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Comparison of Carcass and Immune Traits of Commercial Broiler Farms in Akre Region and its Districts

ABSTRACT

This study aimed to survey the data collected from several commercial broiler farms in Akre region in order to evaluate the live body weight, carcass traits and their cuts, also to compare commercial projects of poultry in different farms in order to determine the best farm for rearing poultry. Statistical analysis was accomplished using the programme of Statistical Analysis System (SAS), also pairwise correlations among studied traits were determined.

At 42 days of age, broilers' live body weight, and dressing percentage averaged 2276.50 g, and 76.52 percent, respectively, and the differences between the 4 farms used in this study were significant in all the mentioned traits. The differences in breast, thigh, back, neck and wing percentages were significant due to the farm and their averages were 36.75%, 25.21%, 18.78%, 5.82% and 8.19% respectively. The lymphoid organs including spleen % and bursa % were averaged 0.155% and 0.179% respectively, and the differences in all the lymphoid traits according to farm were significant. The higher coefficient of correlation (0.78) obtained between breast % and back % and was very highly significant, while the negative and higher value (-0.83) calculated between live body weight and back % and also was very highly significant. It can be concluded that a significant difference was found in all studied traits which may be due to differences in some factors including rearing system. Some of the correlations between each pair of studied traits were positive and highly significant, so to improve some traits, the breeder can focus on measuring other related traits.

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INTRODUCTION

Abdullah et al. (2010) and Hermiz et al. (2016) stated that poultry now occupies the second place in the world meat production, just after pork, and the success of poultry production has been strongly related to the improvements in growth performance and carcass yield and composition. With the rapid growth of the global population, the demand for food continues to rise. Poultry industry (meat and eggs) contribute significantly to the world food supply (Elahi et al., 2020). By 2050, there will be a 121 percent rise in poultry meat production and a 65 percent increase in egg production (Mottet and Tempio, 2017). Because breast yield is the most valuable portion of the chicken carcass in the market, even small differences in breast yield among strain crosses could have a significant economic impact. Local chicken represents an important resource of meat in the local poultry market of many countries. The body weight is used as one of the selection criteria whereas the carcass traits are valuable market requirements (Peertile et al., 2014).

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In poultry industry, birds are reared in various systems; the semi-intensive system and closed system. In the Middle East, such systems are very popular, especially in Northern Iraq. However, due to a variety of factors, including food safety in the local market, the closed system has become increasingly popular in recent years. According to Barbosa Filho et al. (2005), house conditions should be monitored more closely in order to avoid detrimental effects on poultry performance, particularly production, because they have a significant impact on metabolism and, ultimately, production. Broiler chicken rearing systems are critical for influencing their wellbeing, wellness, and productivity improvement, especially when high temperature is present, which has a substantial and critical impact on the birds' welfare and performance (El-Kholy et al., 2018; Abd El-Hack et al., 2020 and Ghanima et al., 2020). Various prior studies indicated that due to varying raising practices, the features of growth performance were not constant (Santos et al., 2012; Al-Bahouh et al., 2012; Bahreiny et al., 2013 and Wang et al., 2015). Significant variance in productivity features is vital for selection studies; also, in order to produce more chicks with high internal and external qualities, it is necessary to choose roosters based on their body weight to be the parents of the next generation (Hermiz et al., 2016). Modern chicken production methods, such as better breeding management and health control, have resulted in a higher feed conversion ratio and higher production efficiency. Several studies have demonstrated that increasing broiler house environmental control, managerial practices, weather and rearing circumstances, genetics, transportation, and the capacity of the birds to respond to the environment can all help improve broiler production, as well as all other variables that may interact and affect the production cycle, can increase the productivity of the poultry industry (Bertol, 2004; Aradas et al., 2005 and Baracho, et al., 2006). Economic feasibility, qualified labor, intensive use of good practices, and a close link with the consumer market are all linked to broiler production success. It is also claimed that, due to market demand for quality, there is a trend to produce broiler free of chemical, biological, and physical contaminants due to food safety concerns (Lima, 2005). The effects of regular human contact on the physiology and behavior of poultry producing animals have been studied extensively (Hemsworth et al., 1994). The discrepancy in data values between various places could be due to stress reactions in broiler chicks, such as high temperatures, immunological challenges, and handling shipping.

Since, no researches found on evaluating live body weight, carcass traits and their cuts in Akre region, this study conducted to evaluate the mentioned traits of chicks belongs to several commercial broiler farms. Also to compare commercial projects of poultry in different farms in order to determine the best farm for rearing poultry.

MATERIAL AND METHODS

This study aims to collect data from broiler production farms in Akre, Bijeel, Girdasen and Bardarash districts. The districts include 10, 5, 5, and 60 farms on the same order. The farms were managed by the owners directly including all the details till the marketing in order to increase their outcome. One farm in each district was selected randomly and some of their preliminary information were registered during March (spring season) and summarized in table (1), which includes live body weight at 1 day, mortality %, feed intake, feed conversion ratio and production index. Feed conversion ratio calculated as a ratio of feed consumed to body weight gain. All birds that perished were weighed to modify the feed conversion ratio, and mortality was recorded as it happened. The equation: $(\text{live body weight (g)} \times \text{livability}) / (\text{number of raising days} \times \text{feed conversion efficiency} \times 10)$ was used to calculate the production index.

Table (1) Means of some productive traits of broilers in each farm

Farms	No. Chicks	Live body weight at 1 day (g)	mortality rate %	feed intake (g)	feed conversion ratio	Production index
Akre	18000	40	3.889	2716.76	1.319	364.38
Bejeel	12000	40	7.916	4977.48	2.337	203.95
Bardarash	10000	42	7.5	4216.22	1.751	308.17
Girdasen	13500	40	3.22	3859.56	1.671	324.09

Each farm provided a random sample of five 42-day-old Ross 308 broiler chickens, which were transferred to the Akre Technical College laboratory of physiology at Duhok Polytechnic University. Their live body weights, carcass weights as well as other quantitative carcass characteristics were measured. Accordingly, the dressing percentage, breast percent, thigh percent, back percent, neck percent, and wing percent were calculated. As lymphoid organs, several immunological features were also obtained, such as the weight of the bursa of Fabricius and the spleen, and then their percentages as a ration from carcass weight were obtained. Statistical analysis was accomplished using the programme of Statistical Analysis System (SAS, 2005), according to the procedure of One-Way ANOVA table. To diagnosing the significant differences between farms, the proceeding of Duncan's multiple range tests (Duncan, 1955) at level of $p \leq 0.05$ belongs the above programme was detected. Pairwise correlations among live body weight and carcass parts were also determined.

RESULTS AND DISCUSSION

Table (2) presented the effect of farm on live body weight, and dressing percentage of broilers at 42 days of age, with averages 2276.50 g, and 76.52 % respectively. The higher live body weighs at 42 days old (2427.00 g) was registered for the chicks bred at Bardarash farm which was significantly higher than those bred in other farms. It appears from the same table that dressing percentages recorded in Bardarash (77.76 %) and Girdasen (77.59) were significantly higher than those recorded in Bejeel (74.78 %).

Age, gender, diet, management, bird density, and stress condition all influenced broiler growth, according to a previous study by Baracho et al. (2006). Several studies including Al-Bahouh et al. (2012) and Bahreiny et al. (2013) have shown that commercial broiler chicks kept in cages had a higher growth rate and a higher survival rate. Also it was found that broiler chicks raised on a slatted floor gained more weight than those raised on litter (Chuppava et al., 2018). Moreover, Baracho et al. (2006), Al-Bahouh et al. (2012), and Li et al. (2017) discovered significant changes in body weights between chicks reared in different seasons and rearing regimes. Baracho, et al. (2006) concluded that using black plastic screen to provide shading of the pasture in the semi-intensive rearing system improved the ambient conditions, welfare and performance of the birds, and final bird weight. Several prior research by Kosarachukwu et al. (2010), Malik et al. (2013), Hermiz et al. (2014), (2016), and (2018a) found significant differences in live body weight, and dressing % amongst genetic groupings (strains) of roosters.

Skinner et al. (1992) conducted four trials to see how different dietary nutrient density affected carcass traits and body weight gain in commercial strain broilers. They discovered that increasing food density resulted in a considerable reduction in broiler body weight gain from 42 to 49 days, as well as their body weight at 49 days. As a result, the dressing percentage and abdominal fat content were dramatically declined. The between-farm relationships between the behavioral responses to humans and the productivity of broiler chickens were examined at 22 commercial farms and it appears that the behavioral variables were significantly correlated in a negative trend with feed conversion ratio which could be due to increasing corticosterone concentrations, which accordingly affect adversely the growth rate and efficiency in chickens (Hemsworth et al., 1994). So an attention is drawn to the potential for improving the productivity and welfare of commercial broiler chickens by identifying and manipulating those human factors which are influential in commercial units. Recently, Ghanima et al. (2020) discovered that different systems of rearing affected growth performance traits greatly and significantly ($P < 0.05$). They concluded that these differences among different systems of rearing under the stress of heat could be attributable to differing in broilers' ability to exchange body temperature with air, mattress flotation, and other reasons. However, contradictory studies reported reduced weight gain in broiler chicks when reared under cage system (Özhan et al., 2016 and Darwish et al., 2017).

Schmidt et al. (2006) observed genetic gains in commercial broiler stocks following 15 generations of combination selection (mass and independent culling levels). Weight increase and carcass qualities have been subjected to selection pressure. Body weight, average breast area, and

adjusted feed conversion were all improved in both female and male lines. This breeding initiative has yielded genetic gains as well as the development of two commercial goods.

On the other hand, Tayeb et al. (2011), Wang et al. (2015), Almeida et al. (2018), and Hermiz et al. (2018b) found no significant changes in broiler performance namely growth across different systems of rearing or geographies. Several authors also verified that there was no effect of farms, treatments or rearing systems on dressing percentage (Sartori et al., 2002; Tayeb et al., 2011; and Wang et al., 2015). In addition, conflicting findings demonstrated no substantial difference in growth performance between commercial broiler chicks grown in cages versus on the floor (Bahreiny et al., 2013; Wang et al., 2015). Also Hussein et al. (2020) found no significant variations in terms of growth parameters among the used treatments. Broiler chicks fed a diet containing several nutritional supplements have no linear or quadratic influence on eviscerated weight and dressing percentage, according to Elahi et al. (2020).

Variations in experimental circumstances, such as ambient temperature, season, and broiler strain and sex, could explain the differences in research results. Because there is no need for litter, improved chick density, low labor costs, decreased illness and parasites, better hygienic conditions, and effective space usage, the cage system is popular in broiler chick production (Santos et al., 2012 and Wang et al., 2015).

Table (2) Effect of farm on live body weight, carcass weight and dressing percentage of broilers at 42 days of age

Farms	Live body weight at 42 days (g)	Dressing %
	Mean \pm standard error	
Overall mean	2276.50 \pm 28.83	76.52 \pm 0.40
Akre	2154.00 \pm 20.39 c	75.96 \pm 0.76 ab
Bejeel	2180.00 \pm 40.62 c	74.78 \pm 0.47 b
Bardarash	2427.00 \pm 13.00 a	77.76 \pm 0.60 a
Girdasen	2345.00 \pm 25.49 b	77.59 \pm 0.69 a

According to Duncan multiple range test, means with different letters are substantially different at $p < 0.05$.

The differences in breast, thigh, back, neck and wing percentages were summarized in table (3) Their averages were 36.75%, 25.21%, 18.78%, 5.82% and 8.19% on the same trend as above. From the same table, it appears that the differences were significant in all traits and the higher values of breast (39.37%), thigh (26.30%), back (19.71%), and neck (6.18%) were registered in the farm Bejeel, while higher value of wing (9.75%) was found in Akre farm.

Similarly, Malik et al. (2013) and Hermiz et al. (2016 and 2018a) discovered substantial changes in the percentages of roosters' carcass key components, including breast, thigh, back, neck, and wing percentages, among genetic groups of roosters. The changes in relative weights of the breast were significant ($P < 0.05$) due to different raising systems, according to Bahreiny et al. (2013) and Ghanima et al. (2020). Earlier studies reported that breast yield in broiler chicks reduced when reared under cage system (Özhan et al., 2016 and Darwish et al., 2017). In a research by Hermiz et al. (2018b), Kurdish local roosters outperformed ISA brown roosters in numerous features, including thigh and wing weights, however there were no significant differences in back weight ($P > 0.05$). Carcass features are highly influenced by the diet's nutritional value and chemical composition (Zuidhof et al., 2003).

Table (3) Effect of farm on Carcass parts (%) of broilers at 42 days of age

Farms	Breast %	Thigh %	Back %	Neck %	Wing %
	Mean \pm standard error				
Overall mean	36.75 \pm 0.61	25.21 \pm 0.25	18.78 \pm 0.17	5.82 \pm 0.08	8.19 \pm 0.21
Akre	37.15 \pm 0.31 b	24.11 \pm 0.25 b	18.99 \pm 0.19 b	5.90 \pm 0.04 b	9.75 \pm 0.18 a
Bejeel	39.37 \pm 0.71 a	26.30 \pm 0.29 a	19.71 \pm 0.14 a	6.18 \pm 0.03 a	7.43 \pm 0.10 c
Bardarash	32.59 \pm 0.31 c	24.48 \pm 0.32 b	17.89 \pm 0.17 c	5.97 \pm 0.05 b	7.79 \pm 0.04 b
Girdasen	37.87 \pm 0.31 b	25.94 \pm 0.28 a	18.53 \pm 0.18 b	5.22 \pm 0.03 c	7.80 \pm 0.09 b

According to Duncan multiple range test, means with different letters are substantially different at $p < 0.05$.

Other studies found no significant differences in the yield of the carcass components investigated due to different rearing techniques (Al-Bahouh et al., 2012; Almeida et al., 2018 and

Ghanima et al., 2020); regions (Tayeb et al., 2011); breeds or strains (Kosarachukwu et al., 2010); feeding system (Sartori et al., 2002); or treatments (Hussein et al., 2020). Broiler chicks fed on the diet of some nutritional supplements have no linear or quadratic effect on the percentages of breast muscle, thigh, and wings (Elahi et al., 2020). Wang et al. (2015), on the other hand, found no significant changes in breast relative weight of chicks reared in different rearing techniques, but substantial differences in thigh weight (%).

It appears from table (4) that the lymphoid organs including spleen % and bursa % were averaged 0.155% and 0.179% respectively. The differences in all the lymphoid traits according to farm were significant and the higher value of spleen percentage (0.182%) recorded in the Bardarash farm and surpassed significantly the values in the other farms, while the higher bursa percentage (0.228%) was registered in the Bejeel farm. The above results could contributed to the location of each farm, where the farms located in Bejeel are in the mountain with lower temperature comparing with those located in Bardarash and Girdasen, while the farms in Akre district could be considered as a middle between the others.

Hussein et al. (2020) reported that the differences in weights of bursa as the immune-related organs were significant. Other investigations, such as those by Ghanima et al. (2020) and Hussein et al. (2020), found that the relative weights of the spleen were unaffected by alternative rearing systems or treatments. Broiler chicks fed on the diet of some nutritional supplements have no linear or quadratic effect on spleen and bursa percentages (Elahi et al., 2020).

Table (4) Effect of farm on lymphoid organs of broiler at 42 days of age

Farms	Spleen%	Bursa %
	Mean \pm standard error	
Overall mean	0.155 \pm 0.004	0.179 \pm 0.009
Akre	0.152 \pm 0.006 b	0.133 \pm 0.001 c
Bejeel	0.153 \pm 0.005 b	0.228 \pm 0.006 a
Bardarash	0.182 \pm 0.005 a	0.214 \pm 0.003 b
Girdasen	0.133 \pm 0.003 c	0.142 \pm 0.002 c

According to Duncan multiple range test, means with different letters are substantially different at $p < 0.05$.

The coefficients of correlation among live body weight and carcass traits including dressing %, breast %, thigh %, back %, neck %, wing %, spleen % and Bursa % were listed in table (5). The positive and higher value of correlation of live body weight was with dressing % (0.42) and was not significant, while the negative and higher value was with back % (-0.83) and was very highly significant. Its other coefficients of correlation were positive with lymphoid organs (spleen% and bursa %) and were negative with all percentages of the carcass cuts. It appears that the correlations of dressing percentage were negative with all percentages of carcass parts except that with spleen % which was positive (0.12), on the same time only those with breast % and back % were significant ($p < 0.05$). Regarding to the correlations among the percentages of carcass cuts and lymphoid organs, they varied from -0.68 (between wing % and bursa %) to 0.78 (between breast % and back %) and both were highly significant.

Table (5) Correlation coefficients among live body weight and carcass components

	Live body weight at 42 days (1)	Dressing % (2)	Breast % (3)	Thigh % (4)	Back % (5)	Neck % (6)	Wing % (7)	Spleen % (8)	Bursa % (9)
(2)	0.42	1							
(3)	-0.66***	-0.55*	1						
(4)	-0.13	-0.18	0.57***	1					
(5)	-0.83***	-0.47*	0.78***	0.35	1				
(6)	-0.39	-0.40	-0.07	-0.12	0.34	1			
(7)	-0.39	-0.20	0.02	-0.59**	-0.01	0.01	1		
(8)	0.24	0.12	-0.65**	-0.43	-0.27	0.61**	-0.11	1	
(9)	0.15	-0.17	-0.18	0.29	0.12	0.66**	-0.68***	0.54*	1

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

Hermiz et al. (2018a) reported that in Kurdish local chickens, highly ($p < 0.001$) positive correlations were observed between live weight and weights of each of carcass, thigh, back, and wing and being 0.871, 0.700, 0.716, and 0.780 respectively in the line black with brown neck; 0.990, 0.902, 0.724, 0.750 in black line; and 0.997, 0.979, 0.959, 0.934 in white line. While the value of correlation between live weight and neck weight was found to be highly significant (0.724) only in white line. Moreover, Hermiz et al. (2018b) confirmed that most of the coefficients of correlation of live body weight and carcass measurements were highly significant and positive in each of Kurdish local and ISA brown roosters.

CONCLUSION

It can be concluded that a significant difference was found in live body weight, dressing percentage, carcass yields as percentages and lymphoid organs of the four farms. These outcomes could be attributable to variances in management, temperature, ventilation, and humidity, as well as the rearing system. Some of the correlations between each pair of studied traits were positive and highly significant, so to improve some traits, the breeder can focus on measuring other related traits.

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مقارنة بين صفات الذبيحة والمناخية لمزارع الدواجن التجارية في منطقة عقرة وضواحيها

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الخلاصة

هدفت هذه الدراسة إلى إجراء مسح للبيانات التي تم جمعها من عدة مزارع لفراريح تجارية في منطقة عقرة وضواحيها من أجل تقييم وزن الجسم الحي وصفات الذبيحة وقطعياتها ، وكذلك مقارنة المشاريع التجارية للدواجن في مناطق مختلفة من أجل تحديد أفضل منطقة لتربية الدواجن. تم إجراء التحليل الإحصائي باستخدام برنامج التحليل الإحصائي SAS، كما تم احتساب الارتباطات بين الصفات المدروسة. عند عمر 42 يومًا ، بلغ متوسط وزن الجسم الحي ، ونسبة التصافي 2276.50 غم ، و 76.52 % على التوالي ، وكانت الفروق بين المناطق الأربعة المستخدمة في هذه الدراسة معنوية في جميع الصفات المذكورة. كانت الفروق في النسب المئوية لكل من الصدر والفخذ والظهر والرقبة والجناح معنوية بسبب المنطقة وبلغ متوسطها 36.75% و 25.21% و 18.78% و 5.82% و 8.19% على التوالي. بلغ متوسط الأعضاء للمفاوية والمتضمنة نسبتي الطحال والجراب 0.155% و 0.179% على التوالي ، وكانت الفروق في جميع الصفات الليمفاوية حسب المنطقة معنوية. تم الحصول على أعلى معامل ارتباط (0.78) بين نسبتي الصدر والظهر وكان عالي المعنوية ، بينما كانت القيمة السالبة والأعلى (-0.83) محسوبة بين وزن الجسم الحي ونسبة الظهر وكانت أيضا عالية المعنوية. يمكن الاستنتاج أنه تم العثور على اختلافات معنوية في جميع الصفات المدروسة والتي قد تكون بسبب الاختلافات في بعض العوامل بما في ذلك نظام التربية

الكلمات المفتاحية:
المناطق،
الفراريح ، أداء
الإنتاج ، الذبيحة
، الصفات
المناخية
والارتباطات.

في المناطق المشمولة بالدراسة. كانت بعض الارتباطات بين كل زوج من الصفات المدروسة إيجابية وذات دلالة عالية ، لذا لتحسين بعض الصفات ، يمكن للمربي التركيز على قياس الصفات الأخرى ذات الصلة.