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Effect of breed and coat color on some non-carcass components characteristics with prediction regression equations in goat.

تاثير السلالة ولون الفروة على بعض صفات مكونات الذبيحة غير المأكولة مع معادلات التنبؤ بالانحدار في الماعز

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Abstract

This study was conducted in Ruminants Researches Station /Ministry of Agriculture. Study targeted some parameters of the live weight at slaughter and some non- carcass characteristics in 10 months aged Male goats. The characteristics were studied for 45 Cyprian , 25 Iraqi Local , 18 (Croosbred1) and 5 (Crossbred2) male goats which slaughtered and measured the weights of head, legs, pelt, heart, liver ,lungs and trachea ,spleen, kidneys and testes. The results of the non-carcass components for the different genetic groups (breeds) indicated that percentage of head , pelt, heart and (lungs &trachea %) of live weight at slaughter (LWS%) did not affected with breed , while legs%, was affected significantly ($P\leq0.01$). The pelt and legs Empty Body Weight (EBW%) generated the same results of breed effect in LWS% . Breed effect was significant ($P\leq 0.05$) as effect on liver % (% of LWS) and lungs & trachea (as % EBW) . Crossbred 2 generated the higher value significantly ($P\leq0.01$) in the percentage of spleen from LWS. Effect of coat color was significant in some traits and non in others. Results indicated to possibility of some regression equations to used for predict the studied traits from live weight at slaughter.

Key words: goat , breed , coat color , carcass , prediction regression

الملخص العربي

اجريت الدراسة في محطة المجترات التابعة لدائرة البحوث الزراعية غي وزارة الزراعة . شمل البحث دراسة صفات الوزن الحي عند الذبح وبعض صفات الذبيحة غير المأكولة بعمر ذبح عشرة اشهر في ذكور الماعز. تضمنت الدراسة 45 ذكر ماعز قبرصي و25 محلي و18 (مضرب1) و5 (مضرب2) ، قيست صفات اوزان الرأس والارجل والجلد والقلب والكبد والرئتين والقصبة الهوائية والطحال والرئتين والخصيتين لكل الحيوانات اعلاه.

اشارت نتائج الدراسة الى عدم تاثير السلالة على نسب اوزان الرأس والجلد والقلب والرئتين والقصبة الهوائية (كنسبة مئوية من الوزن الحي) ، بينما اثرت السلالة معنويا ($P\leq0.01$) على نسبة وزن الارجل. وزن الجلد ووزن الارجل (نسبة الى الوزن الفارغ) مشابهة لمثيلتها في نسبها للوزن الحي. تأثرت نسبة وزن الكبد من الوزن الحي ونسبة وزن الرئتين والقصبة الهوائية كنسبة من الوزن الفارغ للحيوان معنويا ($P\leq 0.05$) بالسلالة .المضرب 2 تميز بنسبة الطحال الاعلى من الوزن الحي للحيوان.

وتباينت الصفات المدروسة بين المتأثرة معنويا وغير المتأثرة بعامل صفة لون الفروة ، واظهرت النتائج ايضا امكانية الاعتماد على بعض من معادلات الانحدار للتنبؤ بالصفات المدروسة اعتمادا على الوزن الحي عند الذبح .

Introduction

Goats had received relatively little scientific attention compared with sheep and cattle (**1**). However, recently, there is a world wide tendency for rapid increase in demand to goat meat (**2**) due to several reasons including; the increased consumer desire to leaner meat compared to other types of red meat (**3**), subcutaneous fat is slow development in goat (**1**), goat deposit higher polyunsaturated fatty acids than other ruminants (**4**).Meat production depends on factors such as breed, sex, nutrition and environmental condition (**5**). Goat breeding is an activity of great

importance in many countries , playing an important role in the context of local agribusiness, being an alternative income source based on the marketing of meat, milk and pelt (**6**). The objective of studying carcass is to evaluate subjective and objective parameters related to qualitative and quantitative aspects (**7**). Thus, the value of a carcass depends, among other factors, on the body weight: slaughter age ratio, whose objective is to obtain higher weights at younger ages in order to meet the demands of the consumer market (**8**). The non-carcass components traditionally served only to cover parts of the costs generated during slaughter. According to (**9**), the quality of the animal yield does not depend only on the carcass yield and its cuts, but also on the proportion and quality of the other components(non-carcass components), requiring the appreciation of these components so that the commercialization would be fair for producers who seek total quality, benefiting also consumers, both for the lower price as for the improved health aspect. Depending on the cultural context, the non-carcass components (offal) may be considered as waste material that is thrown away, or as delicacies that can command an interesting price such as in Jamaica, Antigua and French West Indies (**10**). Non-carcass components are an important part of the goat farmers' economies. Studies aiming at the development of the local meat sector should take into account the cultural habits of the consumer such as in Africa (**11**), Texas (**12**) or in Brazil (**13**).The lower proportion of non-carcass components may have contributed to higher dressing percentages which is in agreement with the literature findings (**14**) in goats and (**15**) in Omani sheep. The objective of this study is to determine the effect of breed and pelt color on some non-carcass components characteristics of four goat different genotypes.

Materials and Methods

This study was conducted at Ruminants Researches Station /department of animal resources researches /Ministry of Agriculture, 23 km west of Baghdad for the period from 20/1 until 1/7/2014 . Animals were slaughtered when reached the assigned age (10 months) . The study included 93 goat males aged 10 months consist of 45 Cyprus goat males(C) , 25 Local goat males(L) , 18 (crossbred1) goat males (♂1/2 L+1/2 C ×♀1/2 L+1/2 C) and 5 (crossbred2) goat males (♂L×♀C) . They were fasted for 18-h, and weighed immediately prior to slaughter. The dressed carcass comprised the body after removing the pelt, head and fore and hind feet and the viscera and the non-carcass and offal traits were recorded which include the weights of animal head, legs, pelt, heart, liver ,lungs and trachea ,spleen, kidneys and testes and record these organs weights as a percentage of live weight at slaughter (LWS) and a percentage of Empty Body Weight (EBW).

The statistical analysis of data within each breed group was carried out using the GLM (General Liner Model) with (SAS 2012)(16) program according to the following model:

$$Y_{ij} = \mu + G_i + T_j + b_1(x_i - \bar{x}) + e_{ij}$$

Where: Yij = observational value of the kth animal, μ = overall mean, G_i= effect of breed (Cyprus ,Local ,Crossbred1 and Crossbred2),Tj= effect of pelt color (black,brown,white and blotting),) eij= experimental error assumed to be NID with (0, $\sigma^2 e$). the simple linear regression was used for prediction of studied traits means. The coefficient of Determination(R^2) was estimated (**17**) to describe effects of factors on studied traits.

Results and discussion

Effect of breed

The results of the non-carcass components for the different genetic groups(breeds) indicated that percentage of head and pelt (% of LWS) (Table1) did not affected with breed , while the legs% was affected significantly (P≤0.01)by the superiority of crossbred 1 (2.87%) comparing with the less one (Local ,2.36%). Percentage of head ,pelt and legs as a percentage of empty body weight (EBW) generated the same results of breed effect in LWS% (Table 2).

Table 3, showed no significant effect of breed for the variables related to(heart %) and (lungs &trachea %) , but it was significant (P≤ 0.05)as effect on liver % (% of LWS), which reveal the

superiority of Cyprian and crossbred 2 (2.04 &2.01% respectively). Otherwise , the results in (table 4, as % EBW) refer to significant effect (P≤ 0.05)of breed on lungs & trachea by the superiority of crossbred 2 (1.68%) comparing with the rest of breeds, and a significant effect on liver by the superiority of three breeds , Cyprian (2.65%) , crossbred 2 (2.60%) and crossbred1 (2.49%). Breed effects were significant on head and hide as a percentage of body weight (**18**). However, (**19**) reported a non-significant effect of breeding groups on legs as a percentage of body weight.

Crossbred 2 generated the higher value significantly (P≤0.01) between the four breeds in the percentage of spleen from LWS,by giving 0.18% comparing with 0.13% for Local breed (Table 5). In the same context, Crossbred 2 giving the higher value significantly (P≤0.01) between the four breeds in the percentage of testes (0.80%). The table (5) showed no significant effect of breed for kidneys percentage. The previous results showed for the same variables (spleen, testes and kidneys) as a percentage of EBW (Table 6). This finding was disagreement with the study of (**20**), who reported a significant effect of crossing groups on kidney weight. The variation in the kidney and spleen weight could be due to differences in slaughter weight (**21**).

Trait	No. Of Animals	Head %	Legs %	pelt%
Mean	93	7.47±0.080	2.89±0.050	5.83±0.096
Source of variation				
Breed				
Local	25	6.99±0.297a	2.36±0.176a	6.47±0.358a
Cyprian	45	7.13±0.302a	2.74±0.179b	6.20±0.364a
Crossbred 1	18	7.42±0.259a	2.87±0.153b	6.04±0.312a
Crossbred 2	5	7.14±0.435a	2.42±0.258ab	6.39±0.525a
Coat color				
Black	22	7.80±0.207a	2.92±0.123a	6.00±0.250a
Brown	60	7.49±0.169a	2.86±0.100a	5.96±0.205a
White	5	7.25±0.421a	2.66±0.249a	6.43±0.507a
Blotting(black+white)	6	6.90±0.890a	1.82±0.528b	6.17±1.074a
Regression on live weight (%/kg)	93	- 0.052±0.015	- 0.028±0.009	0.036±0.018

Table 1: Least squares means (± SE) of head , legs and pelt (% on live body weight)

Trait	No. Of Animals	Head %	Leg %	Pelt%
Mean	93	9.85±0.124	3.82±0.075	7.68±0.127
Source of variation				
Breed				
Local	25	9.02±0.386a	3.05±0.236a	8.39±0.443a
Cyprian	45	9.32±0.409a	3.61±0.250b	8.06±0.469a
Crossbred 1	18	9.61±0.351a	3.73±0.214b	7.74±0.402a
Crossbred 2	5	9.43±0.589a	3.21±0.360ab	8.41±0.676a
Coat color				
Black	22	10.26±0.283ab	3.86±0.173a	7.90±0.325a
Brown	60	9.96±0.224a	3.80±0.137a	7.96±0.257a
White	5	9.34±0.579a	3.41±0.354a	8.30±0.664a
Blotting(black+white)	6	9.12±1.131ac	2.51±0.692a	8.05±1.297a
Regression on live weight (%/kg)	-	- 0.083±0.021	- 0.044±0.001	0.037±0.024

Table 2: Least squares means (± SE) of head , legs and pelt (% on empty body weight)

Trait	No. Of Animals	Heart %	Lungs & Trachea %	Liver %
Mean	93	0.40±0. 350	1.20±0.018	1.83±0.002
Sources of variation				
Breed				
Local	25	0.35±0.120a	1.16±0.063a	1.82±0.086a
Cyprian	45	0.34±0.120a	1.19±0.064a	2.04±0.088b
Crossbred 1	18	0.35±0.104a	1.23±0.055a	1.94±0.075ab
Crossbred 2	5	0.33±0.176a	1.28±0.092a	2.01±0.127ab
Coat color				
Black	22	0.40±0.008a	1.24±0.044a	1.86±0.060a
Brown	60	0.41±0.006a	1.23±0.036a	1.81±0.049a
White	5	0.44±0.017a	1.30±0.089a	2.07±0.123ab
Blotting(black+white)	6	0.40±0.036a	1.08±0.018a	1.68±0.112b
Regression on live weight (%/kg)	-	0.004±0.006	- 0.008±0.003	-0.025±0.004

Table 3: Least squares means (± SE) of heart , Lungs & Trachea and pelt (% on live body weight)

Trait	No. Of Animals	Heart %	Lungs & Trachea %	Liver %
Mean	93	0.55±0. 037	1.59±0.026	2.42±0.041
Source of variation				
Breed				
Local	25	0.43±0.137a	1.44±0.086ab	2.28±0.114a
Cyprian	45	0.44±0.145a	1.57±0.092a	2.65±0.012b
Crossbred 1	18	0.46±0.124a	1.59±0.078a	2.49±0.104b
Crossbred 2	5	0.42±0.209a	1.68±0.132ac	2.60±0.175b
Coat color				
Black	22	0.53±0.008a	1.64±0.044a	2.44±0.060a
Brown	60	0.55±0.006a	1.63±0.036a	2.42±0.049a
White	5	0.58±0.017a	1.69±0.089a	2.68±0.123a
Blotting(black+white)	6	0.41±0.036a	1.40±0.018a	2.37±0.112a
Regression on live weight (%/kg)	-	0.004±0.007	- 0.001±0.004	-0.037±0.006

Table 4: Least squares means(± SE) of heart , Lungs & Trachea and pelt (% on empty body weight)

Trait	No. Of Animals	Spleen %	Testes %	kidneys %
Mean	93	0.15±0.050	0.62±0.002	0.40±0.002
Sources of variation				
Breed				
Local	25	0.13±0.020a	0.71±0.087a	0.41±0.102a
Cyprian	45	0.17±0.020b	0.55±0.089ab	0.37±0.103a
Crossbred 1	18	0.15±0.017a	0.64±0.076a	0.37±0.089a
Crossbred 2	5	0.18±0.030b	0.80±0.128ac	0.33±0.149a
Coat color				
Black	22	0.16±0.014a	0.58±0.061a	0.46±0.071a
Brown	60	0.14±0.011a	0.66±0.050a	0.41±0.058a
White	5	0.18±0.029a	1.00±0.124b	0.43±0.144a
Blotting(black+white)	6	0.07±0.061b	0.55±0. 263a	0.15±0.306a
Regression on live weight (%/kg)	-	- 0.012±0.005	0.004±0.004	- 0.002±0.000

Table 5: Least squares means (± SE) of spleen , testes and kidneys (% on live body weight)

Trait	No. Of Animals	Spleen %	Testes %	kidneys %
Mean	93	0.20±0.007	0.82±0.033	0.53±0.034
Source of variation				
Breed				
Local	25	0.20±0.026a	0.96±0.111a	0.57±0.123a
Cyprian	45	0.23±0.028a	0.72±0.117b	0.52±0.131a
Crossbred 1	18	0.19±0.024ab	0.82±0.101ab	0.50±0.112a
Crossbred 2	5	0.27±0.040ac	1.09±0.169a	0.48±0.188a
coat color				
Black	22	0.21±0.019a	0.77±0.081 a	0.61±0.090a
Brown	60	0.19±0.015a	0.89±0.064 a	0.53±0.071a
White	5	0.22±0.040a	1.25±0.166 b	0.54±0.185a
Blotting(black+white)	6	0.20±0.078a	0.88±0. 325 a	0.44±0.362a
Regression on live weight (%/kg)	-	- 0.002±0.000	0.004±0.000	- 0.005±0.000

Table 6: Least squares means (± SE) of spleen , testes and kidneys (% on empty body weight).

Effect of coat color

The effect of coat color was significant (P≤ 0.05) in legs% as a percentage of LWS (table 1) by the superiority of black goats (2.92%) compared with (1.82%) of blotting goats. While no significant effect of coat color was occurred on head and pelt percentages(table 1).As a percentage of EBW, black goats had the highest percentage (P≤ 0.05) of head(10.26%) compared with the rest colors ,but no significant coat color effect was existed on leg% and pelt% (table 2).

Liver % of LWS was affected significantly (P≤0.01)by coat color (table 3). The white animals appeared the highest percentage of liver (2.07%), while the blotting ones appeared the lesser percentage (1.68%). Otherwise ,no significant effect of coat color was occurred on heart and lungs & trachea percentages (table 3). There were no significant effects of animal color on heart ,lungs & trachea and liver EBW percentages (table 4).

Table 5, showed a significant effect(P≤ 0.05)of coat color on both spleen and testes as LWS percentages , but it wasn't significant on kidneys percentage. While table 6 showed a single

significant effect (P≤ 0.05)of coat color on testes as a percentage of EBW by the superiority of white goats (1.25%) compared with the lesser ones which were the black goats (0.77%). Other characteristics(spleen and kidneys%) were not affected by animal color .There is evidence that hair color influences the susceptibility of the animal to climatic stress because coat color is related to the amount of heat absorbed from solar radiation(22*)*. Hair sheep usually tolerate climatic conditions better than wooled sheep and Dark-colored animals are more susceptible to climatic stress while light-colored animals may be prone to sunburn (22*)*. In Bos indicus cattle the in wared flow of heat at the skin of black stress was 16% greater than for brown stress and 58% greater than for white stress (23). Indeed, it has been reported that unpigmented goats are more adversely affected by climatic stress likely due to their decreased activity and increased water consumption (24).

Regression equations

The second objective of the study was to develop practical prediction equations for use in non-carcass components yields for goat . It is expected that heavier goats would produce carcasses with higher non-carcass components yields .Table (7) represents the regression equations used to predict non-carcass components(%LWS) from live weight at slaughter . There is a significant regression of head, legs, skin, Lungs and Trachea and liver % on live weight at slaughter (P≤ 0.05)and (P≤0.01) with a moderate R^2 (0.17 - 0.45).This indicate that (0.17-0.45%) of the previous traits variances belongs to variance of live weight at slaughter. Otherwise , there is no significant regressions of heart, spleen, testes and kidneys percentages (%LWS) on live weight at slaughter and the R^2 values of each trait were 0.06,0.29,1.26 and 0.11 respectively . Head, legs and hide represents the largest part of carcass byproducts which affect slaughter weight and dressing %. Increasing the weight of those residuals was accompanied by a reduction on dressing % and carcass weight (**25**).

NO	Dependent variable (Y)	Independent variable (X)	Regression equation	R^2
1	Head%	live weight at slaughter (LWS)	$\hat{Y}$= 8.675 +(- 0.052) (X)	0.28**
2	Legs %	live weight at slaughter (LWS)	$\hat{Y}$= 3.540 +(- 0.028) (X)	0.29**
3	Skin %	live weight at slaughter (LWS)	$\hat{Y}$= 4.996 + 0.036 (X)	0.17*
4	Heart %	live weight at slaughter (LWS)	$\hat{Y}$ = 0.308 + 0.004 (X)	0.06
5	Lungs and Trachea %	live weight at slaughter (LWS)	$\hat{Y}$ =1.385 +(- 0.008) (X)	0.25**
6	Liver %	live weight at slaughter (LWS)	$\hat{Y}$ =2.410 +(- 0.025) (X)	0.45**
7	Spleen %	live weight at slaughter (LWS)	$\hat{Y}$ = 0.428 +(-0.012) (X)	0.29
8	Testes %	live weight at slaughter (LWS)	$\hat{Y}$ = 0.527 + 0.004 (X)	0.26
9	Kidneys %	live weight at slaughter (LWS)	$\hat{Y}$ =0.450 +(- 0.002) (X)	0.11

Table 7: Regression equations for predicting non-carcass components (% of LWS) (n = 93).

Conclusion

It is concluded that animals breed and color affecting some non-carcass components and offal characteristics as both (%LWS) and (EBW%).Also the practical prediction equations could be used to predict with some of the studied characteristics. However, there is a need for further studies to evaluate other economically important traits in
different crossbreds raised under different goat production systems .

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