J.Soil Sci. and Agric. Eng., Mansoura Univ., Vol. 6 (8): 903 - 910 , 2015

PREDICTION EQUATION FOR WATER CONSUMPTION OF BROILER CHICKENS

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ABSTRACT

The present study was conducted in the Al-Beida, AL-Gabal AL-Akhdar region, Libya and carried out during the period from April 2013 to March 2015, on open broiler houses. The objective of this study was to predict the water consumption for broiler house. Water consumption must be precisely predicted in order to extreme supply the water as a vital and important factor for the living. A large proportion to the bird weight consists of bird's water consumption and also as a measure of bird health and welfare. In this study feed type and broilers (Spanish) are constant during this study. The average daily water consumption of ten flocks of broiler chickens was measured (average = 8,000 birds/flock), and the weekly feed consumption and broiler live body weight was measured. The results showed that the water consumption for one broiler (in grams) was the twice in comparison with feed consumption. The results show that also the mean water consumption for one bird during its flock duration (49 days) was (8.48 L.). On the other hand, it can be seen linear relationship between daily broiler water consumption (W.C) (ml) and its age (A) (days), and this relationship submitted to the following equation:

$$W.C\ (ml) = 7.16\ A\ (days) \qquad (R^2 = 0.98)$$

Keywords: broiler; open house; water consumption; prediction equation.

INTRODUCTION

Broiler producers need water for birds to drink, to decrease air temperature, and to clean and sanitize the house. Furthermore, the drinking water is used to deliver vaccines, vitamins, electrolytes, and antibiotics to birds. Therefore, the capability to predict the water consumption for bird grown is important.

Water is of vital importance to a living being because a large proportion to the weight of an animal consists of water. Water also plays a very important role within the respiratory systems, especially by cooling it under "hot" conditions. It goes without saving the water intake to a large degree determines the functioning of the bird and consequently, technical results. Water represents a major part of the nutrient intake of animal. The vital role of water is indicated by the body can lose practically all of its fat and over one-half of its protein while the loss of one-tenth of its water results in over serious physical ailments (Fairchild *et al.,* 2005). Water, in addition to being a vital nutrient, is embroiled in many aspects of poultry metabolism, including body temperature control, digestion and absorption of food, transport of nutrients, and the elimination of water products, via urine, from the body (Jafari *et al.,* 2006). The quantity of water consumed by birds is influenced by a number of differing and even cumulative factors (Manning *et al.,* 2007). It is accepted practice to monitor the birds' water consumption by the house in liters/1000 birds per day (Defra, 2002 and ACP, 2006). A number of factor affects the amount of water a bird will drink. These include internal environmental factors such as temperature and relative humidity; dietary factors such as the slat content; antibiotics; genotype and pelleting Marks and Pesti, 1984). An increase or decrease from expected water consumption levels can be an indication of a health problem (Butcher *et al.,* 1999). Indeed, inadequate control of moisture in to the house environment can lead to health and welfare issues, including contact dermatitis, ascites and respiratory disease if the concentration of ammonia into the air exceeds definite levels (Manning et al., 2007). Factors which impact on internal air humidity include: external air humidity, type and management of drinker system, water consumption, bird density in house, bird age and live body weight, internal ventilation rates, temperature profile and disease status of the birds (Scahaw, 2000). Increasing dietary salt to birds increases water consumption (Marks, 1987), whilst increasing the level of crude protein in to the diet increases water intake and water: feed ratios (Marks and Pesti, 1984). Water consumption of bird was approximately 69.08 liters/hen/year for Leghorns and 75.13 liters for Rhode Island Reds. Further it has been argued that water consumption increases by 6% for every 1ºC rise in temperature from 20ºC where it approximates to 1.8-2.0 time feed quantity, and that feed intake are reduced by 1.23% for every 1ºC rise in temperature and by 5% for every 1ºC rise between 32-38 ºC (Singleton, 2004). The most common way to predict birds water consumption are as a function of the weight of feed consumed. The "rule of thumb" is that twice the weight of feed will be consumed daily as water (National Research Council, 1994). The dependableness of this factor is, however, not well established and estimates of water: feed consumption ratio has ranged from 1.54 for young Rhode Island Red chicks to 2.4 for White Leghorn females 1 to 16 weeks of age (Georgia, 2001, and Lott *et al.,* 2003). To a greater extent recent estimates were 1.6 to 2.6 for broiler stocks random bred since the late 1950s and 1.8 to 2.34 for modern commercial broilers (Marks, 1987). The ratio of water to feed was approximately 2:1 when internal air temperature was 18.3 ^{o}C and 4.7:1 at 35 ^{o}C (Jordan and Pattison, 1996), thus management procedures, which effectively manage air and litter moisture content are essential to bird health and welfare. The dry matter content of bird faces is around 20%, and the moisture content is involuntary by water consumption (Broadbent and Pattison, 2003). Georgia (2001) stated the water: feed ratio varied between 1.5:1 in winter season and 1.77:1 in summer season.

The aim of this study was to predict the water consumption for open broiler house, in order to observe whether, the results obtained correlated with those according in other studies, and water consumption can be impersonal used as a measure of bird health and welfare.

MATERIALS AND METHODS

Water consumption data were collected daily from the open broiler house raised under commercial conditions from April 2013 to March 2015.

Average flock size was 8000 birds, and the average cycle duration was 49 days.

The area of a open broiler house was (62 x 11 m), and height of 3.40 m and East-West oriented. The house had concrete floors (10 cm) and used butane gas as a heating source. Lighting system was 15 lambs (200 Watt incandescent) as shown in fig. (1).

Feed was supplied by 100 manual-feeders (35 cm diameter) for a brooding period and 80 pan feeder (40 cm diameter) for fatting period. The composition percentages of broiler feed complete diet is shown in Table (1).

Fig. (1): The conventional broiler house.

Table 1: The composition percentages of the experimental broiler diets.

S/N	Feed Ingredients	Starter 0 to 21 day (%)	Finisher 22 to 49 day (%)
1	Corn yellow	52.79	60.52
2	Soybean meal	37.20	30.14
3	Fats	5.08	4.49
4	Di-calcium phosphate	1.97	2.01
5	Limestone	0.84	0.85
6	Methionine	0.20	0.07
7	Salt	0.42	0.42
8	Mineral mixture Premix	0.25	0.25
9	Vitamin Premix	0.25	0.25

Drinking water was supplied through 100 manual-drinkers (five liters) of the house for the brooding period. Manual-drinkers were then replaced by 45 automatic-drinkers (35 cm diameter). Italian water meter (19.5 mm x 19.1 mm) was used for recording water consumption. Water consumption was recorded daily by reading the level of water remaining in the barrel. The barrel was manually refilled as required. Internal temperature was maintained at approximately 35°C for the first week, and during the next four week was reduced by 3°C/week. Continuous lighting was provided throughout the experiment. Birds were weighed at weekly intervals to monitor growth rates. Drinking water in founts was measured daily and replaced with freshly prepared water. Average feed consumption was calculated daily. Broiler live body weight was calculated weekly.

Statistical methods:

Descriptive statistics of data,correlation coefficient and regression analyses were computed by using the SPSS statistic's software(Version 17.0).

RESULTS AND DISCUSSION

The results were examined to predict water consumption of the open broiler house. The best guideline to predict water consumption in broiler appears, to be derived from the slopes of the regression lines representational process the relationship between broiler age and water consumption as illustrated in fig. (2). The water consumption of chicks at any age can be predicted very precisely by multiplying the bird age in days by the appropriate coefficient (7.16). This coefficient can be used under commercial conditions for producing broiler chicken.

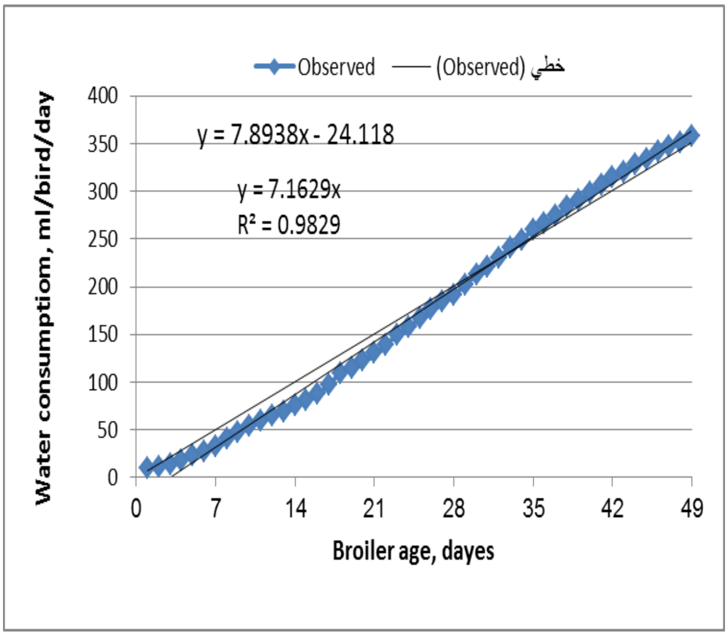

Fig. (2): The relationship between water consumption and broiler age.

Data illustrated in table (2) show a comparison between the average water consumption and predicted water consumption according to regression lines describing the relationship between broiler age per day and water consumption. Table (2) also illustrates the difference, % between cumulative observed and predicted water consumption, ml/bird/day. There was a difference at the early weeks varied from 56.18 to 15.52 % in the first and third weeks respectively, while there was a little and a minus difference at the late weeks, due to spillage in chick drinking water at the early weeks.

Table 2: The difference between cumulative observed and predicted water consumption, ml/bird/day.

Age, day	Water consumption, ml/bird/day		* Difference, %
	Observed	Predicted	
7	135.10	200.54	56.18
14	411.80	551.47	33.16
21	745.10	902.41	15.52
28	1165.20	1253.35	4.72
35	1617.00	1604.29	-3.66
42	2035.30	1955.23	-4.60
49	2378.57	2306.16	-1.89

*** (Predicted - Observed) / observed X 100**

Data illustrated in fig. (3) show the relationship between the observed and predicted mean water consumption; and broiler age. Furthermore, data illustrated in fig. (4) show the relationship between the observed against predicted water consumption of the broiler and was drawn after adding ± 25 %, to include the prediction equation. There was a matching between water consumption data, which indicates the validity of prediction.

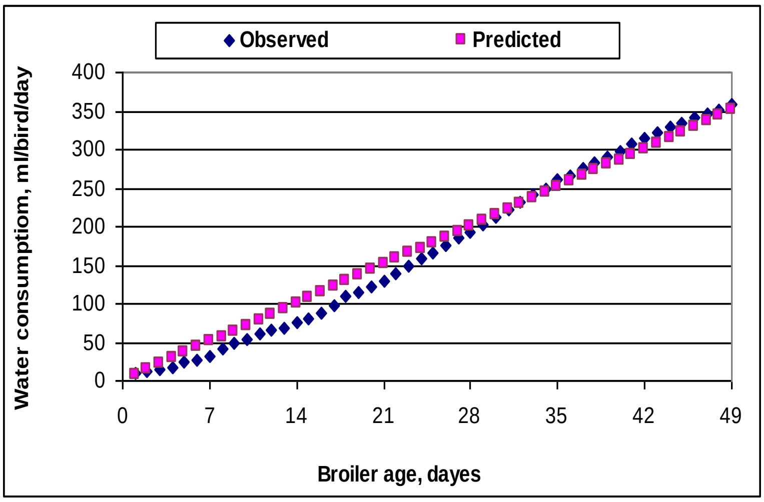

Fig.(3): The relationship between observed and predicted water consumption and broiler age.

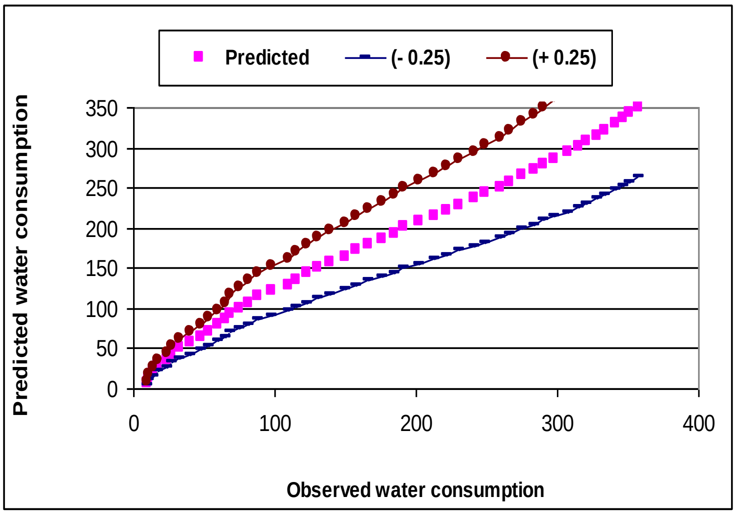

Fig. (4): Observed against predicted of the broiler water consumption (ml/bird/day).

Data illustrated in table (2 and 3) show that the broiler chickens will consume water twice the consumption of feed (2 gram water:1 gram feed).

Table (3): Average feed consumption and body weight of broiler chickens.

Age (day)	Feed consumption (gm)	Body weight (gm)
7	70	105
14	210	265
21	387	470
28	580	880
35	807	1185
42	1013	1550
49	1152	1746

Table (4): Comparison between observed and predicted water consumption of broiler.

Descriptive	Observed	Predicted
Average (ml/day)	173.23	179.05
Minimum (ml/day)	9.80	7.16
Maximum (ml/day)	357.7	350.94
Std. Error (mean)	16.16	14.62
Std. Deviation (ml/day)	113.12	102.34
Coef. of Variance (%)	16.160	57.15

Table (4) illustrates the arithmetic mean, the minimum, maximum value and standard deviations for the observed and predicted water consumption. The standard deviation was 113.12, and the standard error was

16.160, so the range of observed water consumption correct asset value was between 173.23 ± 16.160.

The correlation coefficient between the two variables was 0.997. This means a strong relationship between the amount of water consumed and the age of the broiler chicken, so water can be used to monitor bird performance. The regression analysis was R^2 = 0.98 as illustrated in table (5).

Table (5):Regression analysis between broiler age and observed water consumption.

Items	Values
Correlation (R)	0.997
R^2	0.9829
Constant Coeff.	- 24.118
day Coeff.	7.8938

From the previous data, the mean water consumed in this study was 8.48 litter/bird/flock complied with (Manning *et al.,* 2007) who recorded that, the standard water consumption between 4.5 to 11 litter/bird/flock, while there was a quantity of drinking water was spilled by small chicks.

CONCLUSIONS AND RECOMMENDATIONS

Findings in the study established that the water consumption was a linear function of broiler age (R^2 =0.98). It could be predicted by multiplying 7.16 times the broiler's age. It is suggested that 8.48 L/bird/flock of age is a best method of predicting the water consumption of broiler chickens. The average water: feed consumption ratio was 2:1 g/g. There was a quantity of drinking water was spilled by small chicks, water needed for house cleaning and disinfection and, thus, should be investigated in the future.

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معادلة للتنبؤ باستهلاك مياه الشرب لدجاج التسمين

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*** قسم ميكنة الانتاج الحيوانى والداجنى والسمكى بمعهد بحوث الهندسة الزراعية- الدقى – جيزة.**

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أجريت هذه الدراسة فى مزرعة دجاج لحم نظام مفتوح، بمدينة البيضاء، محافظة الجبل الأخضر، ليبيا، وذلك فى الفترة من ابريل 2013 حتى مارس 2015 م، بهدف التنبؤ باستهلاك مياه الشرب لدجاج اللحم بالمساكن المفتوحة والتى تعتمد فى تهويتها على النوافذ ، نظرا لأن الماء من العوامل الهامة والضرورية لحياة الكائن الحى، كما تدل كمية الماء المستهلكة أيضا على أداء وراحة الطيور. قد تم تثبيت نوع الغذاء للدجاج المختبر (سلالة أسبانية) والماء يضاف حسب احتياج الطيور إليها خلال فترة الدراسة. حيث تم قياس متوسط استهلاك المياه يوميا للدجاج خلال عشر دورات تربية (متوسط 8000 طائر /دورة) ، كذلك كمية الغذاء المستهلكة ووزن الدجاج الحى اسبوعيا، ومنه حسبت متوسط كمية كل من الماء والغذاء فى نهاية الدورة وذلك لحساب نسبة الماء: الغذاء. أظهرت النتائج أن متوسط كمية مياه الشرب المستهلكة لطائر واحد (جم) تعادل مرتين بالمقارنة باستهلاك الغذاء. أظهرت النتائج أيضاً أن متوسط استهلاك المياه لطائر واحد اثناء دورة تربية (49 يوم) كانت (8.48 لتر). وقد بينت النتائج وجود علاقة خطية بين استهلاك مياه الشرب (مل) (W.C) وعمر الدجاج (يوم) (A) توضحها المعادلة التالية:

$$\mathbf{W.C\ (ml) = 7.16\ A\ (day) \qquad (R^2 = 0.98)}$$