Reproductive Performance of F1 Pekin Duck Breeders Selected with Ultrasound Scanning for Breast Muscle Thickness and the Effect of Selection on F2 Growth and Muscle Measurement

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Introduction

Reducing fatness in farm animals has been most successful with pigs by selective breeding because the body fat in the pig is mainly subcutaneous and its measurement on live animals can be assessed. Duck fat distribution follows closely a similar pattern as in the pig since the body fat presence in this poultry species is the subcutaneous deposits that cannot be removed during processing. However, reducing body fat content in pigs resulted in poor reproductive performance. In poultry, selection for maximum weight gain has led to increased body fatness which negatively correlates with body protein, which in turn positively correlates with egg production. Although improving carcass quality of meat type ducks is an objective and a necessity, the effect of selection for breast muscle thickness using the ultrasound on reproduction of the breeders and the continuity of response of the progeny in term of breast muscle thickness is unknown.

Objective

The objective of this study is to assess the effect of selection for breast muscle thickness in Pekin ducks on reproduction and growth performance of their progeny.

Materials and Methods

The F1 duckling selected for control (C), body weight (BW), and breast muscle thickness (MT) were identified by line (C, BW, MT) with wing bands at day of hatching. At 47 d of age, 120 females and 25 males per line were selected for the same criteria and randomly assigned to floor pens with 30 females and 5 males per pen (0.186 m^2 / bird) and 4 pens per line. The selected breeders were fed a conventional breeder diet up to 23 wk of age. The feeding program was restricted in term of feed quantity to ensure an appropriate breeding weight before reaching laying period. The proximate analysis of the diet is presented in Table 1. The eggs were collected, dated, marked by line and pen, individually weighed, and incubated. Four hatches of F2 ducklings were identified with wing bands at hatching and raised on floor. At 7 and 23 wk of age, the ducklings were weighed and their total breast and breast muscle thickness were measured with an ultrasound scanner. The data were analyzed as repeated measures

Table 1 : Proximate analysis of the breeder diet

Component	DM %	EE %	CP %	ADF %	ASH %	Ca %	P %	GE kcal/g
Value	89.99	5.64	20.48	9.77	3.20	2.60	0.56	4.219

Results and Discussion

The effects of line of selection and sex on body weight, total breast, and breast muscle thickness of the F1 Pekin breeders at 7 and 23 wk of age are presented in Table 2. There was no interaction between line and sex for any of the parameters considered. There was a significant ($P<0.05$) difference in body weights among the 3 lines with weight 3.49, 3.13, and 2.89 kg for BW, MT and C, respectively. That order of difference was not the same for total breast and breast muscle thickness where MT had significantly ($P<0.05$) higher measurement than C and BW indicating that the heavier ducks do not necessarily possess more breast muscle. The same birds were weighed and measured at 23 wk of age, and the data show similar differences ($P<0.05$) in body weights among the lines but no significant

(P>0.05) differences in total breast and breast muscle thickness (Table 2). This loss of significance between wk 7 and wk 23 can be explained by the MT birds being most affected by the restricted feeding that may have slowed their breast muscle growth. Sex had an effect at both 7 and 23 wk where males were significantly heavier and had higher breast measurement than females (Table 2). The lack of a significance interaction indicated that the MT males or females possessed higher breast muscle thickness than BW and C males and females.

The reproductive performance of the F1 breeders from 23 to 31 wk of age is presented in Table 3. There was no significant (P>0.05) difference among lines in feed consumption and egg number per duck. The BW breeders laid eggs significantly (P<0.05) heavier than those of C, while there was no difference between MT and C. The BW eggs included a high percentage of double yolk eggs that were culled from incubation. In addition, BW showed significantly (P<0.05) lower percent fertility and percent hatching of fertile eggs compared to C and MT, while there was no difference between MT and C. These data indicate that the selection for breast muscle thickness had no effect on reproduction, but selection by body weight reduced reproductive performance.

The F2 ducklings showed similar differences in body weight and breast measurements as those observed in the parents (Table 4). The BW birds were heavier (P<0.05) than C and MT, while the MT ducklings had higher (P<0.05) total breast and breast muscle thickness indicating the heretability of these traits by the response of the progeny to the selection.

Impact

These data support the feasibility of applying ultrasound scanning to measure breast muscle thickness of live Pekin ducks at market age. They also demonstrate that selection only for body weight had a negative effect on the reproductive performance and that the selection of the parents based on this trait seems to be highly heritable as it is reflected in the progeny. These results contribute to the knowledge on improving carcass quality in meat type Pekin ducks.

Table 2 : Effect of line (C, BW, MT) and sex (M, F) on body weight (kg), total beast (Total) and breast muscle (Muscle) thickness (mm) of Pekin breeders at 7 and 23 wk of age

		7 wk of age			23 wk of age		
Line	Sex	Body Wt	Total	Muscle	Body Wt	Total	Muscle
C	M	3.06	11.59	9.21	3.65	17.34	12.75
C	F	2.72	10.90	8.41	3.09	15.54	11.33
BW	M	3.70	12.05	9.41	4.54	18.00	13.68
BW	F	3.29	11.44	8.83	3.85	16.44	12.59
MT	M	3.32	13.43	11.01	3.91	18.33	13.85
MT	F	2.93	12.67	10.27	3.32	16.12	12.22
SEM		0.07	0.21	0.21	0.11	0.34	0.30
		Probabilities					
Line		0.0001	0.0001	0.0001	0.0003	0.4841	0.2189
Sex		0.0001	0.0116	0.0100	0.0003	0.0062	0.0204
Line*Sex		0.8196	0.9709	0.9261	0.9093	0.9036	0.9162
Main Effects							
Line	C	2.89 [c]	11.24 [b]	8.81 [b]	3.37 [c]	16.44	12.04
	BW	3.49 [a]	11.74 [b]	9.12 [b]	4.20 [a]	17.22	13.13
	MT	3.13 [b]	13.05 [a]	10.64 [a]	3.62 [b]	17.23	13.04
Sex	M	3.36 [a]	12.35 [a]	9.87 [a]	4.03 [a]	17.89 [a]	13.43 [a]
	F	2.98 [b]	11.67 [b]	9.17 [b]	3.42 [b]	16.03 [b]	12.05 [b]

[ab] Means within columns with no common superscripts differ significantly (P < 0.05)

Table 3 : Effect of line on weight gain, feed consumption (FC), egg number, egg mass, % fertility, and % hatching of fertile eggs of breeder ducks from 23 to 31 wk of age

Line	Wt gain (kg)	FC (kg)	Egg Number	Egg mass (g)	%fertility	%hatching
C	0.213	12.78	38.02	83.67 [b]	65 [a]	68 [a]
BW	0.108	12.63	37.06	93.81 [a]	37 [b]	52 [b]
MT	0.178	12.86	41.66	85.98 [b]	61 [a]	64 [a]
SEM	0.03	0.28	1.03	1.47	2.05	2.19

[ab] Means within columns with no common superscripts differ significantly ($P < 0.05$)

Table 4. Mean body weight and breast measurements at 47 days of age of F2 progeny of control and selected parents

Line	n	BWt (kg)	TOT (mm)	MT (mm)
C	446	3.17 [c]	11.41 [b]	8.04 [b]
BW	99	3.66 [a]	11.46 [b]	8.14 [b]
MT	419	3.31 [b]	12.61 [a]	9.28 [a]
SEM		0.01	0.05	0.05

[ab] Means with different superscripts in the same column differ significantly ($P<0.05$)