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EFFECT OF GENERATION, LINE, SEX AND FEEDING SYSTEM ON SOME PRODUCTIVE TRAITS DURING GROWING PERIOD IN PEKIN DUCKS

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ABSTRACT : *The present work was carried out in the Farm of French group at Sadat City, El Menofiya Government, which cooperated with the French Gourmand (Duck breeders) selection group. The experiment was conducted in 2012 for two generations, in order to, study the effect of generations, lines, sexes, and feeding systems on some productive traits of parent stock females of two lines, PKL (light line) and PKM (medium line) of Pekin ducks during the rearing period. One thousand and sixty hundred (1600) duckling were used. Each line (PKL) and PKM) was represented by 800 ducklings, 400 ducklings for each generation.*

The following results were obtained

1. *Generation had highly significant effect on body weight from 5 to 7 wk of age. These differences were due to the genetic differences between the two lines.*
2. *Sex had highly significant effect on body weight, and males were heavier than females.*
3. *Feeding system had highly significant effect on body weight from 4 to 7 wk of age. Birds under two meals feeding system had heavier body weight and gained higher body weight gain than those supplied with ad libtum feeding system.*
4. *Birds fed two meals daily grew faster than those fed ad libtum.*
5. *Better feed efficiency for Pekin medium line (PKM) than those for Pekin light line (PKL) and this may be due to the genotype effect of each line.*

Key words : *Body weight, feed efficiency, and feeding system.*

INTRODUCTION

Like the meat production of all poultry species, the world duck meat demand and production is still increasing. In 2009, 3.8 million tones of duck meat was produced in world, this value is about one million more than the value in year 2000 and one million and 3000 tones than 2006 (Hans, 2008 and Ariane, 2012). The Egyptian duck production was 42000 tones in 2006 and it is equal to 1.7 % from the world production in this year (2 millions and 5000 tones). By this production capacity, Egypt take the second place after China (2 million and 383 thousand tones or 94.3 % from the world production (Hans, 2008). According to Ministry of Agriculture and land reclamation (Egyptian statisticstics of poultry, 2012), the number of Egyptian farms are 588 overall Egypt and the number of activated houses are 813. The total number of duck layers (activated) 1,650,956 and the deactivated capacity were 686277.

Feed restriction during rearing period of ducks and regulation of feed intake by restricted the time of feeding during the rearing period are a potential means of reducing feed costs and may be improve the efficiency of meat production from ducks.

The present study was undertaken to determine the effect of some factors such as generations, lines, sexes and feeding system on body weight and feed efficiency of parent stock ducks (Pekin ducks) under the conditions of commercial farmers in Egypt.

MATERIALS AND METHODS

The present work was carried out in the Farm of French group at Sadat City, El Menofiya Government, which cooperated with the French Gourmand (Duck breeders) selection group. The experiment was conducted in 2012 for two generations, in order to, study the effect of generations,

lines, sexes, and feeding systems on some productive traits of duckling of Pekin ducks.

Pekin duck lines :

Two lines of Pekin ducks (PKL, light line) and (PKM, medium line) were used during the rearing periods. One thousand and sixty hundreds (1600) female ducks were used. Each line (PKL) and PKM) was represented by 800 ducklings, 400 ducklings for each generation. Two feeding systems were applied, two meals each day and *ad libtum*. Table (1) illustrate the distribution of birds in each line and each generation on the different feeding systems.

Stock management :

A total number of 800 birds in each generation were used. One day ducklings from both lines (PKL and PKM) were exported from French Gourmand selection group (Duck breeders) in Cooperation with the Egyptian French group at Sadat City. The ducklings were grouped in Parcs 200 around a heater (not more than 20 ducklings / m^2) at 35°C, and the house temperature was recorded daily. The house was divided to 8 separate departments. These departments were used as 4 departments for the PKL line and 4 for the PKM line. Each sex of each line with one type of feeding system was represented with 100 ducklings (Table 1).

Table (1) : Distribution of birds on treatment factors.

Generation	Strain	Sex	Feeding system	No. birds
G1	PKM	Males	*Ad. Lib.*	100
	PKM	Males	Two meals	100
	PKM	Female	Two meals	100
	PKM	Female	*Ad. Lib.*	100
	PKM			400
G1	PKL	Males	*Ad. Lib.*	100
	PKL	Males	Two meals	100
	PKL	Female	Two meals	100
	PKL	Female	*Ad. Lib.*	100
	PKL			400
Total G1				800
G2	PKM	Males	*Ad. Lib.*	100
	PKM	Males	Two meals	100
	PKM	Female	Two meals	100
	PKM	Female	*Ad. Lib.*	100
	PKM			400
G2	PKL	Males	*Ad. Lib.*	100
	PKL	Males	Two meals	100
	PKL	Female	Two meals	100
	PKL	Female	*Ad. Lib.*	100
	PKL			400
Total G2				800
Total birds				1600

The temperature falls 1°C every days after 5 days and will be at 25 – 26°C at 4 weeks. The light program was 24 hours at the first four days then 22 hours till the end of rearing period. The light intensity was 40 lux for the first 4 days, then it is 10 lux till the end of rearing period. The water system was 1 circular drinker for 50 ducklings, at 1 – 5 days, then, 1 for 80 ducklings at 6 – 16 days, and 1 for 100 at 17 – 50 days.

Feeding composition :

Table (2) presented the composition of the experimental diet. Ducklings were fed *ad libitum* from one day till 4 weeks. Ducklings were fed with starter diet from one day till 4 weeks, then from 4 – 6 weeks with grower diet, then in the last week, ducklings fed a finisher diet.

Feed Consumption was recorded for each 100 birds per period till 50 days of age. Period 1 (one day – 28 days) and period 2 (28 – 50 days). Body weight of birds were recorded weekly also died birds were recorded till age of market.

Studied traits : The following traits were measured :

1. Body weights at one day, 1, 2, 3, 4, 5, 6 and 7 weeks of age.
2. Feed consumption (FC) (Kg per bird per period) and feed efficiency (FE) g feed / g gain were calculated from 1 – 28 days of age and from 28 – 50 days of age.

Table (2) : Composition of the experimental diet (Kg / Ton).

Ingredients	Starter 1–4 wks	Growing 4-6 wks	Finishing 6-7 wk
Yellow corn	615	662.5	697
Soybean meal (44%)	325	273	220
Limestone	18	17	17.5
Premix	3	3	3
Mono\Mineral	18	18	18
Salt	4	3	3
Oil	0	7	25
Methioneen	2	1.5	1.5
Fish meal (72%)	15	15	15
Total	1000	1000	1000
Calculated analysis :			
Energy Kcal/Kg diet	2845.56	2952.57	3108.75
Crude protein %	20.2	18.10	16.03
Methionine %	0.55	0.47	0.44
Cysteine %	0.84	0.74	0.68
Lysine %	1.08	0.94	0.79
Cal. %	1.04	0.97	0.96
Available (P) %	0.50	0.47	0.43
Sodium %	0.16	0.16	0.16

3. Growth rates and body weight gain were calculated according to Brody (1945).
   Body weight gain = body weight at (t) ages (W2) – body weight at (t – 1) ages (W1).

$$\text{Growth rate} = \frac{W2 - W1}{½\,(W2 + W1)} \times 100$$

Statistical analysis :

Data were computerized and analyzed (SPSS 1997) according to the following Model. Also, significant difference among means were detected by Duncan (1955).

$Y_{ijkm} = \mu + G_i + L_j + S_K + F_m + (GxL)_{ij} + (GxS)_{iK} + (GxF)_{im} + Y_{iokmn} (LxS)_{jK} + (LXF)_{jm} + (FxLxS)_{mjK} + (GxLxF)_{ijm} + (GxSxF)_{iKm} + (LxSxF)_{jKm} + (GxLxSxF)_{ijKm} + e_{ijkmn}$.

Where :

Y_{ijkmm} =Observation from generation I, line j, Sex k and feeding system m.
G_i = Fixed effect of (i) generation.
L_j = Fixed effect of (j) line.
S_K = Fixed effect of (K) sex.
F_m = fixed effect of (m) feeding system
$(GxL)_{ij}$ = Interaction effect of G_i and L_j.
$(GxS)_{iK}$ = Interaction effect of G_i and S_K.
$(GxF)_{im}$ = Interaction effect of G_i and F_m.
$(LxS)_{jK}$ = Interaction effect of (L_j and S_K.
$(LxF)_{jm}$ = Interaction effect of L_j and F_m.
$(FxS)_{mK}$ = Interaction effect of S_K and F_m.
$(GxLxS)_{ijk}$ = Interaction effect of G_i, L_j and S_K.
$(GxLxF)_{ijm}$= Interaction effect of gi, L_j and F_M.
$(GxSxF)_{ikm}$= Interaction effect of G_i, S_K and F_m.
$(GxLxSxF)_{ijkm}$ = Interaction effect of G_i, L_j, S_K and F_m.
e_{ijkmn} = Residral effect.

RESULTS AND DISCUSSION :

1. Weekly body weight, body weight gain and growth rates:

Table (3) illustrated that generations did not affect body weight at one day, 1, 2, 3 and 4 weeks of age and significantly affect body weight at 5, 6 and 7 weeks of age. The difference between the two lines among all growing weeks was highly significant, and This was due to the genetic difference between the two lines, where the first line (PKM) had genetically medium weight, but the second line (PKL) have low weights. Also, sex effect was highly significant and males were heavier than females.

The effect of feeding system was highly significant at the latest 4 weeks of growing, because the feeding system was applied from 4 – 8 weeks. Most of interactions effects were not significant except (L*S), (L * F) and (F * S) and these may be due to the significant effect of these strong factors (L, S and F).

These results indicate that birds under two meals feeding system had higher body weight than those under *ad libtum* feeding system. The present results are similar to the results reported by Mihaylov (2009) who explained that breed differences by the weight and length of the intestinal tract had highly significant effect on Pekin, Muscovy and Mallard ducks.

Table (3) illustrated also the effect of sex, the male ducks of both lines were heavier than females, similar finding was noticed by Tai *et al.* (1991), Bochno *et al.* (1992), Fattouh (1994), Mariaca and Blaha (2006) and Hay and Scott (2007).

Table (4) showed body weight gain as affected by different factors. Pekin medium line (PKM) had significantly higher body weight gain at (one day – 1 week.), (1 -2), (2 – 3), (3 – 4) and (5–6) wks., where PKL line had higher body weight gain at (4 – 5) and (6 – 7) weeks of age. Also, ducklings supplied with *ad Libtum* feeding system were gained less body weight gain than those under two meals feeding system. In addition, males gained significantly more body weight gain than female, in all growing period except at (4 – 5) and (6 – 7) weeks of age (Table 4).

Table (5) illustrated that PKM ducklings gained 2856.91 g and PKL have 2891.07 g

from one day - 7 weeks of age. The PKL line had higher significantly body weight gain during the period from one day old to 7-wk ($P \leq 0.05$). Ducklings under two meals

Table 3

Table 4

Table 5

feeding system gained higher body weight gain (3631.87 g) than those of ducklings with *ad libtum* feeding system (2116.12 (g)) at one day - 7 weeks of age (Table 5).

Similarly, Pekin line differences in body weight gain and effect of restricted feeding systems were found and noticed by Bochno *et al.* (1992), Fattouh (1994), Hay and scott (2007) and Mihaylov (2009) and recently, Kokoszynski and Bernacki (2011) and Sar *et al.* (2012).

Growth rates of the first period (one day – 1 wk.) were higher than all interval periods under all factor effects (Table 6). Also, it could be noticed that growth rates were decreased by increasing age of birds till 8 weeks of age.

Birds fed two meals daily grew faster than those fed *ad libtum*, (Table 6). Most of interaction effects were not significant. However, Fig. (1) and Fig. (2) illustrate the interaction effect for body weight at 8 weeks of age and growth rates at 1 day – 7 weeks of age. Both figures showed the performance of birds of both lines according to feeding system and sex in each generation, where PKL line had better performance than PKM under two meals feeding system with higher body weight at 7 weeks and higher growth rate than PKM birds. But PKM ducklings have better performance than PKL ducks with *ad Libtum* feeding system.

Kokosznski and Bernacki (2011) found similar significant difference between two lines of Pekin ducklings (P 44 and P 55) for growth rates at different ages.

2. Feed consumption and feed efficiency:

Highly significant differences between generations and also were noticed between lines and feeding systems (Table 7). Difference between sexes was obtained for feed consumption (1 – 28 days), feed efficiency at (1 – 28) and (28 – 50) days of age. Interaction effects were highly significant for all types of interaction for the previous traits, where these traits were strong affected by all factors in this study (generation, line, feeding system and sex). Similar finding was noticed by Aydn *et al.* (1994), El Ghamry (2004), Mariaca and Blaha (2006), Hower, Solomon *et al.* (2007) found insignificant differences between 3 genotypes of Pekin ducks in feed conversion rates when birds fed restricted diets (63, 74 and 100 of full feeding).

In respect, of line effects, overall means were 2.03, 5.37 Kg / bird / period in PKM line at 1 – 28 days and 28 – 50 days, respectively. Corresponding values for PKL line were 2.20 and 5.71 at 1 -28 and 28–50 day, respectively (Table 7). It is clear that PKL line consumed more feed than those in PKM line at the same period. Also feed efficiency for (PKM) line were 2.12 and 2.83 (g feed / g gain) at 1 – 28 days and 28–50 days, respectively, where it were 2.98 and 3.49 for (PKL) line at (1 – 28 day), (28 – 50) days (Table 7). These results leads to better feed efficiency for PKM line than those for PKL line and this may be due to genotype effect of each line. Similar lines or genotype differences were noticed by Ptitzevodstvo (1991) who reported that feed consummation per Kg gain was ranged from 2.88, 3.91, 3.91 and 4.11 for Pekin, Muscovy, (AS) Ukrainian Ushite and Kombinatsiya 13, respectively.

Table 6

Fig 1

Fig 2

Table 7

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تأثير كل من الجيل والخط والجنس ، ونظام التغذية علي بعض الصفات الإنتاجية خلال فترة النمو في البط البكين

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الملخـص العــربي

أجريت هذه الدراسة بمزرعة المجموعة الفرنسية بمدينة السادات بمحافظة المنوفية والتي تتعاون مع مجموعة جورماند الفرنسية لتربية البط والانتخاب . وأجريت التجربة خلال عام ٢٠١٢ لمدة جيلين من أجل دراسة تأثير الأجيال والخطوط والجنسين ونظام التغذية علي بعض الصفات الإنتاجية لقطعان أباء البط البكيني الإناث المكون من خطين ، خط PKL (خفيف الوزن) وخط PKM (متوسط الوزن) خلال فترة الرعاية . استخدم في التجربة عدد ١٦٠٠ من إناث البط وكان كل خط بعدد ٨٠٠ بطة صغيرة بمعدل ٤٠٠ بطة لكل جيل .

وكانت أهم النتائج ما يلي :

١ – وجد تأثير عالي المعنوية للجيل علي وزن الجسم من ٥ – ٧ أسابيع من العمر ، هذه الفروق ربما ترجع إلي الاختلافات الوراثية بين الخطين .

٢– وجد تأثير علي المعنوية للجنس علي وزن الجسم ، وحققت الذكور وزن أثقل من الإناث .

٣ – حقق نظام التغذية تأثير معنوي عالي علي وزن الجسم من ٤ – ٧ أسابيع من العمر . وقد وجد أن الطيور التي تغذي مرتين يوميا أثقل في وزن الجسم وحققت عائد في الوزن أكبر من الطيور التي تغذي للشبع .

٤ – وجد أن الطيور التي تغذي مرتين يوميا أسرع في النمو من الطيور التي تغذي للشبع .

٥ – كان خط البط البكين المتوسط الحجم ذو كفاءة غذائية أفضل من الطيور في خط البط الخفيف الحجم ، وربما يرجع ذلك إلي تأثير التركيب الوراثي في كل خط .

Table (3): Means and Standard errors of body weights at different ages as affected by generations, lines, feeding system and sex.

				$(\bar{X} \pm SE)$							
Generations	Lines	Feeding Systems	Sex	One day	W1	W2	W3	W4	W5	W6	W7
Generation1				72.4±0.06	256±0.54	830±3.03	1499±3.60	2048±11.21	2380±6.60b	2609±6.46^{b}	2899±5.15^{b}
Generation2				72.4±0.06	257±0.54	824±3.00	1499±3.57	2025±11.11	2398±6.55a	2736±6.41^{a}	2994±5.11^{a}
	PKM			73.6±0.06^{a}	266±0.54^{a}	850±3.03^{a}	1547±3.60^{a}	2068±11.21^{a}	2410±6.60^{a}	2778±6.46^{a}	2930±5.15^{b}
	PKL			71.3±0.06^{b}	246±0.54^{b}	804±3.00^{b}	1451±3.57^{b}	2005±11.11^{b}	2368±6.55^{b}	2567±6.41^{b}	2862±5.11^{a}
		Ad. lib.		72.4±0.06	256±0.54	828±3.01	1492±3.58^{b}	1759±11.14^{b}	1931±6.56^{b}	2078±6.42^{b}	2189±5.12^{b}
		Two meals		72.4±0.06	257±0.54	827±3.02	1507±3.59^{a}	2315±11.18^{a}	2846±6.59^{a}	3266±6.44a	3704±5.14^{a}
			Female	71.3±0.06^{b}	244±0.54^{b}	702±3.01^{b}	1358±3.58^{b}	1865±11.14^{b}	2243±6.56^{b}	2538±6.42^{b}	2838±5.12^{b}
			Male	73.5±0.06^{a}	269±0.54^{a}	952±3.02^{a}	1640±3.59^{a}	2208±11.18^{a}	2535±6.59^{a}	2807±6.44^{a}	3055±5.14^{a}
Generation1	PKM	*Ad. lib.*	Female	72.7±0.16	244±1.52	708±8.54	1400±10.16	1782±31.62	1841±18.63	2073±18.23	2137±14.54
			Male	74.2±0.16	285±1.52	991±8.54	1671±10.16	1894±31.62	2054±18.63	2233±18.23	2341±14.54
		Two meals	Female	72.7±0.16	248±1.53	713±8.59	1402±10.21	2104±31.79	2612±18.73	3248±18.32	3248±14.62
			Male	74.4±0.16	285±1.55	989±8.68	1709±10.32	2534±32.13	3034±18.93	3616±18.52	3616±14.77
	PKL	*Ad. lib.*	Female	69.8±0.16	240±1.52	698±8.54	1301±10.16	1577±31.62	1835±18.63	1955±18.23	2097±14.54
			Male	72.8±0.16	254±1.53	932±8.59	1578±10.21	1854±31.79	1968±18.73	2085±18.32	2182±14.62
		Two meals	Female	69.9±0.16	241±1.51	698±8.50	1323±10.11	2090±31.45	2626±18.53	2649±18.13	3641±14.46
			Male	72.6±0.16	250±1.52	911±8.54	1608±10.16	2549±31.62	3066±18.63	3016±18.23	3928±14.54
Generation2	PKM	*Ad. lib.*	Female	72.9±0.16	246±1.51	711±8.50	1413±10.11	1665±31.45	1938±18.53	2087±18.13	2176±14.46
			Male	74.4±0.16	287±1.52	982±8.54	1677±10.16	1912±31.62	2056±18.63	2184±18.23	2313±14.54
		Two meals	Female	72.7±0.16	248±1.52	714±8.54	1405±10.16	2105±31.62	2643±18.63	3167±18.23	3671±14.54
			Male	74.4±0.16	286±1.53	992±8.59	1703±10.21	2548±31.79	3099±18.73	3614±18.32	3941±14.62
	PKL	*Ad. lib.*	Female	69.8±0.16	240±1.51	690±8.46	1309±10.05	1570±31.29	1815±18.43	1935±18.04	2073±14.39
			Male	72.7±0.15	250±1.50	911±8.41	1585±10.00	1816±31.13	1942±18.34	2076±17.94	2188±14.32
		Two meals	Female	69.9±0.16	241±1.51	688±8.46	1312±10.05	2027±31.29	2633±18.43	3188±18.04	3659±14.39
			Male	72.7±0.16	253±1.51	908±8.46	1591±10.05	2560±31.29	3057±18.43	3633±18.04	3929±14.39

Means within the same column at the same factor carry different small superscripts are significant at level P ≤ 0.05,

Table (4) : Means and Standard error of interval body weight gain according to generations, lines, feeding system and sex.

Factors				Period of						
Generations	Line	Feeding	sex	1day-1wks	1-2wks	2-3 wks	3-4 wks	4-5 wks	5-6 wks	6-7 wks
Generation1				183.50±0.54	574.11±3.07	669.11±4.70	548.84±11.70	331.68±13.08^{b}	229.67±9.28^{b}	289.53±7.78^{a}
Generation2				184.10±0.54	567.86±3.05	674.91±4.66	526.00±11.60	372.59±12.97^{a}	337.60±9.20^{a}	258.49±7.71^{b}
	PKM			192.66±0.54^{a}	583.81±3.07^{a}	697.37±4.70^{a}	520.54±11.70^{b}	341.73±13.08	368.01±9.28^{a}	152.79±7.78^{b}
	PKL			174.93±0.54^{b}	558.17±3.05^{b}	646.64±4.66^{b}	554.30±11.60^{a}	362.54±12.97	199.25±9.20^{b}	395.23±7.71^{a}
		Ad. lib.		183.34±0.54	572.00±3.05^{a}	664.07±4.68^{b}	266.68±11.63^{b}	172.79±13.01^{b}	147.10±9.22^{b}	110.14±7.73^{b}
		Two meals		184.25±0.54	569.98±3.06^{b}	679.95±4.69^{a}	808.16±11.67^{a}	531.48±13.05^{a}	420.16±9.25^{a}	437.88±7.76^{a}
			Female	172.20±0.54^{b}	458.93±3.05^{b}	655.70±4.68^{b}	506.82±11.63^{b}	377.97±13.01^{a}	294.78±9.22	300.28±7.73^{a}
			Male	195.40±0.54^{a}	683.05±3.07^{a}	688.32±4.69^{a}	568.02±11.67^{a}	326.31±13.05^{b}	272.48±9.25	247.74±7.76^{b}
Generation1	PKM	*Ad. lib.*	Female	171.22±1.53	463.64±8.67	692.53±13.27	381.47±33.00	59.37±36.91^{b}	232.21±26.17	64.32±21.94
			Male	211.19±1.53	706.02±8.67	679.63±13.27	222.84±33.00	160.53±36.91^{a}	178.21±26.17	108.00±21.94
		Two meals	Female	174.81±1.53	465.53±8.71	689.07±13.34	702.23±33.17	507.66±37.10	635.74±26.31	0.00±22.06
			Male	210.91±1.55	703.53±8.81	719.97±13.48	825.00±33.53	500.43±37.50	581.96±26.59	0.00±22.30
	PKL	*Ad. lib.*	Female	170.06±1.53	458.34±8.67	603.24±13.27	275.37±33.00	258.11±36.91^{a}	119.79±26.17	142.63±21.94
			Male	180.70±1.53	678.25±8.71	646.55±13.34	275.32±33.17	114.36±37.10^{b}	116.91±26.31	97.13±22.06
		Two meals	Female	171.37±1.52	457.01±8.62	624.84±13.20	766.98±32.82	536.15±36.71	22.50±26.03	992.19±21.83
			Male	177.70±1.53	660.58±8.67	697.06±13.27	941.47±33.00	516.84±36.91	-50.00±26.17	912.00±21.94
Generation2	PKM	*Ad. lib.*	Female	173.29±1.52	464.64±8.62	701.75±13.20	252.08±32.82	273.33±36.71^{a}	149.38±26.03	88.75±21.83
			Male	212.71±1.53	694.79±8.67	695.13±13.27	234.95±33.00	144.21±36.91^{b}	127.37±26.17	129.58±21.94
		Two meals	Female	175.43±1.53	466.07±8.67	690.45±13.27	700.74±33.00	537.68±36.91	523.68±26.17	504.53±21.94
			Male	211.73±1.53	706.25±8.71	710.47±13.34	845.00±33.17	550.64±37.10	515.53±26.31	327.13±22.06
	PKL	*Ad. lib.*	Female	169.90±1.51	450.03±8.58	619.33±13.13	260.62±32.65	245.77±36.52^{a}	119.48±25.90	138.45±21.72
			Male	177.68±1.50	660.29±8.53	674.39±13.06	230.77±32.49	126.63±36.34^{b}	133.47±25.76	112.24±21.61
		Two meals	Female	171.50±1.51	446.18±8.58	624.36±13.13	715.05±32.65	605.67±36.52^{a}	555.46±25.90	471.34±21.72
			Male	180.56±1.51	654.66±8.58	683.39±13.13	968.81±32.65	496.80±36.52^{b}	576.39±25.90	295.88±21.72

Means within the same column at the same factor carry different small superscripts are significant at level $P \leq 0.05$,

Table (5) : Means and Standard error of cumulative body weight gain according to generations, lines, feeding system and sex.

Factors				Period of					
Generations	Line	Feeding	sex	1day-2wks	1day -3 wks	1day -4 wks	1day -5 wks	1day -6 wks	1day -7 wks
Generation1				757.61±3.03	1426.72±3.60	1975.56±11.21	2307.24±6.60^{b}	2536.90±6.46^{b}	2826.43±5.16^{b}
Generation2				751.96±3.00	1426.87±3.57	1952.87±11.12	2325.47±6.55^{a}	2663.06±6.40^{a}	2921.55±5.11^{a}
	PKM			776.47±3.03^{a}	1473.85±3.60^{a}	1994.38±11.21^{a}	2336.12±6.60^{a}	2704.13±6.46^{a}	2856.91±5.16^{b}
	PKL			733.10±3.00^{b}	1379.75±3.57^{b}	1934.04±11.12^{b}	2296.59±6.55^{b}	2495.84±6.40^{b}	2891.07±5.11^{a}
		Ad. lib.		755.34±3.01	1419.41±3.58^{b}	1686.09±11.14^{b}	1858.88±6.56^{b}	2005.98±6.42^{b}	2116.12±5.13^{b}
		Two meals		754.23±3.02	1434.18±3.59^{a}	2242.34±11.18^{a}	2773.83±6.59^{a}	3193.98±6.44^{a}	3631.87±5.14^{a}
			Female	631.13±3.01^{b}	1286.82±3.58^{b}	1793.64±11.14^{b}	2171.61±6.56^{b}	2466.39±6.42^{b}	2766.67±5.13^{b}
			Male	878.44±3.02^{a}	1566.77±3.59^{a}	2134.79±11.18^{a}	2461.09±6.59^{a}	2733.57±6.44^{a}	2981.32±5.14^{a}
Generation1	PKM	*Ad. lib.*	Female	634.87±8.55	1327.39±10.16	1708.87±31.62	1768.24±18.62	2000.45±18.22	2064.76±14.55
			Male	917.21±8.55	1596.84±10.16	1819.68±31.62	1980.20±18.62	2158.41±18.22	2266.41±14.55
		Two meals	Female	640.34±8.59	1329.41±10.22	2031.65±31.79	2539.31±18.72	3175.05±18.32	3175.05±14.62
			Male	914.45±8.69	1634.42±10.33	2459.42±32.13	2959.85±18.93	3541.81±18.51	3541.81±14.78
	PKL	*Ad. lib.*	Female	628.40±8.55	1231.64±10.16	1507.01±31.62	1765.11±18.62	1884.90±18.22	2027.54±14.55
			Male	858.95±8.59	1505.50±10.22	1780.82±31.79	1895.18±18.72	2012.09±18.32	2109.22±14.62
		Two meals	Female	628.38±8.50	1253.22±10.11	2020.20±31.46	2556.34±18.53	2578.84±18.12	3571.03±14.47
			Male	838.27±8.55	1535.33±10.16	2476.81±31.62	2993.65±18.62	2943.65±18.22	3855.65±14.55
Generation2	PKM	*Ad. lib.*	Female	637.93±8.50	1339.68±10.11	1591.76±31.46	1865.10±18.53	2014.47±18.12	2103.22±14.47
			Male	907.50±8.55	1602.63±10.16	1837.57±31.62	1981.78±18.62	2109.15±18.22	2238.73±14.55
		Two meals	Female	641.49±8.55	1331.94±10.16	2032.68±31.62	2570.37±18.62	3094.05±18.22	3598.58±14.55
			Male	917.98±8.59	1628.45±10.22	2473.45±31.79	3024.09±18.72	3539.62±18.32	3866.75±14.62
	PKL	*Ad. lib.*	Female	619.93±8.46	1239.26±10.06	1499.88±31.29	1745.65±18.43	1865.14±18.03	2003.59±14.39
			Male	837.97±8.42	1512.36±10.01	1743.12±31.13	1869.76±18.34	2003.22±17.94	2115.47±14.32
		Two meals	Female	617.68±8.46	1242.04±10.06	1957.09±31.29	2562.76±18.43	3118.23±18.03	3589.57±14.39
			Male	835.22±8.46	1518.62±10.06	2487.43±31.29	2984.23±18.43	3560.63±18.03	3856.50±14.39

Means within the same column at the same factor carry different small superscripts are significant at level $P \leq 0.05$,

Table (6) : Means and Standard error for interval growth rates at different ages as affected by generations, lines, feeding system and sex.

Factors				Growth rate at period of						
Generations	Line	Feeding systems	sex	1day-1wks	1 -2wks	2 -3 wks	3 -4 wks	4 -5 wks	5 -6 wks	6-7wks
Generations1				111.08±0.48	104.31±0.42^{a}	57.90±0.42	29.27±0.49	14.70±0.55	8.87±0.44^{b}	9.60±0.33^{a}
Generations2				110.19±0.47	102.81±0.42^{b}	57.98±0.42	28.10±0.48	16.05±0.54	12.07±0.43^{a}	8.46±0.33^{b}
	PKM			112.86±0.48^{a}	103.31±0.42	58.88±0.42^{a}	27.30±0.49^{b}	15.00±0.55	13.28±0.44^{a}	5.18±0.33^{b}
	PKL			108.41±0.47^{b}	103.81±0.42	57.00±0.42^{b}	30.07±0.48^{a}	15.74±0.54	7.66±0.43^{b}	12.88±0.33^{a}
		Ad. lib.		110.19±0.48	103.69±0.42	57.41±0.42	15.47±0.48^{b}	10.06±0.55^{b}	7.48±0.43^{b}	5.22±0.33^{b}
		Two meals		111.08±0.48	103.43±0.42	58.47±0.42	41.89±0.49^{a}	20.69±0.55^{a}	13.46±0.43^{a}	12.84±0.33^{a}
			Female	108.23±0.48^{b}	96.23±0.42^{b}	62.93±0.42^{a}	29.61±0.48^{a}	18.09±0.55^{a}	11.34±0.43^{a}	10.17±0.33^{a}
			Male	113.03±0.48^{a}	110.90±0.42^{a}	52.95±0.42^{b}	27.76±0.49^{b}	12.65±0.55^{b}	9.60±0.43^{b}	7.89±0.33^{b}
Generations1	PKM	*Ad. lib.*	Female	106.52±1.35^{b}	96.89±1.19^{b}	65.72±1.18^{a}	19.28±1.37a	7.67±1.55	11.68±1.23^{a}	2.61±0.94^{b}
			Male	117.25±1.35^{a}	110.24±1.19^{a}	51.12±1.18^{b}	11.50±1.37^{b}	8.79±1.55	8.33±1.23^{b}	4.81±0.94^{a}
		Two meals	Female	109.10±1.36^{b}	96.72±1.20^{b}	64.60±1.19^{a}	40.11±1.38^{a}	21.05±1.56^{a}	22.14±1.24^{a}	0.00±0.95
			Male	117.18±1.37^{a}	110.09±1.21^{a}	53.40±1.20^{b}	38.89±1.39^{b}	17.89±1.57^{b}	17.54±1.25^{b}	0.00±0.96
	PKL	*Ad. lib.*	Female	109.69±1.35	97.62±1.19^{b}	60.03±1.18^{a}	18.81±1.37^{a}	15.37±1.55^{a}	6.16±1.23	7.27±0.94^{a}
			Male	110.75±1.36	113.76±1.20^{a}	51.77±1.19^{b}	15.72±1.38^{b}	5.97±1.56b	5.96±1.24	4.56±0.95^{b}
		Two meals	Female	108.93±1.34	96.12±1.19^{b}	60.84±1.17^{a}	44.55±1.37	22.65±1.54^{a}	0.82±1.22	31.02±0.94^{a}
			Male	109.21±1.35	113.06±1.19^{a}	55.71±1.18^{b}	45.26±1.37	18.18±1.55^{b}	1.72±1.23	26.51±0.94^{b}
Generations2	PKM	*Ad. lib.*	Female	108.53±1.34^{b}	96.90±1.19^{b}	65.89±1.17^{a}	16.24±1.37^{a}	15.28±1.54^{a}	7.16±1.22	4.45±0.94^{a}
			Male	117.61±1.35^{a}	108.95±1.19a	52.44±1.18^{b}	12.96±1.37^{b}	7.16±1.55b	6.20±1.23	5.76±0.94^{b}
		Two meals	Female	109.29±1.35^{b}	96.63±1.19^{b}	65.01±1.18^{a}	39.72±1.37	22.85±1.55^{a}	17.66±1.23	15.06±0.94^{a}
			Male	117.39±1.36^{a}	110.07±1.20^{a}	52.83±1.19^{b}	39.72±1.38	19.29±1.56^{b}	15.50±1.24	8.72±0.95^{b}
	PKL	*Ad. lib.*	Female	105.96±1.34	94.91±1.18^{b}	60.37±1.17^{a}	17.50±1.36^{a}	13.70±1.53^{a}	6.59±1.22	7.30±0.93^{a}
			Male	105.22±1.33	110.26±1.18^{a}	51.92±1.16^{b}	11.77±1.35^{b}	6.51±1.52^{b}	7.78±1.21	4.97±0.93^{b}
		Two meals	Female	107.85±1.34	94.03±1.18^{b}	60.98±1.17^{a}	40.67±1.36b	26.18±1.53^{a}	18.53±1.22	13.61±0.93^{a}
			Male	109.66±1.34	110.73±1.18^{a}	54.39±1.17^{b}	46.23±1.36^{a}	17.38±1.53^{b}	17.19±1.22	7.77±0.93^{b}

Means within the same column at the same factor carry different small superscripts are significant at level $P \leq 0.05$,

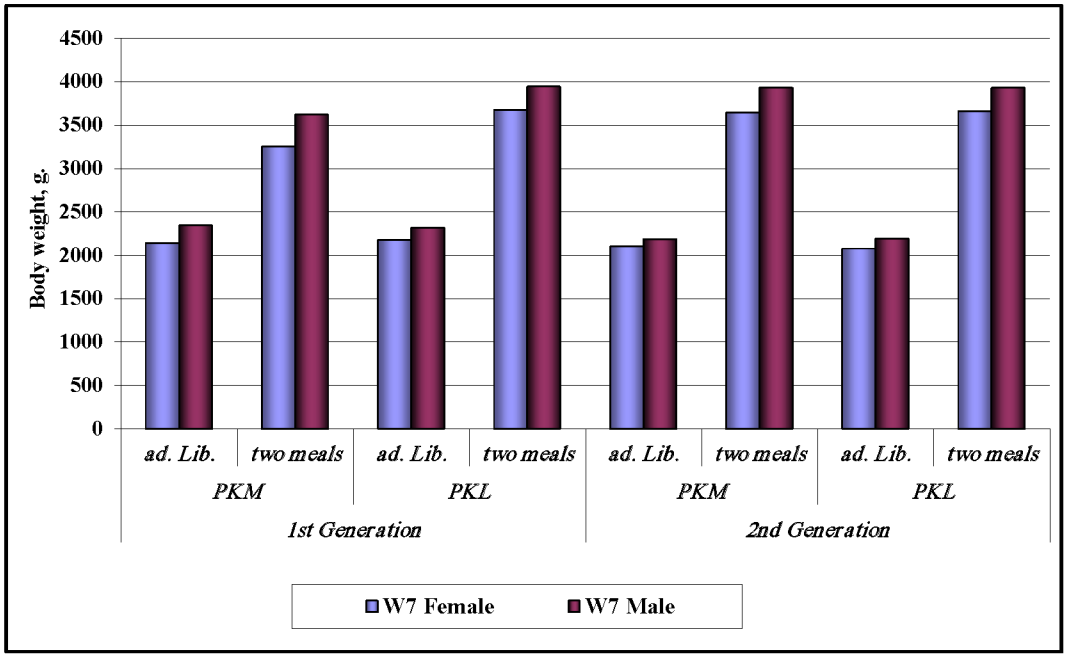

Fig (1) : Body weights at 7 weeks of age of two lines of ducks in each generation according to sex and feeding system effects.

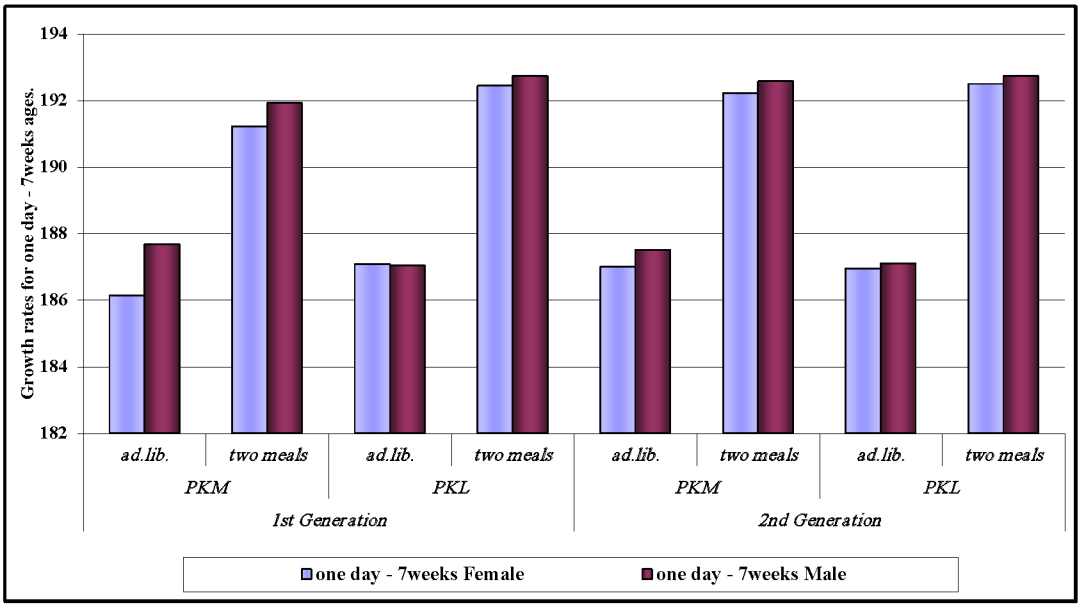

Fig (2) : Growth rates (one day-7 weeks) of two lines of ducks in each generation according to sex and feeding system effects.

Table (7) : Mean and standard errors of feed consumption (FC), feed efficiency (FE) and viability (V), as affected by generations, lines, feeding system and sex.

				$(\bar{X} \pm SE)$				
Generation	Lines	Feeding system	sex	FC 1-28days	FC 28-50days	FE 1-28days	FE 28-50days	V
Generation1				2.1770±0.06^{a}	5.3621±0.06^{b}	3.67±0.06^{a}	2.59±0.06^{b}	94.88±0.06^{b}
Generation2				2.05370.06^{b}	5.7182±0.06^{a}	1.43±0.06^{b}	3.73±0.06^{a}	96.38±0.06^{a}
	PKM			20340±0.06	5.3745±0.06^{b}	2.12±0.06^{b}	2.83±0.06^{b}	96.38±0.06^{a}
	PKL			2.1967±0.06	5.7058±0.06^{a}	2.98±0.06^{a}	3.49±0.06^{a}	94.88±0.06^{b}
		Ad. lib.		2.0847±0.06	4.1756±0.06^{b}	2.23±0.06^{b}	3.03±0.06^{b}	95.88±0.06
		Two meals		2.1460±0.06	6.9047±0.06^{a}	2.86±0.06^{a}	3.29±0.06^{a}	95.38±0.06
			Female	2.0497±0.06^{b}	5.5409±0.06^{a}	3.03±0.06^{a}	3.63±0.06^{a}	96.13±0.06^{a}
			Male	2.1810±0.06^{a}	5.5394±0.06^{b}	2.06±0.06^{b}	2.69±0.06^{b}	95.13±0.06^{b}
Generation1	PKM	*Ad. lib.*	Female	2.0300±0.17^{b}	3.8835±0.17^{b}	1.65±0.17^{a}	2.90±0.17	95.00±0.17^{a}
			male	2.1880±0.17^{a}	3.9093±0.17^{a}	1.20±0.17^{b}	2.90±0.17	94.00±0.17^{b}
		Two meals	Female	2.0330±0.17^{b}	6.6692±0.17^{a}	4.30±0.17^{a}	2.40±0.17^{a}	96.00±0.17^{a}
			male	2.1800±0.17^{a}	5.8480±0.17^{b}	4.20±0.17^{b}	2.00±0.17^{b}	95.00±0.17^{b}
	PKL	*Ad. lib.*	Female	2.0800±0.17^{b}	4.1460±0.17^{b}	8.40±0.17^{a}	2.90±0.17^{a}	96.00±0.17^{a}
			male	2.2220±0.17^{a}	4.2764±0.17^{a}	1.00±0.17^{b}	2.80±0.17^{b}	95.00±0.17^{b}
		Two meals	Female	2.2820±0.17^{b}	7.0366±0.17^{b}	3.80±0.17^{a}	2.40±0.17	95.00±0.17^{a}
			male	2.4010±0.17^{a}	7.1277±0.17^{a}	4.80±0.17^{b}	2.40±0.17	93.00±0.17^{b}
Generation2	PKM	*Ad. lib.*	Female	1.8905±0.17^{b}	4.1800±0.17^{b}	1.50±0.17^{a}	1.70±0.17^{a}	98.00±0.17
			male	2.0300±0.17^{a}	4.2000±0.17^{a}	1.30±0.17^{b}	1.10±0.17^{b}	98.00±0.17
		Two meals	Female	1.8905±0.17^{b}	7.0217±0.17^{b}	1.50±0.17^{a}	4.30±0.17^{b}	98.00±0.17^{a}
			male	2.0300±0.17^{a}	7.2845±0.17^{a}	1.30±0.17^{b}	5.30±0.17^{a}	97.00±0.17^{b}
	PKL	*Ad. lib.*	Female	2.0420±0.17^{b}	4.3030±0.17^{b}	1.50±0.17^{a}	8.80±0.17^{a}	96.00±0.17^{a}
			male	2.1950±0.17^{a}	4.5067±0.17^{a}	1.30±0.17^{b}	1.10±0.17^{b}	95.00±0.17^{b}
		Two meals	Female	2.1496±0.17^{b}	7.0870±0.17^{b}	1.60±0.17^{a}	3.60±0.17^{b}	95.00±0.17^{a}
			male	2.2020±0.17^{a}	7.1630±0.17^{a}	1.40±0.17^{b}	3.90±0.17^{a}	94.00±0.17^{b}

Means within the same column at the same factor carry different small superscripts are significant at level $P \leq 0.05$,