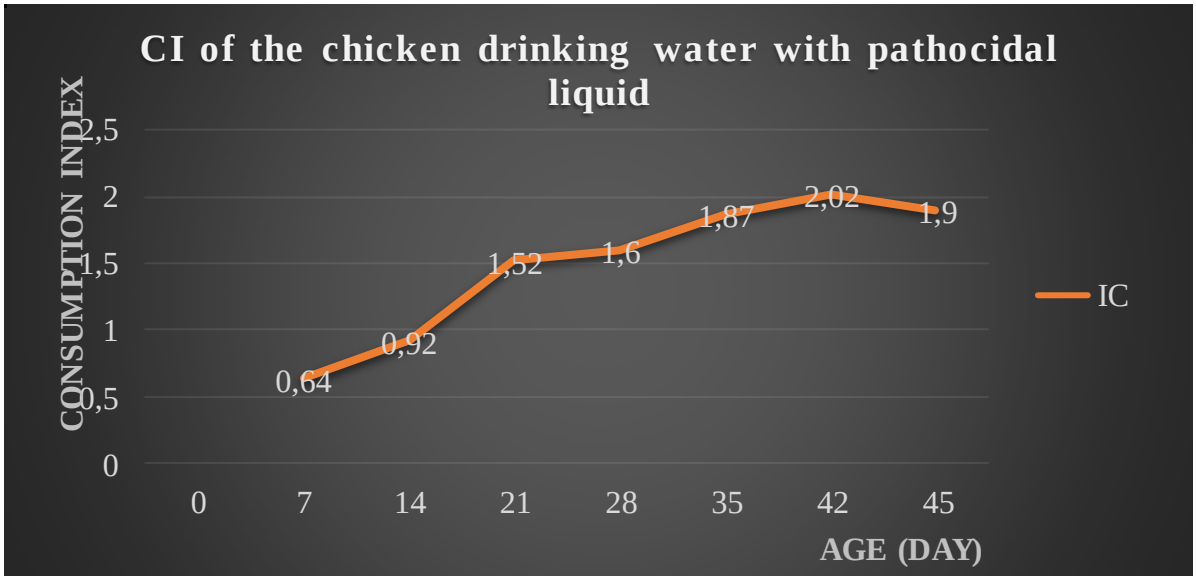
Source: Authors, 2020

From this table, the minimum ADG is 14g, the maximum is 92g. And which gives an average ADG of 37g / day. The ADG decreases on the 42nd day which is due to the problem not clearly specified. In any case, the chicken gains its weight faster on the 45th day which is 92g. The ADG obtained expresses that in the 45th day of age of the chicken, the weight gain of the chicken which drinks water with pathocidal liquid is 119g which is greater than 92g which is the weight gain of the chicken which drinks the pathocidal liquid.
The refusal feed is between 6 and 70g during the start-up phase until the finishing phase. From the start until slaughter, the intake of the chicken is constantly increasing. The total amount of feed consumed per chicken is 4294 g.

According to this table, the refused feed is between 8 and 100g during the start-up phase until finishing. Chicken ingestion increases slowly compared to chicken which drinks water with pathocidal liquid. The total amount of feed consumed per chicken is 4617g. The difference between the chicken that drinks water with pathocidal liquid and the chicken that drinks water without pathocide is diligence in eating.

The consumption index (CI) is a criteria used in zootechnics to measure the efficiency of the conversion of a food into a given production (generally the increase in weight) by an animal. The average consumption index per chicken, depending on age, is shown in Figure 1.

Figure 1. Variation in feed efficiency of chicken drinking water with pathocidal liquid



Source: Authors, 2020

From this figure, the minimum CI is 0.64 and the maximum is 2.02. Normally the CI should be in increasing mode during the cycle, but on day 45 there is a decrease. The chick stage had the best CI 0.64kg and 0.92kg of feed can give 1kg of live weight.
The maximum CI is 2.28 and the minimum representing the best CI is also 0.66. In addition, the CI decreases to 2.2 in the 45th day of breeding. This is because the CI of the chicken drinking water without pathocidal liquid which is 2.28 is higher than the CI of the chicken drinking water with pathocidal liquid which is 2.02. Generally, the more the live weight and age of a chicken increases, the more the food processing capacity decreases.
As for the mortality rate (MR), it is the percentage of dead chicken during the production cycle. Remembering the initial band size is 20 heads but during the rearing cycle there were no dead chickens. This gives us a zero mortality rate (MR = 0%).

IV. DISCUSSION

With regard to laboratory analyzes, this work is limited to the assessment of the overall quality of the treated water. It is therefore a question of studying its potability for chickens. The microbiological analyzes revealed the importance of adding the acidifier to the water. However, since the pathocidal liquid is a chemical acidifier, we should have studied the effect of the use of this disinfectant on the health of the chicken. This fluid may be hepatotoxic. This should therefore be the subject of another, more in-depth study. Moreover, the volume of the manuscript imposed by the school and given that it is a mini-thesis, we are forced to limit the scope of our study.

According to the results of analyzes of untreated well water, the presence of germs is confirmed especially *Escherichia coli* (present in the respiratory and digestive tract). This enterobacteria causes avian colibacillosis disease (Hassane Malal Ba, 2012). For its part, *Salmonella* sp, which is practically present in the digestive tract, is responsible for avian salmonellosis. It is for all these reasons that Sample I does not meet the bacteriological criteria for potability. On the other hand, sample II, which is acidified water, does not present any bacteriological risk for chickens. This could be explained by the addition of the pathocidal liquid which is either bactericidal or bacteriostatic. Another reason would be the acidifying power of the pathocidal liquid. Indeed, its addition strongly acidifies the water. However, most bacteria do not survive in an acidic environment. It is therefore important to study the antibacterial activity of this fluid using the antibiogram technique.

In the study of zootechnical parameters, in the case of the sample size, the results affirm that the mortality rate is 0% neither for chickens which drink water with pathocidal liquid, nor for chickens who drinks water without pathocidal liquid. According to the result obtained in the farm, the broilers which drink water without pathocidal liquid weighed 2.09 kg at slaughter (45 days) and the other chickens which drink water with liquid. pathocide weighed 2.25 kg at slaughter so the comparison shows that the difference in live weight between these two is 0.16 kg live weight. These results are close to the performance objective (Aviagen Brand, 2012) especially the weight of chickens which drink water with pathocidal liquid. This weight shift is due to diligence in eating and clean water that impact broiler performance and weight growth.

Regarding the ADG, it is a parameter that varies according to the age and the quality of the food and drinking water (Ayssiwede et al., 2012). The ADG of broilers drinking water with pathocidal liquid is 58g / d, and other chickens have an ADG of 37g / d. These results mean that the shift between the ADGs of these two samples is 27g. For the all-rounder of Gnabro Ouakoubo G. (2017) of Arbor Acres strain which is 35g / d is lower than that of chickens which drink water with pathocidal liquid, nor of others; but the ADG of the chicken which drinks the pathocidal liquid is close to that of the Hubbard Classic (2005) which is 59 g / day; higher than the standard chicken which is 50g / day. The ADG of chickens which drink water without pathocidal liquid is close to that of standard chickens.

For CI, the two criteria that say that a breeding is good profitability are the weight of the slaughter and the consumption index. Technically, the best consumption index should not exceed 2, which implies that two kilos of food produces one kilogram of live weight. After processing the data and calculating certain criteria, the CI of broilers drinking water with pathocidal liquid was 0.64 as the minimum which is the best CI during the rearing cycle and 2.02 the maximum; and for the other chickens which no longer drink water with pathocidal liquid is 0.66 the minimum which is also a better CI but the maximum is raised to 2.28. These results indicate that broilers which drink water with pathocidal liquid have a better CI than chickens which drink water without pathocidal liquid, so this represents that the pathocidal liquid is one of the reasons, which decreases the CI of broilers.

During the study period (8 weeks), broilers that drink water without pathocidal fluid grew slowly compared to broilers that drink water with pathocidal fluid. The use of the acidifier in the drinking water of chickens that drink it has had a positive effect on their growth.

V. CONCLUSION

This study allowed us to analyze the well water used in this farm in the laboratory to know the quality of the water, to analyze the zootechnical parameters to confirm the effect of use of the acidifier on the

water of drink of broilers. The results suggest that the addition of the acidifier to the drinking water of chickens improves the hygienic quality of the drinking water, this was confirmed by the satisfactory results of the microbiological analyses carried out on the drinking water treated with pathocidal liquid. In addition, zootechnical results revealed a difference between the use of water treated with acidifier and that of untreated water. The use of the pathocidal liquid gives the best results. However, it remains to be seen whether these differences are significant or not. In addition, a toxicological study and another on the antibacterial activity of this acidifying product will have to be the subject of another scientific experiment.

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