

Conclusions

The cows descended from Dutch bulls were characterized by the highest milk productivity.

A fat content below 4% was recorded in milk from the cows by American sires; their milk was also poorest in protein (3,14%).

The highest protein to fat ratio, observed in Dutch cows, resulted from the highest protein content of their milk (3.32%).

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SUITABILITY OF MULTIPLE REGRESSION EQUATIONS FOR ESTIMATING BREAST AND LEG MUSCLE CONTENT IN MUSCOVY DUCKS

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Introduction

Muscovy ducks, similarly as chickens and turkeys, can be used for meat production. The carcass dressing percentage of Muscovy ducks is about 74% (5). Carcasses of Muscovy ducks, compared with those of Pekin ducks, usually contain more breast and leg muscles (1,2,3). Further selection within this species towards meatiness improvement requires reliable methods for meat content prediction. Thus, the objective of the present study was to develop multiple regression equations for intravital estimation of breast and leg muscle content in Muscovy ducks.

Materials and Methods

The experimental materials comprised 240 White Muscovy ducklings (120 ♂ and 120 ♀). The birds were reared according to relevant technological standards (4,6). They were fed *ad libitum* commercial diets: a starter diet (from one day to three weeks of age) containing 22.51% crude protein (CP) and 12.31 MJ metabolizable energy (ME), and a grower diet (from four weeks of age to the end of the experimental period) containing 20.07% CP and 12.79 MJ ME).

116 females aged 10 weeks and 112 males aged 12 weeks were randomly selected for slaughter. Before slaughter the ducks were weighed and the following body measurements were taken: length of: bird, trunk, upper arm, thigh, drumstick, and breast-bone crest; humerus width; chest girth, chest depth. A statistical analysis included the determination of characteristics of particular traits (\bar{x} and v), calculation of coefficients of simple correlation between body weight and measurements, and the content (g and %) of breast muscles and leg muscles in ducks, derivation of multiple regression equations, assessment of suitability of these equations for predicting the content of particular tissue components. Regression equations were derived by selection of variables by stepwise regression (Statistica for Windows, StatSoft, Inc 1995).

Results

The birds showed considerable sexual dimorphism in body weights and measurements (Table 1). This is consistent with findings of other authors (1,2,3,5). In both females and males the highest correlation was recorded between the weight of breast and leg muscles (Y_1) and body weight X_1 ($r > 0.74$), chest girth X_8 ($r > 0.55$), humerus width X_9 ($r > 0.50$), length of bird X_2 ($r > 0.40$) and drumstick length X_6 ($r > 0.29$). The coefficients of simple correlation between the total percentage of breast and leg muscles (Y_2) and body measurements were generally low and statistically non-significant. A relatively high correlation was observed only between this trait and body weight in both sexes ($r_{\sigma} = -0.296$; $r_{\text{♀}} = -0.207$).

The multiple regression equations (Table 2) developed in this study to estimate total weights of breast and leg muscles in Muscovy ducks show small standard errors of dependent variable estimation ($S_{\hat{y}} < 67.5$ g), high values of multiple correlation coefficients ($R > 0.7$), and quite high values of determination coefficients ($D > 58\%$). The multiple regression equations for predicting tissue component percentages provided less accurate results of dependent variable estimation. The values of multiple correlation coefficients varied from 0.412 to 0.629, and the coefficients of determination did not exceed 40%.

Table 1. Arithmetic means (\bar{X}) and coefficients of variation (v) of traits and coefficients of simple correlation (r) between the traits and the content (g and %) of breast and leg muscles in Muscovy ducks

Specification	Variable	Sex	Statistical measures		r	
			\bar{X}	v	Y ₁	Y ₂
Body weight before slaughter (g)	X ₁	♂	5147**	7,89	0,740	-0,296
		♀	2750	7,34	0,776	-0,207
		♂♀	3935	31,58	0,984	0,462
Body measurements (cm): Length of: bird	X ₂	♂	55,79**	3,43	0,403	-0,100
		♀	44,10	2,63	0,422	-0,179
		♂♀	49,88	12,17	0,962	0,492
trunk	X ₃	♂	35,86**	4,67	0,258	-0,270
		♀	27,35	4,31	0,369	-0,096
		♂♀	31,55	14,27	0,940	0,453
upper arm	X ₄	♂	15,69**	3,26	0,511	0,015
		♀	12,32	3,31	0,197	0,026
		♂♀	13,99	12,25	0,962	0,523
thigh	X ₅	♂	11,00**	4,91	0,196	0,085
		♀	8,36	4,94	0,178	0,047
		♂♀	9,67	14,55	0,927	0,526
drumstick	X ₆	♂	16,62**	3,44	0,437	-0,020
		♀	12,86	3,41	0,294	0,165
		♂♀	14,72	13,24	0,961	0,530
breast-bone crest	X ₇	♂	18,51**	3,20	0,377	-0,046
		♀	13,10	3,06	0,220	0,062
		♂♀	15,77	17,48	0,968	0,527
chest girth	X ₈	♂	45,84**	2,94	0,563	-0,202
		♀	36,79	3,22	0,554	0,056
		♂♀	41,27	11,42	0,969	0,496
humerus width	X ₉	♂	14,30**	3,38	0,507	-0,076
chest depth	X ₁₀	♀	10,82	3,14	0,506	-0,013
		♂	12,54	14,30	0,971	0,513
		♂♀	12,08**	9,85	0,334	-0,077
weight of breast and leg muscles (g)	Y ₁	♀	9,60	6,44	0,148	-0,179
		♂	10,82	14,41	0,816	0,376
		♂♀	1247,9**	8,24		
Percentage of breast and leg muscles in body weight (%)	Y ₂	♂	619,4	8,15		
		♀	930,2	34,96		
		♂♀	24,28**	5,73		
		♂	22,54	5,12		
		♂♀	23,40	6,61		

Means of sexes followed by ** differ significantly at $\alpha = 0.01$

Critical values of r: P_{0,05}: ♂ and ♀ - 0.205, ♂♀ - 0.138; P_{0,01}: ♂ and ♀ - 0.267, ♂♀ - 0.181

Table 2. Multiple regression equations for predicting the weight (g; \hat{Y}_1) and percentage (%; \hat{Y}_2) of breast and leg muscles in Muscovy ducks

No of equation	Sex	Data for independent variables ^a	Standard error of estimation $S_{\hat{Y}}$	Coefficient of	
				multiple correlation R	determination D (%)
1	♂	$\hat{Y}_1 = 0,178X_1 - 7,895X_3 + 37,857X_4 + 19,9$	67,5	0,764	58,37
2	♀	$\hat{Y}_1 = 0,163X_1 + 15,482X_6 + 6,813X_8 - 278,5$	30,7	0,799	63,84
3	♂♀	$\hat{Y}_1 = 0,168X_1 + 24,285X_4 + 17,174X_5 + 17,859X_7 - 519,7$	52,9	0,987	97,42
4	♂	$\hat{Y}_2 = -0,001X_1 + 0,200X_2 - 0,307X_3 + 0,659X_4 + 20,43$	1,28	0,432	18,66
5	♀	$\hat{Y}_2 = -0,002X_1 + 0,515X_6 + 0,331X_8 - 0,427X_{10} + 13,79$	1,07	0,412	16,97
6	♂♀	$\hat{Y}_2 = -0,002X_1 + 0,538X_6 + 0,374X_7 + 0,542X_9 + 9,71$	1,22	0,629	39,56

a – explanations of symbols of independent variables are given in Table 1

Conclusions

Among the multiple regression equations for predicting weights of breast and leg muscles (g) in Muscovy ducks, the most accurate results can be obtained using the equation based on data acquired for both sexes:

$$\hat{Y}_1 = 0.168X_1 + 24.285X_4 + 17.174X_5 + 17.859X_7 - 519.7.$$

The appropriate selection of independent variables for this equation is confirmed by a small standard error of dependent variable estimation ($S_{\hat{Y}} = 52.9g$) and a high value of the determination coefficient ($D = 97.42\%$).

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Summary

Suitability of Multiple Regression Equations for Estimating Breast and Leg Muscle Content in Muscovy Ducks

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The experimental materials comprised 240 White Muscovy ducklings (120 ♂ and 120 ♀). 116 females aged 10 weeks and 112 males aged 12 weeks were randomly selected for slaughter. Before slaughter the ducks were weighed and the eight body measurements were taken. The data on body weights and measurements provided the basis for developing multiple regression equations for predicting the weights and percentages of breast and leg muscles in females, males, and both sexes.

The most accurate results of predicting weights of breast and leg muscles (g) in Muscovy ducks can be obtained using the equation based on data acquired for both sexes:

$$\hat{Y}_1 = 0.168X_1 + 24.285X_4 + 17.174X_5 + 17.859X_7 - 519.7.$$

The appropriate selection of independent variables for this equation is confirmed by a small standard error of dependent variable estimation ($S_{\hat{Y}} = 52.9\text{g}$) and a high value of the determination coefficient ($D = 97.42\%$).

Key words: Muscovy ducks, breast muscles, leg muscles, regression equations.

Резюме

Пригодность уравнений множественной регрессии для оценки содержания грудных мышц и ног мускусных уток

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Опытным материалом являлись 240 цыплята белых мускусных уток (120 ♂ и 120 ♀). До убоя отобрали при помощи жеребевки 116 самок в возрасте 10 недель и 112 самцов в возрасте 12 недель. Перед убоем птицы взвесили и сделали 8 измерений тела. На основании данных касающихся массы и процентной доли грудных мышц и ног у селезней и уток совместно двух полов.

Наиболее точные результаты вычисления массы и грудных мышц и ног у мускусных уток получено применяя уравнение на данных птиц совместно двух полов:

$$\hat{Y}_1 = 0,168X_1 + 24,285X_4 + 17,174X_5 + 17,859X_7 - 519,7.$$

О соответственном выборе независимых переменных в этом уравнении свидетельствует невеликая ошибка оценки зависимой переменной ($S_{\hat{Y}}=52,9\text{g}$) и большая стоимость коэффициента детерминации ($D = 97,42\%$).