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An Economic Analysis of Broiler Chicken Production for Different Production Rotations in the Northern Region of Iraq*

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Abstract

Poultry meat is one of the most dynamic agricultural subsectors in Iraq. The main objective of this study is to shed light on the most important economic and productivity factors affecting the poultry production in the Northern Region of Iraq, so as to raise the return on investment for the poultry industry and increase production to meet the needs of the Iraqi market. The data collected from 180 broiler farms by face- to- face survey. To analyze data, descriptive statistics and multiple regression were used. The results were focused on four rotations for one year. According to results, feed costs accounted for the highest cost (58.3%) among all farm groups and the Benefit-Cost Ratio was 1.28. The coefficients of independent variables indicated that total entering chicks, mortality rate and consuming feed have strong significant effects on production in each rotation from 1 to 4. The mortality rate has negative and significant effects in all rotations. The total number of workers has significant effects in rotations 1 to 3 but not significant in rotation four. Based on the model in total production from one year, all variables have significant effects on broiler production. The government should motivate and encourage the farmers to increase their capacities and to enter the production process to meet a large part of the production of poultry meat in Erbil.

Keywords: *Broiler chicken farm, Production, Cost, Erbil-Iraq*

Irak'ın Kuzey Bölgesinde Farklı Üretim Rotasyonlarında Etlik Piliç Üretiminin Ekonomik Analizi

Öz

Kanatlı eti Irak'ta insan beslenmesinde hayvansal proteinin ana kaynağı haline gelmiş ve son bir kaç yıl içinde kanatlı üretimi özellikle Erbil'de en dinamik alt sektörlerinden biri olmuştur. Bu çalışmanın amacı Erbil ilindeki kümes hayvanları üretimini etkileyen faktörleri belirleyerek ildeki kümes hayvancılığı yatırımını ve üretimini artırmak amacıyla öneriler geliştirmektir. Çalışmada 180 broiler işletmesiyle yapılan anketlerden elde edilen veriler kullanılmıştır. Verilerin analizinde tanımlayıcı istatistikler ve çok değişkenli regresyon modeli kullanılmıştır. Analizlerde bir yılda dört üretim dönemi esas alınmıştır. Analiz sonuçlarına göre, işletmelerde en yüksek maliyeti (%58.3) yem maliyetleri oluşturmuş ve Fayda-Maliyet Oranı ise ortalama 1.28 olarak tespit edilmiştir. Dört rotasyonunun tamamında broiler üretimi ile toplam civciv sayısı, ölüm oranı ve besin tüketimi arasında istatistiki açıdan anlamlı bir farklılık olduğu, ölüm oranının tüm dönemlerle olumsuz etki gösterdiği, toplam işçi değişkeninin ise 1., 2. ve 3. rotasyonda anlamlı bir farklılık gösterdiği belirlenmiştir. Karar vericilerin Erbil'deki kanatlı eti üretiminin büyük bir bölümünü karşılamak için çiftçileri kapasitelerini artırmaya ve üretim sürecine girmeye teşvik etmesi gerekmektedir.

Anahtar kelimeler: *Broiler tavuk çiftliği, Üretim, maliyet, Erbil/Irak*

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INTRODUCTION

Agriculture is the most significant sector for developing countries as it provides basic necessities for the increasing population, employment opportunities for rural people, and contributes to national income and exports. Agriculture also provides labor and raw materials for the industrial sector; and creates demand for the inputs produced by different industries, such as chemicals and farm machinery (Boz et al., 2005; Cinemre and Kılıç, 2015).

Agriculture production is an important pillar in developing the economy of the countries, for that it is crucial to encourage this sector and productivity in animal production (Gollin et al., 2011). Animal resources are essential and important part of the agricultural sector and it is not less than the plant side, and poultry constitutes an important part of animal production. Poultry meat had both industrial and commercial importance (Kanno et al., 2011). Broiler productions emanate from the word "Broiler" and it is about keeping birds for rearing (Koc et al., 2007).

Broiler chicken attracts consumers because of its characteristics such as fast growth rate, early feathering higher qualifications of feed conversion, and eligible flesh color (Bessei, 2006). The importance of broiler chicken meat production stands out that poultry meat is the best alternative to red meat, there is always a high demand for it, characterized meat chicken breeding projects limiting capital cycle and speed time to recover. Today, broiler breeding projects have become widespread in many developed and developing countries. A large number of chickens can be grown in a small area and very high profits can be obtained in this very small area that cannot be used as agricultural land. The poultry industry is becoming increasingly important as most poultry farms in Iraq are small and spread across most provinces of the country, providing jobs for tens of thousands of unemployed people in Iraq (Natali, 2010).

Poultry meat is an important source of high-quality protein, minerals, and vitamins to balance the human diet (Sarica and Cam, 1998; İkikat Tümer et al., 2016.). In the case of meat consumption in Iraq, per capita consumption of red and white meat are on an increasing trend. However, the countries of the Middle East, including Iraq, suffer from a shortfall in meat production, particularly with regard to red meat and to a lesser extent in the case of white meat (Aw-Hassan et al., 2010).

The agricultural sector is the main pillar in the national economic structure of Iraq's Northern Region. The sector provides work opportunities for young people as well as the contribution to agricultural exports to increase the outcome of the state and the trade deficit reduction in the region. Poultry production, which has been used for a long time with traditional methods in Erbil, has become a commercial sector especially since 2010. The Northern Region of Iraq, like many other countries, is faced with the problem of insufficient production to meet the domestic demand for chicken meat in Erbil (Andeky, 2010).

There are no doubts that the governorate of Erbil has the required human and material resources if properly invested to not only achieve food self-sufficiency but also to be able to export. For that, we can say there is be a big potential investment source in the field

of animal production including the production of chicken meat. Thus, investments to be made in the poultry sector with high efficiency and capital turnover can increase (Looney, 2008). It is known that the poultry production sector in Erbil has two sectors. One of them is the rural sector (traditional) which produces chicken locally way and the commercial sector which is actively fattening poultry (Andeky, 2010).

In recent years poultry production has evolved in the Erbil province and become dependent on science and technology for greater economic return in less time at the lowest possible cost. But despite these developments, inadequate poultry production cannot meet the needs of the population in Erbil. Province currently imports large quantities of chicken meat because of the lack of national production capacity to meet the growing demand for these items. In spite of the provision of the basic components to increase and improve production, government supports are still not sufficient to protect national production. The state initially concerned the poultry industry through the provision of production inputs at subsidized prices. The removal of subsidies was gradually lifting subsidies completely on poultry farm production requirements, and this is what led to the rise in input prices, which affected the performance of these farms and the impact on production capacity and operational efficiency.

There are some studies on the structure and economic analysis of broiler farms in Iraq (Andeky, 2010; Akbay and Azeez, 2016; Kshash and Oda, 2019; Al-Wassity et al., 2020). For example, USAID (2021) focused on the study of poultry production in Baghdad Governorate and summarized that on average, poultry farms in Baghdad are not covering their variable expenses of production. Akbay and Azeez (2016) make a study to determine the effects of factors on the mortality rate in broiler farms in Iraq. Kshash and Oda (2019) pointed out that production, financial, and marketing constraints had a high effect on broiler production such as high cost of feed, drug and vaccines, high mortality rate and high cost of energy. Al-Wassity et. al. (2020) analyzed the economic structure of broiler farms in Al-Qadisiyah Governorate during the 2019 season and found that feed costs accounted for 78.4% of the total variable costs and the benefit-cost ratio for broiler farm was 1.8. We contribute to the literature in two aspects. First, to the best of our knowledge, this is the first paper that investigates the productivity factors affecting poultry production in Iraq. Second, we estimate the cost, profit and factors affecting poultry production for each rotations in one year.

The main purpose of this study is to find out and analyze the factors affecting broiler chicken production in the Northern Region of Iraq, to investigate the effects of these factors on farm income and profit. So, this research is trying to analyze the effects of these factors on poultry production to find out the solution in order to increase production also to investigate the relationship between production performance and socio-demographic characteristics of farms and farmers.

This paper sheds light on the most important economic and productivity factors affecting poultry production in the Erbil province of Iraq.

The remainder of the paper is organized as follows. Section two briefly describes the material and methods. Section 3 briefly describes and discussed the empirical results, including total cost, total income, total profit and multiple regression analysis for broiler production, and section 4 presents concluding remarks and recommendations.

MATERIAL AND METHODS

The city of Erbil is located in the Northern Region of Iraq and it is the second capital of Federal Iraq after Bagdad (Erbil Governorate, 2021). The study area was chosen as the governorate of Erbil for being the top provinces of the region in terms of the number of broiler chicken farms and broiler chickens fields. The study is mainly used data collected from 180 broiler chicken farms in the province of Erbil during the year 2016.

To obtain the necessary data for the study, a questionnaire has been designed specifically, besides that sample was chosen in a random way for getting data through producers. The seasons of rotation during one year are mainly; rotation one in winter, rotation two in the fall time, rotation three in summertime and rotation four in springtime.

In this study, we have two major variables contains dependent and independent variables. The dependent variable represents the production (ton) of chicken meat, independent variables contain age and education level of farmers, year of experience, the capacities of farms, number of workers, entering chicks, mortality rate, feed consumption, type of chick and total cost. Total costs contain the cost of electricity, heating, vaccine, medicine, worker, feed, hatchery chick, and other costs.

Descriptive statistics were employed to analyze and present the farmer/farm characteristics, to rank the responses of the farmers with regard to certain questions. The descriptive statistics used were frequencies, percentages, mean and standard deviation. In addition, exploratory data analysis tool such as tables and figures were employed to make the necessary graphical illustration of the data. Also, one way ANOVA test was employed.

A Multiple Linear Regression model is used to study the relationship between a dependent variable and independent variables. (Wooldridge, 2015). For example, in our study, we put our dependent variable as broiler production and all others as explanatory variables such as age, education and experience of farmers, the capacity of farms, numbers of worker, total entering chicks, mortality, and amount of feed consumption.

The general multiple linear regression model (also called the multiple regression model) can be written as (Wooldridge, 2015):

$$Y = \beta_0 + \sum_i \beta_i x_i + u$$

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \cdots + \beta_k X_k + u$$

where Y is the production of broiler, X_i's are independent variables, β_0 is the intercept, β_i is the parameter associated with X_i, and u is the error term.

Table 1 showed the description and mean of variables that put in the model for total production.

Table 1. Descriptive of independent and dependent variables in model

Variable	Description	Mean
Total Production	Production of meat (ton)	31.66
Total Mortality rate	Mortality (dead bird) number and rate (%)	2089.93 (14.69%)
Total No. worker	No. of worker in the farm	3.32
Total entering chick	Entering chick to the farm	14229.25
Total consuming feed	Consuming feed and using (ton)	63.28

RESULTS AND DISCUSSIONS

The study sought to analyze the broiler chicken production in the province of Erbil in the Northern Region of Iraq and the ways of its development. This section starts with the presentation of the farmer/farm characteristics; followed by the descriptive statistics of all variables. Thereafter, the factor associated with the technological change and the impacts of the improved variety per-farm productivity are presented.

Socio-demographic and economic characteristic of farms/farmers

According to the results, all broiler producers participating in the questionnaire are male, 28.9% were less than 35 years of age, 35% were between 35-45 years, and 36.1% were above 45 years of age. The average age of the farmers was 41.8 (Table 2). This result is similar to the study done by Ngozi and Chinonso (2013) and Dziwornu (2014) (44.2 and 43.4 years old, respectively).

Moreover, 21.7% of farmers are having poultry farming experience less than 5 years, and the average experience of farmers is 11 years. This result is higher than Dziwornu (2014) who found the average experience of broiler farmers was about 7.6 but lower than Kshash and Oda (2019)' research (15.1).

In the research area, 9% of farmers was iterate, 18% completed primary education, 32% secondary education, 15% had agronomist education, and 4% were veterinarian.

The number of workers in the broiler farm plays a significant role for running the farm. The results in Table 2 showed that 62.2% of farms used less than 3 workers, while 12.8% used more than 6 workers. The average number of workers was found to be 3.

Farm size refers to the number of birds that the installed housing capacity of the farm could hold at a given time. The average capacity of farms was 14487.2 birds and 44.4% of farms were less than 12000 birds, 41.1% were between 12000 and 20000 and 14.4% were more than 20000 birds.

In the broiler production process, broiler farmers are facing many important problems. The major problems of the farmers in broiler chicken production are marketing of chicken (41%), feed price (35%), chicken diseases (17%), veterinary and medication cost (4%), and chick price (3%).

Table 2. Socio-demographic characteristics of farmers

Demographic Features	Frequency	%	Demographic Features	Frequency	%
Age of producers (Mean: 41.77)			Education of producers		
< 35	52	28.9	Illiterate	16	8.9
35-45	63	35.0	Primary	33	18.3
> 45	65	36.1	Secondary	58	32.2
Experience of producers (Mean: 11.09)			Vocational	41	22.8
Less than 5	39	21.7	Agronomist	27	15.0
5-16	102	56.7	Veterinarian	5	2.8
More than 16	39	21.7			
Number of workers (Mean: 3.32)			Total capacity of farms (Mean: 14487.22 birds)		
Less than 3	112	62.2	Less than 12000 birds	80	44.5
3-6	45	25.0	12000-20000 birds	74	41.1
More than 6	23	12.8	More than 20000 birds	26	14.4

Production structure of farms

The broiler production system used by farmers is divided into three categories depending on the number of broiler chicks for each rotation. The result showed that 44.9% of farmers have capacities of more than 13000 birds for each rotation, 32.5% have between 10000 and 13000, and 22.6% have a capacity less than 10000. The average number of birds for each rotation was 14254 (Table 3). The farm capacities are very low compared to other producer countries.

This paper also investigated the usage of pads on the effectiveness of broiler production and poultry place preference and its effects mortality in broiler chicken farm. Table 4 shows the mortality rate for each rotation in broiler farms in Erbil province. According to the results, the share of the farms that have a mortality rate less than 12% is 38.9% in Rotation 1, 30.6% in Rotation 2, 38.3% in Rotation 3, and 51.7% in Rotation 4. Share of the farms who have mortality rate between 12-20% mortality was R1: 36.1%, R2: 48.3%, R3: 46.1%, R4: 35.6% and production was more than 20% mortality that R1: 18.9%, R2: 21.1%, R3: 15.6%, R4: 12.8%. The average percentage of the mortality rate of all rotation was 14.7%. According to the One way Anova test results, the average mortality rate of each rotation is statistically different ($P<0.01$). Table 4 shows that while rotation 2 in fall time has the highest mortality rate, rotation 4 in springtime has the lowest mortality rate. Rotations 1 and 3 have a mortality rate close to the average value of 14.7%. This result is so high compared to Awobajo et al (2007). They found the average percentage of the mortality rate was less than %10.

Total cost, income and gross profit of farms

The total cost of production was calculated to determine the input-output relationship. Total cost is defined as the sum of variable and fixed costs. The variable costs are specific to a farm and vary with its scale, which means the variable cost has a direct relationship with the level of output. The variable cost includes one day chick, feed, vaccination, medication, veterinary, worker, electricity and heating and other costs.

Table 3. Frequency and percentage of entering chick to farm group

Bird/each rotation	Rotation 1		Rotation 2		Rotation 3		Rotation 4	
	Frequency	(%)	Frequency	(%)	Frequency	(%)	Frequency	(%)
< 10000	36	20.0	42	23.3	45	25.0	40	22.2
10000 – 13000	62	34.4	57	31.7	55	30.6	60	33.3
> 13000	82	45.6	81	45.0	80	44.4	80	44.4
Total	180	100.0	180	100.0	180	100.0	180	100.0
Average		14375.3		14227.5		14110.6		14303.6

Table 4. Frequency and percentage of mortality in rotations group

Mortality Rate (%)	Rotation 1		Rotation 2		Rotation 3		Rotation 4	
	Frequency	(%)	Frequency	(%)	Frequency	(%)	Frequency	(%)
< 12%	81	38.9	55	30.6	69	38.3	93	51.7
12% – 20%	65	36.1	87	48.3	83	46.1	64	35.6
> 20%	34	18.9	38	21.1	28	15.6	23	12.8
Total	180	100	180	100	180	100	180	100
Av. mortality rate (%)		15.36 [b]		16.57[a]		15.30[b]		13.36[c]
F-test (P-value): 25.887 (0.000)								

Table 5. Variable cost in 4 rotations (ID)

Variable cost	Rotation 1 (R1)		Rotation 2 (R2)		Rotation 3 (R3)		Rotation 4 (R4)		Total Mean
	Mean	%	Mean	%	Mean	%	Mean	%	
Cost of Hatchery Chick	8254.48	15.4	8070.52	16.2	8176.93	17.0	8239.87	16.6	32741.81
Cost of Feed	29865.34	55.7	28771.83	57.8	29019.61	60.3	29344.07	59.4	117000.86
Cost of Vaccine	995.33	1.8	1047.61	2.1	1011.61	2.1	996.39	2.0	4050.94
Cost of Medicine	2998.33	5.6	2857.78	5.7	2859.72	5.9	2631.94	5.3	11347.78
Cost of Electric and Heating	7027.11	13.1	4796.31	9.6	2623.87	5.4	3496.71	7.0	17944
Cost of worker	2297.96	4.2	2270.84	4.5	2401.73	4.9	2276.18	4.6	9246.71
Other cost	2089.24	3.9	1963.06	3.9	1955.11	4.0	2379.78	4.8	8387.19
Total cost	53527.81	100.0	49777.94	100.0	48048.59	100.0	49364.94	100.0	200719.28

ID: Iraqi Dinar

The study was found the mean and percentage of variable cost in four rotations in each season. We found all total cost for each rotation. Feed is the most important input for manipulating production cost and making farm profitable in poultry production. Thus a thorough analysis is necessary to understand the challenges and opportunities of the poultry industry in Iraq. The feed cost is the largest variable cost, and the total cost of rotation one (R1) in the wintertime is more than other rotation season time because farmers spend and use more heating and gas in winter. The total cost of rotation three (R3) in the summertime is less than in other rotation. Vaccine and medicine cost is higher in rotation 2 and rotation 3 because of the high potential of disease and infection as shown in Table 5.

Table 6 summarizes total cost, total income and gross profit for each rotation. Each rotation has its own cost. The total cost for rotation 1 to 4 averagely was 53527.81, 49777.94, 48048.59 and 49364.94 ID. The income of each rotation 1 to 4 averagely was 59305.40, 59007.02, 77999.20 and 61708.22 ID, respectively. Gross Profit is defined as the difference between total income and total cost. Profits were determined by subtracting the total cost of production from the total income per flock realized by the broiler chicken farm in Erbil. The profit of all cost in rotations 1 to 4 that averagely was 5777.59, 9229.08, 29950.61 and 12343.28 ID. Total cost was not always so much but total revenue was high for the last two rotation. In the summer and spring cycle, the total income and gross profit will increase compared to two other cycles.

The biggest problem is marketing and selling the product. The results indicate that the average total cost was 200719.28, the average income was 258019.84 ID and the total profit averagely was 57300.56 ID. After gross profit and total costs have been obtained, it is possible to measure the Benefit-Cost ratio was 1.28 with the net income of 57301 ID for broiler production. Al-Wassity et al. (2020) reported the benefit-cost ratio of broiler production at the optimum and profit-maximizing level of production as 1.8 in Iraq

Table 6. Total cost, total income and total profit for 4 rotations (ID)

	Mean	Std. Deviation
Total Cost R1	53527.81	20539.21
Total Cost R2	49777.94	20200.28
Total Cost R3	48048.59	19846.63
Total Cost R4	49364.94	20387.75
Total Income R1	59305.40	28635.58
Total Income R2	59007.02	30803.28
Total Income R3	77999.20	37105.75
Total Income R4	61708.22	28603.29
Gross Profit R1	5777.59	14078.56
Gross Profit R2	9229.08	14639.80
Gross Profit R3	29950.61	22298.53
Gross Profit R4	12343.28	13883.25
Average Cost	200719.28	78889.51
Average Income	258019.84	117994.77
Average Gross Profit	57300.56	53843.35
Benefit-cost ratio		1.28

Multiple regression analysis for broiler production

In this section, the factors affecting broiler chicken production in each rotation are analyzed by the regression method. The model for each of four rotations was the best linear unbiased estimation (BLUE) because each of the five assumptions of multiple regression has been satisfied. Moreover, there is no multicollinearity between the variables, because of the value of the variance inflection function for each model which was less than 10. According to the Wald test, there is no heteroscedasticity problem because the p-value of the test was greater than 0.05. The R^2 value of each model is higher than 0.90.

Table 7 presents the regression results for the effect of factors on the production rotation 1. As the number of worker increase one unit the production of rotation 1 will significantly increase by 0.97 and presented a positive sign. While the number of total entering chicks increases one unit the production of rotation 1 will significantly increase by 0.0005 and presented a positive sign. The production in rotation 1 significantly decreases by 0.0017 where the number of mortality increases one unit and presented a negative sign. As the number of consumed feed increase one unit, the production of rotation 1 will significantly increase by 0.37 and presented a positive sign.

The Regression analysis of the effective factors on the production in rotation 2 was summarized in Table 8. Regression results showed that if the number of the worker increases one unit, the production of rotation 2 will significantly increase by 0.59 and presented a positive sign. If the number of total entering chicks increase one unit the production of rotation 2 will significantly increase by 0.0005 and presented a positive sign. In addition, production rotation 2 significantly decreases by 0.0012 where the number of mortality increases one unit and presented a negative sign. As the number of consumed feed increase one unit, the production of rotation 2 will significantly increase by 0.42 and presented a positive sign.

According to Table 9, results of the regression analysis showed that the number of worker increase one unit the production will significantly increase by 0.79. However, the number of total entering chicks increases one unit the production will significantly increase by 0.0007 and presented a positive sign. Moreover, the production significantly decreases by 0.0012 where the number of mortality increases one unit and presented a negative sign. As the number of consumed feed increases one unit the production will significantly increase by 0.33.

Table 7. Regression analysis of the affective factors on the production rotation 1

	Coefficient	std. error	t - value	p - value
Constant	0.2535	0.7115	0.356	0.722
Total number worker	0.9710***	0.2871	3.382	0.000
Total entering chicks (bird) R1	0.0005***	9.1651	6.523	0.000
Mortality (bird) R1	-0.0017***	0.0001	-10.03	0.000
Consuming feed (tons) R1	0.3710***	0.0195	18.98	0.000
R^2 : 0.942; Adjusted R^2 : 0.941; F-test : 721.698; P-value : 0.000				

*Note: ***, **and* indicate significance levels at 1%, 5% and 10% respectively*

Table 8. Regression analysis of the affective factors on the production rotation 2 in fall time

	coefficient	std. error	t - value	p - value
Constant	- 1.8075***	0.6286	-2.875	0.004
Total number worker	0.5889**	0.2411	2.443	0.015
Total entering chicks (bird) R2	0.0005***	7.0788	7.563	0.000
Mortality (bird) R2	- 0.0012***	0.0001	-7.762	0.000
Consuming feed (tons) R2	0.4200***	0.0150	27.96	0.000
R^2 : 0.961; Adjusted R^2 : 0.960; F-test : 1079.152; P-value : 0.000				

*Note: ***, **and* indicate significance levels at 1%, 5% and 10% respectively*

Table 9. Regression analysis of the affective factors on the production rotation 3

	Coefficient	std. error	t - value	p - value
Constant	- 0.1315	0.6473	-0.203	0.839
Total number worker	0.7861***	0.2475	3.176	0.001
Total entering chicks (bird) R3	0.0007***	9.3725	8.075	0.000
Mortality (bird) R3	- 0.0012***	0.0002	-5.293	0.000
Consuming feed (tons) R3	0.3299***	0.0199	16.55	0.000
R^2 : 0.954; Adjusted R^2 : 0.953; F-test : 923.084; P-value : 0.000				

*Note: ***, **and* indicate significance levels at 1%, 5% and 10% respectively*

In Table 10 we can see the regression results of the analysis independent variables with the dependent variable. The results of rotation 4 show that number of worker in farm increases one unit the production of broiler chicken will significantly increase by 0.14. However, the number of total entering chick increase by one unit, the production will significantly increase by 0.0006. The production in rotation 4 significantly decreases by -0.0009 where the mortality rate increases by one unit and presented a negative sign. The number of consumed feed increase by one unit the production of rotation 4 will significantly increase by 0.39 and presented a positive sign.

Table 10. Regression analysis of the affective factors on the production rotation 4

	Coefficient	std. error	t - value	p - value
Constant	0.0688	0.6483	0.106	0.915
Total number worker	0.1440	0.2502	0.575	0.565
Total entering chicks (bird) R4	0.0006***	9.1245	6.689	0.000
Mortality (bird) R4	-0.0009***	0.0002	-4.161	0.000
Consuming feed (tons) R4	0.3869***	0.0189	20.44	0.000
R^2 : 0.951; Adjusted R^2 : 0.950; F-test: 860.986; P-value: 0.000				

*Note: ***, **and* indicate significance levels at 1%, 5% and 10% respectively*

Results of regression model for independent variables with total production of total rotation as a dependent variable are showed in Table 11. As the number of workers increases one unit the total production will significantly increase by 0.61 and presented a positive sign. A similar result has been signed by Farooq et al (2013) and Oladeebo and Ambe-Lamidi (2007). In addition, the number of total entering chicks increases one unit the total production will significantly increase by 0.0006 and presented a positive sign. However, the total production significantly decreases by 0.0013 where the number of total mortality increases one unit and presented a negative sign. Similar results have been estimated by USAID (2021), Majid and Hassan (2014),

and Evans and Sayers (2000). Moreover, if the amount of total consuming feed increase by one unit the total production will significantly increase by 0.3805 and presented a positive sign. Similarly, Ojo (2003), Verspecht (2011) and Bandara and Dassanayake (2006) found similar and also a positive sign. By using the Cobb-Douglas production function, Farooq et al. (2013) indicated that the major problems of the broiler farms were high costs of inputs and chicks, high mortality rate, low price of birds and adulteration in inputs. Majid and Hassan (2014) showed that the size of farm, feed conversion rate, average body weight, average marketing age, mortality rate, and rearing housing system significantly affect broiler revenue. Tiffour and Oppong (2014) demonstrated that the price of labor significantly decreased profit but the price of day-old chick increased profit. Dziwornu (2014) indicated that feed cost, one day-old chick cost and market age of broilers positively and significantly affect the cost of broiler production while production capacity negatively and significantly effects cost. Carvalho et al. (2015) found that the expense of electricity, as well as area of occupied land, production scale, and feed intake per hatching egg fundamentally influence the productivity of the broiler breeder farms in Southwestern Paraná, Brazil.

Table 11. Regression analysis of the affective total factors on the total production for all rotation

	Coefficient	Std. error	t - value	p - value
Constant	- 0.4260	0.3316	-1.285	0.199
Total No. Workers	0.6134***	0.1296	4.731	0.000
Total Entering Chicks (bird)	0.0006***	4.2795	14.50	0.000
Total Mortality (bird)	- 0.0013***	9.6249	-14.23	0.000
Total Consumed Feed (tons)	0.3805***	0.0090	41.85	0.000
R^2 : 0.950; Adjusted R^2 : 0.950; F-test : 3447.281; P-value : 0.000				

*Note: ***, **and* indicate significance levels at 1%, 5% and 10% respectively*

CONCLUSION AND RECOMMENDATIONS

Poultry meat becomes one of the main sources of animal protein in the human diet in Iraq, and in the past few years, poultry production has become one of the most dynamic subsectors in the governorate of Erbil in particular.

The purpose of this study is to shed light on the most important economic and productivity factors affecting the broiler production in Erbil province under the current circumstances.

In this study, we focused on four rotations for one year. According to results, feed cost for each rotation is the largest variable cost and the total cost of rotation one (R1) in the wintertime is more than other rotation because of the high heating cost in winter.

The total cost of rotation three (R3) in the summertime is less than other rotation. The mortality rate found in this survey is approximately 14.69%, which is quite high compared to previous studies.

By applying multiple regressions, the effect of some factors such as the total number of workers, total entering chick, mortality rate, and consuming feed on the broiler production were analyzed. The results showed that total entering chicks, mortality rate and consuming feed have an essential impact in each rotation 1 to 4 giving a positive sign. However, the mortality rate has a negative sign with all rotation this

means that when the number of the mortality increase the production of the chicken significantly getting decrease. The total number of workers has a significant effect in rotation 1 to 3 while an insignificant effect in rotation four. Moreover, according to the multiple regressions results in total production from one year, all factors have an important and significant effect on the production of chicken except the mortality which found to be negative and significant.

After interpreting the study results in the production of broiler chickens in Erbil precisely and the information that hinders the development, this study reached a number of proposals for the future of this vital sector. Moreover, some other points are related to the development of the growing demand for chicken meat. The most important proposals and recommendations can be summarized as below:

- Conducting more studies similar to this study that takes care about the economic sides, in different times, periods and other provinces, in order to obtain a clearer picture of the production of broiler chickens.
- In the production process, most of the farms were not worked with full capacity. Therefore the government should motivate and encourage the farmers to increase their capacities and to enter the production process to meet a large part of the production of poultry meat in Erbil.
- The government should grant special facilities, marketing rings and accessories to the massacres, canning factories and stores in order to maintain the balance of supply and demand in the market to reduce price volatility and protect both the producer and the consumer.
- Working on the expansion in the production of broiler chickens because it is a vital commodity that contributes to reducing or solving the problem of food security. Although, taking actions to achieve self-sufficiency or for export to other provinces or abroad. This requires strong government support in helping to run idle fields or carry out researches and studies related to education and delivery to producers through a guiding device versed and other measures such as the use of modern methods of education that rely on electronic devices.
- Take necessary measures by the government in order to achieve the kind of protection by imposing customs taxes or import to identify the size of price support for the productivity factors to increase their ability to compete with imported meat, which imports at low prices in developed countries at low cost and unhealthy for human consumption. In addition to support the producers guiding them to take the level of production to the optimum level, that will bring them the greatest profit and helps them to continue and expand the production process and helps them to avoid the loss.
- The department or division of the Ministry of Agriculture to prepare reports, studies on production trends and consumption, domestic and world prices their changes and the work of private forecasts information on poultry meat and other animal products. This information must be presented to the producers for guidance to help them make better production decisions and to assist the establishment of a private company to ensure their poultry producing fields, whether it is insurance against production risks or insurance

against economic risk a downturn, prices or in the case of an excess of supply and the lack of markets for discharge.

- The veterinary health community control veterinary drugs used in the production process to ensure the validity and integrity and provide facilities to encourage the production of certain types of drugs and vaccines locally and make sure to tighten agricultural quarantines to prevent the entry of diseases and infectious epidemics that infect birds confluence birds and others, which caused severe damage to the point where producers drove many of them from the production process because they could not absorb the damage.

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