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A Study on Body Weight and Carcass Characteristics and Sex in Broilers.

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Keywords
Chicken, Chicken parts, Logistic regression, Gender.

Abstract: In this study, it was aimed to determine the level of relationship between the carcass and piece weights of chickens and their gender. The body weight, carcass, thigh, wing, breast, heart, liver and gizzard values obtained for this purpose belong to Ross 308 hybrid broiler chickens from the commercially operating slaughterhouses in Kahramanmaraş. 60 hybrid broiler chickens (30 females-30 males) were obtained from the slaughterhouse and the measurements of the body weight before slaughter and the values of the relevant carcass, chicken parts (leg, breast, wing) and internal organs (heart, liver, gizzard) after slaughter were taken. In the study, the dependent variable was sex, the independent variables were body weight, carcass, thigh, wing, breast, heart, liver and gizzard, and logistic regression binary analysis was used. According to the estimation results, the reference category was male (1), and the probability value in the test of the model coefficients was found to be 0.036 ($p<0.05$). The most significant independent variable explaining the relationship between carcass and piece weights and gender of chickens compared to other independent variables was found to be breast (0.084), and the most insignificant was gizzard (0.939).

Etlik Piliçlerde Canlı Ağırlık ve Karkas Özellikleri ile Cinsiyet İlişkisi Üzerine Bir Araştırma

Anahtar Kelimeler
Tavuk, Tavuk parçaları, Lojistik regresyon, Cinsiyet

Öz: Bu araştırmada, tavukların karkas ve parça ağırlıkları ile cinsiyetleri arasındaki ilişki düzeyinin belirlenmesi amaçlanmıştır. Bu amaçla elde edilen canlı ağırlık, karkas, but, kanat, göğüs, kalp, karaciğer ve taşlık değerleri, Kahramanmaraş ilinde ticari olarak faaliyet göstermekte olan kesimhaneden Ross 308 hibrit etlik piliçlerine aittir. Kesimhaneden 60 adet etlik piliç temin edilmiş (30 dişi-30 erkek birey) ve kesim öncesi canlı ağırlık ve kesim sonrası ilgili karkas, tavuk parçaları (but, göğüs, kanat) ve iç organlara (kalp, karaciğer, taşlık) ait değerlerin ölçümleri alınmıştır. Araştırmada bağımlı değişken cinsiyet, bağımsız değişkenler de canlı ağırlık, karkas, but, kanat, göğüs, kalp, karaciğer ve taşlık olarak alınmış ve lojistik regresyon ikili (binary) analizinden yararlanılmıştır. Tahmin sonuçlarına göre referans kategorisi erkek (1), model katsayılarının testinde olasılık değeri 0.036 ($p<0.05$) bulunmuştur. Tavukların karkas ve parça ağırlıkları ile cinsiyetleri arasındaki ilişki düzeyinin diğer bağımsız değişkenlere göre en anlamlı şekilde açıklayan bağımsız değişken göğüs (0.084), en anlamsızı da taşlık (0.939) olduğu yapılmış analiz ile belirlenmiştir.

1. INTRODUCTION

The importance of taking protein, carbohydrates, fats and vitamins for a healthy and balanced nutrition program is known. In this respect, it is often emphasized that the consumption of red and white meat is sufficient, especially in protein intake [1].

Broilers raised for white meat production and consumption are among the most important protein sources. Broiler production is mostly carried out in modernized, automated and profitable poultry houses. During the production phase, not only chickens but also roosters are raised sexually; Although the female/male ratio varies according to the breeding stock programs of the producer companies, it is usually 10 females/1 male. The chickens produced are slaughtered in fully

automatic and modern slaughterhouses by means of integrated systems; Some of the chickens are cut as carcasses and some of them are cut in the cutting units of commercial companies and delivered to the consumer through the cold chain. In the said slaughterhouses, the carcass, which is defined as the head, neck, feet, feathers and internal organs removed, is divided into main parts such as thigh, wing and breast in the relevant cutting units. In addition, internal organs such as gizzard, heart and liver extracted from the carcass are consumed as chicken offal [1].

Quality; It is the whole of the parameters involved in the determination of the demand that the consumer sees or will see in the effect of the change in the unit product [1]. Detection and analysis of the chemical components of meat (protein, fat, ash and water) are reference information about the relevant meat quality. It is predicted that different lighting programs and gender affect the determination of chicken meat quality in Ross 308 hybrid broilers [2]. In the production-consumption hierarchy, all processes from the first step of production to the consumer can affect meat quality positively or negatively [3]. Factors causing stress before slaughter may adversely affect the quality of chicken meat. In addition, it is explained that breast meat can be affected more than thigh meat [4]. It is reported that carcass, thigh and breast meat weights of different hybrids are also different in broilers [5]. Breast meat of slow-growing broilers (compared to fast-growing ones) has higher protein and lower fat content [6]. The significance of the effect of gender on internal organs (gizzard, liver) and carcass characteristics (breast, neck, wing) in broilers, including feathers and feet removed from the cassette during slaughter, was statistically analyzed [7].
In research it was aimed to determine the level of relationship between the carcass and piece weights of chickens and their gender.

2. MATERIAL AND METHOD

Material

Live weight, carcass, leg, wing, breast, heart, liver and gizzard values obtained in this study were obtained from Ross 308 hybrid broiler chickens sold in commercial slaughterhouses in Kahramanmaraş. For this purpose, during the slaughtering process of 60 broiler chickens (30 females - 30 males), a deep horizontal cut was made in the neck muscle, just below the jawbone, along the front and both sides of the throat, to avoid damaging the skin after the neck cut (skin has a protein structure). For this reason, the feathers were dry plucked. After dry plucking, the feet were separated from the carcass with a sharp knife. After the feet were removed, the internal organs were removed without causing damage using an incision in the lower abdominal area close to the cloaca, and the carcass was prepared by washing with warm water. In addition, based on the application procedures of integrated shredding facilities, the carcass (thigh, wing, breast, heart, liver and gizzard) was shredded and chicken parts (leg, breast, wing) and internal organs (heart, liver, gizzard) were removed. In the selection of broiler chickens included in the study, chickens with limb deficiencies, diseases or mild disabilities (such as limping) were not selected. The selected chickens were slaughtered at the 6th week (42nd day) of commercial slaughter age. In addition, the selected chickens had access to unlimited feed and water until slaughter, as in standard chicken farming.

Metod

Lojistic regresion

In any multivariate model where the differences between independent and dependent variables are sought, if the scale of a variable is nominal in the dependent variable, the least squares method, which is the normality assumption of the dependent variable, will be incomplete, so discriminant and logistic regression analysis can be preferred in this process [8]. Logistic regression analysis is a regression method that is useful in clustering and transport operations. Continuity and normality assumptions are not required. Three methods are used in logistic regression analysis. These; binary, ordinal and nominal methods [9].
Although the logistics model;

$$\lambda(\text{xi}) = \text{E}(\text{yi} \mid \text{xi}) = \log[\frac{\text{P(xi)}}{(1-\text{P(xi)})}] = \sum_{k=0}^{p} \beta\text{kXik} \quad (1)$$

form of equality. (i=1, 2, …, n; k=1, 2, …, p; xi=1). where P(xi) is the density;

$$p(xi) = \frac{e^{\sum \beta kXik}}{1+e^{\sum \beta kXik}} = \frac{e^{\lambda(\text{xi})}}{1+e^{\lambda(\text{xi})}} \quad (2)$$

It is expressed as [10;11].

Binary metod

It is a logistic regression analysis that includes binary responses with the dependent variable or variables. It is used to determine the relationship between one or more explanatory variables and the binary response variable [9]. In the binary logistic regression model, there are two responses, 0 and 1, whether a situation or event occurs or not. Odds ratio is the ratio obtained by dividing the probability of occurrence of a situation or event by the probability of not happening. Odds ratio can take a value between 0 and +∞ [12].

$$\text{Odds Ratio} = \frac{\pi(x)}{1-\pi(x)} = e^{\beta 0+\beta 1x} \quad (3)$$

When estimating the regression coefficients in logistic regression analysis, the maximum likelihood estimation method can be preferred instead of the least squares method estimation. In the maximum likelihood estimation method, the probability of an event or situation to occur is desired to be the highest [13].
The maximum likelihood function;

$$L(\text{yi} \mid \text{xi}, \beta) = \prod_{i=1}^{n} P(xi)^{yi}[\,1 - \text{P(xi)}]^{1-\text{yi}} \quad (4)$$

can be expressed as [14].

In this study, logistic regression binary method was used to find out whether there is a relationship between the overall and piece weights of chickens slaughtered by sex and their gender.

3. RESULTS

In this study, it was aimed to determine the level of relationship between the carcass and piece weights of chickens and their gender. The body weight, carcass, thigh, wing, breast, heart, liver and gizzard values obtained for this purpose belong to Ross 308 hybrid broiler chickens from the commercially operating slaughterhouses in Kahramanmaraş. 60 broiler chickens (30 females-30 males) were obtained from the slaughterhouse and the measurements of the body weight before slaughter and the values of the relevant carcass, chicken parts (leg, breast, wing) and internal organs (heart, liver, gizzard) after slaughter were taken. In the study, the dependent variable was sex, the independent variables were body weight, carcass, thigh, wing, breast, heart, liver and gizzard, and logistic regression binary analysis was used.

According to the results of the research, the reference category was male (1), and the probability value was 0.036 ($p<0.02$) in the test of the model coefficients, so H_0 (there is no relationship between the carcass and piece weights of chickens and their gender) was rejected, and thus the established model was determined to be statistically significant. It was determined that the hens explained the carcass and piece weights by 32% in a change in gender, and the classification table was an accurate and compatible model with a model estimate of 73.3% in general. According to the other independent variables, the most significant independent variable explaining the relationship between the carcass and piece weights of chickens and their gender was determined by the analysis as breast (X5=0.084), and the most meaningless one was gizzard (X8=0.939).

In the data set created according to the estimation results, the probability value was found to be 0.036. It has been determined by scientific analysis that there is a relationship between the carcass and piece weights of chickens and their gender.
In order to obtain better results in the data set obtained with randomly selected chickens from Ross 308 hybrid broiler chickens sold in commercial slaughterhouses in Kahramanmaraş, keeping the number of observations in the data set larger, preferring breeds with better living conditions in the region, preferring more care should be taken and the nutritional habits of the chickens should be considered before slaughtering in the region. In order to avoid these and similar problems in future articles or thesis research, the deficiencies mentioned should not be ignored.

4. DISCUSSION AND CONCLUSION

A data set was created with measurements taken from slaughtered chickens.

A model was established with the help of the obtained data set.
H_0= There is no relationship between the carcass and piece weights of chickens and their gender.
H_1= There is a relationship between the carcass and piece weights of chickens and their gender.
The hypotheses are stated and the model is established.
This model:

$$Y_{it}=\beta_0 +\beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} +\beta_4 X_{4it} + \beta_5 X_{5it} + \beta_6 X_{6it} + \beta_7 X_{7it} + \beta_8 X_{8it} +u_{it} \quad (5)$$

Yit: Sex of Chickens (Male, Female).
X1it: Live weight of chickens.
X2it: The carcass of chickens.
X3it: Leg parts of chickens.
X4it: Wing parts of chickens.
X5it: Chicken breast.
X6it: Heart part of chickens.
X7it: The liver part of chickens.
X8it: The stony part of chickens.
is in the form.
As a result of the analysis;

Table 1. Model Summary.

Model Summary		
-2 Log Likelihood	**Cox & Snell R Square**	**Nagelkerke R Square**
66.669[a]	.241	.321

a. Estimation terminated at iteration number 5 because parameter estimates changed by less than ,001
In the model established in Table 1, it was determined that a change in gender explained the carcass and piece weights of chickens by 32%.

Table 2. Reference Category.

Depedent Variable Encodıng	
Orginal Value	**Internal Value**
Female	0
Male	1

In Table 2. the reference category is from female to male and it is determined that it is the male reference category.

Table 3. Test of Model Coefficients

Omnibus Tests of Model Coefficients			
	Chi- square	**df**	**Sig.**
Step	16.509	8	.036
Block	16.509	8	.036
Model	16.509	8	.036

In Table 3, H_0 (There is no relationship between carcass and piece weights and gender of chickens) was rejected because the probability value was below 0.05 in the test of model coefficients. In other words, the established model was determined to be statistically significant.

Table 4. Classification Table

Classification Table				
Predicted				
Observed		Gender		Percentage Correct
		Female	Male	

Gender	**Female**	21	9	70.0
	Male	7	23	76.7
Overall Percentage				73.3

Since 30 females were used in the study in Table 4, 21 of them were found and the correct prediction percentage was calculated as 70.0%, while 23 of the 30 males used in the study were found and the prediction percentage was determined to be 73.3%. In addition, it was determined that the model estimation was correct and compatible with 73.3% of the overall total

Table 5. Established Model Variables.

Variables in the Model						
	B	**S.E.**	**Wald**	**df**	**Sig.**	**Exp(B)**
X1	.002	.001	2.219	1	.136	1.002
X2	-.005	.004	1.621	1	.203	.995
X3	.009	.007	1.579	1	.209	1.009
X4	.004	.018	.052	1	.819	1.004
X5	.012	.007	2.984	1	.084	1.012
X6	.085	.080	1.133	1	.287	1,089
X7	-.036	.031	1.318	1	.251	.965
X8	-.001	.016	.006	1	.939	.999
Costant	-9.366	3.732	6.299	1	.012	.000

In Table 5, the ratio of live weight (X1), which has a relationship between the overall and piece weights and gender of the chickens slaughtered according to their sex, is 0.1336, carcass (X2) 0.203, thigh (X3) 0.209, wing (X4) 0.819, It was determined that chest (X5) explained 0.084 ratio, heart (X6) 0.287 ratio, liver (X7) 0.965 ratio and gizzard (X8) 0.999 ratio. As a result of the analysis, it was determined that the independent variable that explained the determination of the relationship between the sex of the chickens in the most significant way compared to the other independent variables was the breast (X5=0.084). In addition, it was determined that an increase of 1.0112 in the breast, which was determined to be significant compared to the others in chicken slaughter according to gender, could be increased by 1.0112 in the female, which is the opposite of the sex determined in the reference.

In a study conducted, pH, hardness (penetrometer value), L*, a* and b* color criteria with and without skin were obtained in male and female broiler (Ross 308) breast and leg meat samples, which were applied 4 different lighting programs (AP) during the 6-week rearing period. data have been identified. As a result of the research, the AP* gender effect on leg meat pH was found to be significant ($p<0.01$). AP* gender effect on breast and leg meat hardness values was found to be significant ($p<0.01$). While the effect of AP on skinned and skinless breast meat on L, a and b color criteria was found to be significant, skinned and skinless thigh meat had AP on L color criterion ($p<0.01$) and on a color criterion ($p<0.01$) and b color criterion ($p<0.05$).) AP* gender effect was significant [15]. In another study, the effects of 4 different lighting programs (AP) commonly applied in broiler farming on yield performances, slaughter and some carcass characteristics were examined. As a result of the research, the effect of AP on live weight at slaughter age was found to be insignificant. 1-10 in terms of live weight gain. and 11-29. On days 4, the differences between AP and the others were found to be significant ($P<0.05$) [16]. In a study, data were determined to determine the effects of gender on edible carcass components and offal products in broilers. As a result of the research, differences between males and females were found to be significant in terms of the share of feathers, feet, liver, gizzard, chest, neck and wings in live weight. Compared to males, females were found to have higher percentages of feathers, whole and edible carcasses, heart, liver, gizzard, abdominal fat, breast and feet, rumps and neck [7]. In another study, the effects of gender and early limited feeding program on some productivity and immunological characteristics in broiler flocks were determined. As a result of the research, it was observed that rearing male and female broilers separately had a positive effect on some productivity characteristics and provided some advantages in breeding. It has been observed that applying a restricted feeding program at an early age has a positive effect on some productivity characteristics such as feed conversion, viability and belly fat amount and may be recommended to producers [17]. As a result of a study, ± 0.15 for female quails and DW= 2.21 ± 0.01 MSE= 35.391 ± 9.07, adj.R^2=0.997 ± 0.033, AIC= | -35,04| ± 0.29 and DW= 2.09 ± 0.91 for male quails [18]. In another study, it was found that the individual growth curves of Ramanov lambs with logistic regression method were 0.534±2.215 in females and 2.659±0.476 in males [19]. In another study, the factors affecting the success of university students with the logistic regression method; gender, the university they attended, the way they chose the department, and father's education were found to be effective [20]. In another study, with logistic regression method, weekly egg yields of Nick Brown and Leghorn breed chickens from the 18th week to the 59th week; in both races, Nick Brown; HKO=0.000007, R^2=0.9999, $\bar{R}^2$=0.9998, AIC=-392.966, DW=1.345: Leghorn; PCO=0.0001, R^2=0.9998, $\bar{R}^2$ =0.9997, AIC=-373.225, DW=1.845 [21].

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