COMPARING CARCASS TRAITS FOR BOTH WHITE AND BROWN DOMYATI DUCKS (EGYPTIAN LOCAL MALLARD)

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SUMMARY

The objective of this work to explore the effect of feather colour on the carcass traits of Domyati ducks. A total of 169 one-day-old Domyati ducks were separated according to phenotypic colour into two groups, White feather (WF) and Brown feather (BF). The distribution ratios were 9% and 91% for WF, and BF, respectively. Carcass traits were taken at the marketing age, 16 ducks /each phenotype (8 male+ 8 female) were saluted. Non-edible meat parts were taken (blood- feather- legs- head- and viscera), edible meat parts (dressed carcass- liver- gizzard- heart), muscles (major – minor – thigh - drumstick), fats (Abdominal fat, gizzard fat – skin), also neck, wings and skeleton were measured. The live body weight was significantly heavier for WF ducks compared to BF ducks. Also, the males recorded heavier body weight than females. The interaction was not significant. There is no significant effect for feather colour or sex on non-edible meat parts, muscles, fats, neck, wings and skeleton. However the BF ducks were significantly higher relative heart weight than WF ducks, the females were significantly higher relative heart weight compared to males, the interaction between feather colour and sex was not significant. In conclusion, there was no significant effect due to feather colour on studied carcass traits.

Keywords: *Feather colour, Carcass traits, Edible meat parts, Local Mallard, Domyati ducks*

INTRODUCTION

Ducks are one of the oldest birds that were domesticated by the ancient Egyptians through hunting and raising wild Mallard ducks. Egypt is considered the highest duck producer in Africa, with production attaining 150 million ducks annually (FAO, 2014; Alsaffar *et al.*, 2024). The world production of duck meat has steadily increased during the last few decades. It was 3.78 million tons in 2008, it's expected to grow at a rate over three percent yearly (FAO, 2010; Makram, 2015).

There are two strains in Egypt of local Mallard ducks, Domyati and Shershery ducks, The Domyati duck is close in phenotypes to wild Mallard duck in feather color j with brown feathers in both males and females, also males had a green head, however, there is another mutation from the Domyati duck with white feather colour, body weight ranged from 1500-1750 g and a 170 eggs on year (Makram, 2016).

Little studies confirm that there is a relationship between feather colour and economic traits, as the result obtained by Rizzi (2018) who detected a relationship between the colour plumage and body weight of Padovana chickens. Another study by Ismoyowati *et al* (2018), reported an effect of feather colour on live body weight in Muscovy duck (Makarova *et al.*, 2019 and Ismoyowati *et al.*, 2018), this study aims to find a relationship between feather colour and some economic traits in the Domyati ducks.

MATERIALS AND METHODS

Total number 169 Domyati ducklings were hatched, healthy and with high vitality. They were reared under the same environmental, managerial and hygienic conditions from one day old to the end of the experiment. As for the lighting systems, it was 24 hours throughout the experiment period (8 weeks). All ducklings were brooded in floor pens. The brooding temperature was 33 C^{o} for the first three days and then reduced gradually until it reached 26 C^{o} at two weeks of age. Feed and water were provided *ad libitum*., at the first weeks of age they were divided into two groups according to their feather colour, white feather (WF) and brown feather (BF) (Photo1). Their distribution ratios were 9% and 91% for WF and BF, respectively. The feed and water were supplied ad libitum. They were fed a diet containing 23 % protein and 3000 K/Cal (0-3 wk), 21% protein and 3100 K/Cal (3 – 5 wk) and 18 % protein and 3200 K/Cal (5-8wk).

Measurements:

Carcass traits:

When the ducklings attained marketing age, 16 birds (8 males + 8 females) from each experimental group, a total birds used were 64 birds were randomly taken and slaughtered for carcass evaluation. They were slaughtered after weighing. Then they were reweighed after bleeding to calculate blood weight by difference. Feathers were manually plucked up after scalding in hot water, and then the birds were reweighed to calculate the feather's weight by difference. The head, shank and foot were weighed after removal. The birds were eviscerated by removing the viscera. The giblets (gizzard, liver and heart) were dissected from the viscera and the gizzard was cut, opened and cleaned from its contents. The abdominal fat, gizzard fat and skin were removed and weighed. The wings and neck were removed and weighed. The carcass, thigh, drumstick and breast muscles (minor and major) were weighed. All parts were expressed as a percentage of the live body weight.

Photo 1: The brown and White Domyati ducks

Statistical analyses:

Data other than those subjected to statistical analysis using two-way ANOVA with feather colour effect and the sex with interaction by General Linear Model (GLM) procedure of SAS (2001) according to the following model according to the following model:

$$Y_{ij} = \mu + B_i + S_j + [BxS]_{ij} + e_{ijk}$$

Yij = Trait measured, μ = Overall mean, B_i= Feather color effect

S_j= Sex effect (j=1 and2), $[BxS]_{ij}$= Interaction between feather colour & Sex,

e_{ijk} = Experimental error.

Duncan's multiple range tests were used when significant differences between means were found.

RESULTS AND DISCUSSION

Carcass traits:

Non-edible meat parts:

Data presented in Table (1) clarifies the effect of feather colour on relative non-edible meat parts traits of Domyati duck. WF ducks recorded a significantly heavier body weight compared to BF ducks, such differences respect 6.24% of the body weight between BF and WF ducklings. Indeed, males had significantly heavier body weight compared to females. No significant interaction between feather colour and sex was detected. Our results agree with Saatci *et al.* (2009); Kırmızıbayrak and Kuru (2018),

Table (1): Effect of feather colour on relative Non-edible meat parts of Domyati duck.

Items	sex	Domyati		Overall (L.x)	Prob.		
		Brown	white		Line	Sex	L*Sx
BW (g)	M	2249.6±41.3	2433.33±65.1	2288.93[a]			
	F	2026.3±29.1	2091.00±80.9	2037.86[b]	.015	.0001	N. S
Overall		2135.44[b]	2277.73[a]				
Blood (g.)	M	4.9±0.1	5.3±0.1	5.00			
	F	5.21±0.2	5.09±0.2	5.19	N. S	N. S	N. S
Overall		5.07[b]	5.20[a]				
Feather (g.)	M	6.17±0.2	6.35±0.2	6.21			
	F	6.24±0.2	6.14±0.2	6.22	N. S	N. S	N. S
Overall		6.21	6.25				
leg (g.)	M	2.74±0.05	2.78±0.05	2.75			
	F	2.73±0.03	2.65±0.09	2.72	N. S	N. S	N. S
Overall		2.74	2.72				
Head (g.)	M	4.39±0.06	4.22±0.03	4.35			
	F	4.37±0.06	4.24±0.09	4.35	N. S	N. S	N. S
Overall		4.38	4.23				
Viscera (g.)	M	6.62±0.7	6.90±0.1	6.68			
	F	6.25±0.7	6.89±0.4	6.36	N. S	N. S	N. S
Overall		6.43	6.90				
Non-edible parts (g)	M	24.86±0.6	25.55±0.4	25.01			
	F	24.82±0.8	25.04±0.4	24.86	N. S	N. S	N. S
Overall		24.84	25.32				

[a and b] *Means within the same row with different letters are significantly different.*

M= Male and F- Female

Edible parts:

The relative edible meat parts as affected by feather colour and sex were presented in Table (2). The interaction between feather colour and sex for the liver was significant, also the relative heart weight was higherly significantly on BF compared to WF, and the female had significantly higher compared to the male duck. However, no significant difference among remain traits of edible meat parts, Makram *et al.* (2021) confirmed that the dark brown feather Mule duck had significantly lower for relative edible meat parts compared to white, black and light brown Mule ducks.

Table (2): Effect of feather colour on relative edible meat parts of Domyati duck.

Items	Sex	Domyati		Overall (Lx)	Prob.		
		Brown	White		Line	Sex	L*Sx
Dressed	**M**	69.30±0.70	68.70±0.52	**69.17**			
	F	69.37±0.75	69.66±0.5	**69.42**	N. S	N. S	N. S
Overall		**69.33**	**69.14**				
Liver	**M**	2.36±0.05	2.68±0.1	**2.43**			
	F	2.30±0.08	2.11±0.1	**2.27**	N. S	N. S	0.03
Overall		**2.33**	**2.42**				
Gizzard	**M**	2.87±0.08	2.66±0.1	**2.83**			
	F	2.85±0.08	2.72±0.06	**2.82**	N. S	N. S	N. S
Overall		**2.86**	**2.69**				
	M	0.69±0.01	0.63±0.02	**0.68[b]**			
Heart	**F**	0.74±0.01	0.63±0.01	**0.72[a]**	.001	.06	N. S
Overall		**0.71[a]**	**0.63[b]**				
	M	5.83±0.11	5.73±0.18	**5.81**			
Giblets	**F**	5.79±0.16	5.29±0.24	**5.70**	N. S	N. S	N. S
Overall lines		**5.81**	**5.53**				
	M	75.13±0.7	74.44±0.4	**74.98**			
Edible meat parts	**F**	75.17±0.8	74.95±0.5	**75.13**	N. S	N. S	N. S
Overall		**75.15**	**74.67**				

[a and b] Means within the same row with different letters are significantly different.

M= Male and F- Female

Relative breast, thigh and drumstick weights:

The livestock characteristics may be observed through both quantitative and qualitative features, with the quantitative attribute being connected to the animal's economic traits. However, qualitative traits like body shape (body length, shank length, keel length and other body measurements) and feather colour, may be associated with quantitative traits (Ismoyowati *et al.*, 2017). Relative breast, thigh and drumstick muscle weight of duck as affected by feather color, sex and their interaction are presented in Table (3).

Table (3): Effect of feather color on relative Muscles of Domyati duck.

Traits	Sex	Domyati ducks		Overall (Lx)	Prob.		
		Brown	White		Feather	Sex	L*Sx
Thigh	**M**	6.93±0.33	6.62±0.6	**6.86**			
	F	7.15±0.2	6.33±0.5	**7.01**	**N. S**	**N. S**	**N. S**
Overall		**7.04**	**6.49**				
Drum	**M**	9.56±0.2	9.86±0.3	**9.63**			
	F	9.35±0.3	9.74±0.3	**9.42**	**N. S**	**N. S**	**N. S**
Overall		**9.45**	**9.81**				
Major	**M**	8.25±0.2	8.85±0.2	**8.37**			
	F	8.63±0.1	9.23±0.5	**8.73**	**.05**	**N. S**	**N. S**
Overall		**8.44[b]**	**9.02[a]**				
	M	1.100±0.06	1.08±0.1	**1.09**	**N. S**	**N. S**	
Minor.	**F**	1.15±0.04	1.20±0.1	**1.16**			**N. S**
Overall		**1.12**	**1.13**				
	M	9.35±0.26	9.94±0.2	**9.47**			
Breast	**F**	9.78±0.19	10.43±0.6	**9.90**	**N. S**	**N. S**	**N. S**
Overall		**9.57**	**10.16**				

[a and b] Means within the same row with different letters are significantly different.

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M= Male and F- Female

There was a significant difference between both phenotypes for relative major pectorals muscle weight, the BF ducks had the lowest relative major compared to WF ducks, However, no significant difference in feather colour, sex and their interaction for remaining traits. Many investigators reported that the raising method is one of the multiple non-genetic factors that may highly affect carcass traits (Erisir *et al.*, 2009). Thus, to produce duck meat of higher quality, ducks must be kept under

environmental and management conditions that ensure the saving of acceptable level of welfare (Onbasilar & Yalçin, 2018).

Relative gizzard fat, abdominal fat, skin, neck and wings weight:

Information relevant to relative gizzard fat, abdominal fat, skin, neck and wings for different duck strains was clarified in Table (4). It could be noticed that there is no significant effect of feather colour or sex or their interaction on relative gizzard fat, abdominal fat, skin, neck and wings. Yakan *et al.* (2012) and Kırmızıbayrak and Boğa (2018) pointed out that there was no significant effect of feather colour on geese carcass traits.

Table (4): Effect of feather colour on relative Fats of Domyati duck.

Items	Sex	Domyati		Overall (Lx)	Prob.		
		Brown	white		Line	Sex	L*Sx
Gizzard Fat	**M**	0.17±0.02	0.1±0.02	0.16			
	F	0.16±0.01	0.21±0.02	0.17	N. S	N. S	0.04
Overall	0.17		0.15				
Abdominal fat	**M**	1.41±0.2	2.20±0.6	1.58			
	F	1.45±0.2	2.04±0.7	1.55	N. S	N. S	N. S
Overall	1.43		2.13				
Skin	**M**	8.36±0.2	8.53±0.2	8.40			
	F	7.88±0.2	8.48±0.7	7.99	N. S	N. S	N. S
Overall	8.11		8.51				
Neck	**M**	4.88±0.1	5.00±0.1	4.91			
	F	4.87±0.1	4.92±0.2	4.88	N. S	N. S	N. S
Overall	4.87		4.96				
Skeleton	**M**	10.36±0.2	10.24±0.2	10.33			
	F	10.27±0.2	10.77±0.02	10.36	N. S	N. S	N. S
Overall	10.31		10.48				
Wings	**M**	8.77±0.2	8.23±0.07	8.65			
	F	9.20±0.2	8.71±0.2	9.11	N. S	N. S	N. S
Overall	8.99		8.44				

[a and b] *Means within the same row with different letters are significantly different.*

M= Male and F- Female

Correlation:

The correlation among carcass traits were presented in Table (5 and 6), through Table (5), we notice that, the most of the traits are related to each other, and have a high positive correlation. the rest of the traits and body weight have a low positive correlation.

In Table (6), we find the same trend among the traits, except for gizzard fat, where the relationship between it and body weight, abdominal fat, and non-edible meat parts in Domyatia brown color has a weak negative correlation, while there is a highly positive correlation in white color for the same traits.

Phenotypic correlations of weight traits were usually positive and high. Similar results for duck populations were generally reported by previous studies (Mazanowski A and Książkiewicz 2004; Gaya *et al.*, 2006; Xu *et al.*, 2011; Deng e*t al.*, 2019; Kokoszyński *et al.*, 2019).

Breast and leg muscle weight, and carcass weight positively correlated with shank length and trunk with neck length, which was partly confirmed in our study. Dressing percentage showed positive and low correlations with weight traits, which is consistent with a previous study (Kokoszyński *et al.*, 2019).

Table (5): Pearson Correlations between BW and non-edible parts for Brown (upper) and White (lower)

Items		BW	Blood	Leg	Head	Nonedible	Gizzard Fat	Abdominal Fat	Skin
BW	Pearson Correlation	1	.827**	.987**	.977**	.943**	.684**	.895**	.957**
	Sig. (2-tailed)		.000	.000	.000	.000	.000	.000	.000
blood	Pearson Correlation	.931**	1	.857**	.847**	.865**	.712**	.901**	.870**
	Sig. (2-tailed)	.000		.000	.000	.000	.000	.000	.000
Leg	Pearson Correlation	.908**	.914**	1	.977**	.948**	.701**	.912**	.976**
	Sig. (2-tailed)	.000	.000		.000	.000	.000	.000	.000
Head	Pearson Correlation	.947**	.966**	.953**	1	.934**	.765**	.929**	.960**
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.000	.000
Nonedible	Pearson Correlation	.975**	.937**	.886**	.949**	1	.673**	.928**	.953**
	Sig. (2-tailed)	.000	.000	.001	.000		.000	.000	.000
Gizzard Fat	Pearson Correlation	-.155	-.037	-.180	-.034	-.117	1	.780**	.735**
	Sig. (2-tailed)	.669	.920	.618	.925	.748		.000	.000
Abdominal Fat	Pearson Correlation	.716*	.829**	.637*	.752*	.754*	.258	1	.940**
	Sig. (2-tailed)	.020	.003	.047	.012	.012	.471		.000
Skin	Pearson Correlation	.821**	.917**	.938**	.932**	.821**	.120	.777**	1
	Sig. (2-tailed)	.004	.000	.000	.000	.004	.742	.008	

***. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed)*

Table (6): Pearson Correlations between BW and edible parts for Brown (upper) and White (lower).

Items		BW	liver	Dressed	Gizzard	Heart	Giblets	Thigh	Drum	Breast
BW	Pearson Correlation	1	.925**	.956**	.922**	.870**	.935**	.884**	.906**	.915**
	Sig. (2-tailed)		.000	.000	.000	.000	.000	.000	.000	.000
Liver	Pearson Correlation	.942**	1	.934**	.899**	.864**	.944**	.915**	.901**	.929**
	Sig. (2-tailed)	.000		.000	.000	.000	.000	.000	.000	.000
Dressed	Pearson Correlation	.992**	.929**	1	.940**	.851**	.961**	.887**	.896**	.875**
	Sig. (2-tailed)	.000	.000		.000	.000	.000	.000	.000	.000
gizzard	Pearson Correlation	.907**	.875**	.906**	1	.915**	.963**	.922**	.861**	.904**
	Sig. (2-tailed)	.000	.001	.000		.000	.000	.000	.000	.000
heart	Pearson Correlation	.931**	.908**	.925**	.925**	1	.924**	.972**	.880**	.941**
	Sig. (2-tailed)	.000	.000	.000	.000		.000	.000	.000	.000
giblets	Pearson Correlation	.940**	.953**	.936**	.938**	.914**	1	.935**	.884**	.921**
	Sig. (2-tailed)	.000	.000	.000	.000	.000		.000	.000	.000
Thigh	Pearson Correlation	.846**	.831**	.832**	.860**	.892**	.780**	1	.882**	.942**
	Sig. (2-tailed)	.002	.003	.003	.001	.001	.008		.000	.000
Drum	Pearson Correlation	.891**	.957**	.882**	.936**	.916**	.951**	.886**	1	.909**
	Sig. (2-tailed)	.001	.000	.001	.000	.000	.000	.001		.000
Breast	Pearson Correlation	.818**	.836**	.808**	.914**	.922**	.877**	.900**	.925**	1
	Sig. (2-tailed)	.004	.003	.005	.000	.000	.001	.000	.000	

***. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).*

CONCLUSION

There effect of feather color of Domyati ducks on body weight, relative heart, breast muscles. Both white and brown Domyati duck had significant higher positive correlation all traits, except gizzard fat showed negative correlation on white Domyati ducks. We recommend increasing the number of WF ducks as new line from Domyati ducks.

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مقارنة لصفات الذبيحة في البط الدمياطي الأبيض والبني

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تهدف هذه الدراسة الي استكشاف تأثير لون الريش علي صفات الذبيحة في البط الدمياطي. 169 بطة عمر يوم تم تقسيمهم حسب لون الريش الي بط دمياطي أبيض وبط دمياطي بني. نسبة توزيع اللون الأبيض 9% والبني 91%. تم أخذ صفات الذبيحة علي عمر التسويق (8 أسابيع). 16 طائر (8 ذكور+ 8 إناث) من كل سلالة تم ذبحهم، تم قياس صفات الأجزاء الغير مأكولة (الدم – الريش – الأرجل – الرأس– الأحشاء) والأجزاء المأكوله (الذبيحة مجوفه – الكبد – القونصه – القلب)، العضلات (الكبرى – الصغري – thigh – drumstick) الدهون (دهن البط – دهن القونصه – الجلد) وأيضا الرقبه والجناح والهيكل تم قياسهم. سجل البط ذو لون الريش الأبيض وزن جسم اعلي معنويا من البط ذو لون الريش البني. وايضا كانت الذكور أعلي معنويا من الإناث لوزن الجسم. لم يكن التداخل بين لون الريش والجنس معنويا. لم يكن هناك تأثير معنوي للون الريش او الجنس على الأجزاء الغير مأكوله والدهن والرقبه والجناح والهيكل. ومع ذلك سجل البط ذو لون الريش البني معنويه أعلي للوزن النسبي للقلب وايضا كانت الاناث أعلي معنويا للوزن النسبي للقلب مقارنة بالذكور ولكن التداخل بين اللون والسلالة لم يكن معنويا. وفي الملخص لم يكن هناك تأثير معنوي للون الريش علي صفات الذبيحة خلال هذه الدراسة.

الكلمات الداله: *لون الريش، صفات الذبيحة، الأجزاء المأكوله, مالارد محلي, بط دمياطي*