Results and Discussion

I. Traits of body weight

I.1. Nature of growth

Least square means and standard errors of body weight, absolute gain, relative gain and accumulative increase in body weight at different ages for males, females and adjusted sex in purebred white Pekin ducks for the first, second and the third generations are presented in tables 3,4,5,6,7 and 8 and figures 1,2,3,4,5 and 6.

The average body weight of adjusted sex over the three generations for 1-day, 8, 14 and 24 weeks of age were about 35.0, 590.0, 1200.0 and 1400.0 grams, respectively.

From the tabulated results, it seems that the nature of growth of this flock could be classified into three stages. The first stage was characterized by rapid growth during the period from one-day old up to the age of eight weeks. During this period there was an increased gain in body weight by about 100.0 grams during the period of 1-day old to 2 weeks of age and about 180 grams during the period of 6-8 weeks of age. Meanwhile, the relative gain was extramely high during the period of 1-day to 2 weeks of age (about 112 %) which gradually decreased till it reached about 36 % during the period of 6-8 weeks of age. Also, body weight at 8 weeks of age was about 17 times that of one day old.

Table 3 : Least Square means (±S.E.) of body weight in grams, absolute gain in grams (A.G.) and relative gain % (R.G.%) for F_1 generation .

Age	Males				Females				Males + Females			
	No*.	body weight	A.G.	R.G.%	No.	body weight	A.G.	R.G.%	No.	body weight	A.G.	R.G.%
1-Day.	131	36.9 ± 0.39			202	37.7 ± 0.27			333	37.4 ± 0.18		
			49.2	80.0			49.0	78.8			49.1	79.3
2 wks**	129	86.1 ± 2.80			196	87.8 ± 2.27			325	86.5 ± 1.76		
			70.3	58.0			67.0	55.7			68.3	56.6
4 wks.	128	156.4 ± 5.58			190	135.7 ± 4.12			318	145.8 ± 3.33		
			104.0	49.9			107.9	52.0			106.3	51.1
6 wks.	128	260.4 ± 9.19			148	281.6 ± 7.11			312	261.1 ± 5.63		
			173.8	50.0			122.8	38.0			145.2	43.0
8 wks.	128	434.2 ± 14.76			128	348.4 ± 10.13			310	406.3 ± 8.54		
			164.8	31.9			159.4	34.3			160.4	33.0
10wks.	128	599.0 ± 19.26			181	543.8 ± 13.61			309	566.7 ± 11.36		
			225.0	31.6			149.6	30.4			206.8	30.9
12wks.	126	824.0 ± 25.72			181	738.4 ± 17.63			307	773.5 ± 15.0		
			228.0	24.3			172.2	20.9			195.7	22.5
14wks.	126	1052.0 ± 28.07			181	910.6 ± 19.17			307	969.2 ± 16.61		
			93.0	8.5			86.9	9.1			87.8	8.7
16wks.	120	1145.0 ± 23.54			178	997.5 ± 17.21			298	1057.0 ± 14.57		
			87.7	7.4			112.1	10.6			101.4	9.2
18wks.	115	1232.7 ± 21.60			175	1109.6 ± 17.01			290	1158.4 ± 13.81		
			40.1	3.2			70.0	6.1			59.0	5.0
20wks.	109	1272.8 ± 21.12			160	1179.6 ±15.24			269	1217.4 ± 12.75		
			25.8	2.0			-27.9	-2.4			-6.4	-0.5
22wks.	96	1298.6 ± 21.50			142	1151.7 ± 14.8			238	1211.0 ± 13.20		
			-14.2	-1.1			22.4	1.9			7.2	0.6
24wks.	76	1284.4 ± 20.26			114	1174.1 ± 14.49			190	1218.2 ± 12.49		

* No. = number of progeny .
** Wks. = weeks .

Table 4 : Least Square means (±S.E.) of body weight in grams, absolute gain in grams (A.G.) and relative gain % (R.G.%) for F_2 . generation .

Age	Males				Females				Males + Females			
	No.	body weight	A.G.	R.G.%	No.	body weight	A.G.	R.G.%	No.	body weight	A.G.	R.G.%
1-Day.	36	33.6 ± 0.59			203	34.1 ± 0.23			239	34.1± 0.22		
			104.5	121.7			86.9	112.0			97.1	117.5
2wks.	36	138.1 ± 9.00			164	121.0 ± 3.15			200	131.2 ± 3.46		
			140.8	67.5			103.2	59.8			117.8	62.0
4wks.	36	278.9 ± 19.33			159	224.2 ± 6.03			195	249.0 ± 6.53		
			185.0	49.8			103.1	37.4			146.4	45.4
6wks.	36	463.9 ± 29.83			154	327.3 ± 10.69			190	395.4 ± 10.00		
			174.4	31.6			132.9	33.8			139.4	30.0
8wks.	36	638.3 ± 38.39			138	460.2 ± 12.14			174	534.8 ± 13.62		
			169.0	23.4			186.5	33.7			168.8	27.3
10wks.	36	807.3 ± 41.46			123	646.7 ± 13.54			159	703.6 ± 14.75		
			245.4	26.4			218.3	28.9			229.9	28.1
12wks.	36	1052.7 ± 44.20			115	865.0 ± 18.41			151	933.5 ± 17.65		
			165.9	15.4			175.5	18.4			170.4	16.7
14wks.	36	1228.6 ± 41.11			103	1040.5 ± 17.42			139	1103.9 ± 16.67		
			111.9	8.7			134.3	12.1			107.2	9.3
16wks.	36	1340.6 ± 49.45			95	1174.8 ± 16.44			131	1211.1 ± 17.46		
			216.0	14.9			63.1	5.2			165.1	12.8
18wks.	31	1556.5 ± 31.04			80	1237.9 ± 16.97			111	1376.2 ± 15.61		
			88.0	5.5			73.2	5.7			89.1	6.3
20wks.	29	1644.5 ± 27.61			74	1311.1 ± 18.55			103	1465.3 ± 16.44		
			11.8	0.7			55.4	4.1			44.6	3.0
22wks.	27	1656.3 ± 25.14			48	1366.5 ± 20.18			75	1509.9 ± 16.06		
			2.9	0.2			121.1	8.5			58.1	3.8
24wks.	22	1659.2 ± 33.90			39	1487.6 ± 25.10			61	1568.0 ± 19.00		

Table 5 : Least Square means (±S.E.) of body weight in grams, absolute gain in grams (A.G.) and relative gain % (R.G.%) for F_3 . generation .

Age	Males				Females				Males + Females			
	No.	body weight	A.G.	R.G.%	No.	body weight	A.G.	R.G.%	No.	body weight	A.G.	R.G.%
1-Day.	73	34.4 ± 1.81			108	34.6 ± 0.17			181	34.5 ± 0.14		
			154.2	138.3			158.0	139.1			155.8	138.6
2wks.	73	188.6 ± 5.17			53	192.6 ± 6.44			126	190.3 ± 4.03		
			129.6	51.1			134.9	51.9			131.6	51.4
4wks.	73	318.2 ± 10.90			49	327.5 ±13.71			122	321.9 ± 8.51		
			262.0	58.3			247.2	54.8			256.2	56.9
6wks.	73	580.2 ± 15.97			45	574.7 ± 23.51			118	578.1 ± 13.83		
			246.6	35.1			253.8	36.2			249.3	35.5
8wks.	73	826.8 ± 19.23			43	828.5 ± 32.62			116	827.4 ± 17.02		
			266.3	27.7			260.3	27.2			264.2	27.5
10wks.	73	1093.1 ± 22.05			41	1088.8 ± 38.71			114	1091.6 ± 19.73		
			172.2	14.6			250.8	20.7			200.4	16.8
12wks.	73	1265.3 ± 23.13			41	1339.6 ± 26.59			114	1292.0 ± 17.88		
			252.5	18.1			137.2	9.7			21.1	15.1
14wks.	73	1517.8 ± 23.23			41	1476.9 ± 90.97			114	1503.1 ± 35.74		
			-3.1	-0.2			18.6	1.3			-8.6	-0.6
16wks.	72	1514.7 ± 17.81			41	1495.4 ± 53.88			113	1494.5 ± 25.91		
			21.1	1.4			20.3	1.3			34.2	2.3
18wks.	70	1535.8 ± 20.23			38	1515.7 ± 63.27			108	1528.7 ± 25.67		
			31.1	2.0			32.1	2.1			31.4	2.0
20wks.	59	1566.9 ± 22.60			33	1547.8 ± 76.19			92	1560.1 ± 30.54		
			-49.6	-3.2			-25.9	-1.7			-41.1	-2.7
22wks.	52	1517.3 ± 26.74			27	1521.9 ± 30.91			79	1519.0 ± 20.08		

Table 6 : Accumulative increase times in body weights of Males, Females and Males + Females for F_1. generation

Age.	Sex	1-Day	2wks	4wks	6wks	8wks	10wks	12wks	14wks	16wks	18wks	20wks	22wks
2wks	M.	2.333											
	F.	2.300											
	M+F	2.313											
4wks	M.	4.238	1.816										
	F.	4.077	1.773										
	M+F	4.139	1.790										
6wks	M.	7.057	3.024	1.665									
	F.	6.939	3.017	1.702									
	M+F	6.981	3.020	1.687									
8wks	M.	11.767	5.043	2.776	1.667								
	F.	10.196	4.434	2.501	1.469								
	M+F	10.864	4.697	2.625	1.556								
10wks	M.	16.233	6.957	3.830	2.300	1.380							
	F.	14.424	6.272	3.538	2.079	1.415							
	M+F	15.152	6.551	3.661	2.170	1.395							
12wks	M.	22.331	9.570	5.269	3.164	1.898	1.376						
	F.	19.586	8.517	4.804	2.823	1.921	1.358						
	M+F	20.262	8.942	4.997	2.962	1.904	1.365						
14wks	M.	28.509	12.218	6.726	4.040	2.423	1.756	1.277					
	F.	24.154	10.503	5.925	3.481	2.369	1.675	1.233					
	M+F	25.914	11.201	6.261	3.712	2.385	1.710	1.253					
16wks	M.	31.030	13.298	7.321	4.397	2.637	1.912	1.390	1.088				
	F.	26.459	11.505	6.490	3.813	2.595	1.834	1.351	1.095				
	M+F	28.262	12.220	6.828	4.048	2.602	1.865	1.367	1.091				
18wks	M.	33.407	14.317	7.882	4.734	2.839	2.058	1.496	1.172	1.077			
	F.	29.432	12.798	7.215	4.242	2.887	2.040	1.503	1.219	1.112			
	M+F	30.973	13.400	7.483	4.437	2.851	2.044	1.498	1.195	1.096			
20wks	M.	34.493	14.783	8.138	4.888	2.931	2.125	1.545	1.210	1.112	1.033		
	F.	31.289	13.606	7.675	4.509	3.069	2.169	1.598	1.295	1.183	1.063		
	M+F	32.551	14.074	7.864	4.663	2.996	2.148	1.574	1.256	1.152	1.051		
22wks	M.	35.192	15.082	8.303	4.987	2.991	2.168	1.576	1.234	1.134	1.053	1.202	
	F.	30.549	13.284	7.493	4.403	2.996	2.118	1.560	1.265	1.155	1.038	0.976	
	M+F	32.380	14.000	7.823	4.638	2.981	2.137	1.566	1.249	1.146	1.045	0.995	
24wks	M.	34.808	14.918	8.212	4.932	2.958	2.144	1.559	1.221	1.122	1.042	1.009	0.989
	F.	31.143	13.542	7.639	4.488	3.054	2.159	1.590	1.289	1.177	1.058	0.995	1.019
	M+F	32.572	14.083	7.870	4.666	2.998	2.150	1.575	1.257	1.153	1.052	1.001	1.006

Table 7 : Accumulative increase times in body weights of Males, Females and Males + Females for F_2 generation

Age.	Sex	1-Day	2 wks	4wks	6wks	8wks	10wks	12wks	14wks	16wks	18wks	20wks	22wks
2wks	M.	4.113											
	F.	3.548											
	M+F	3.848											
4wks	M.	8.301	2.020										
	F.	6.575	1.853										
	M+F	7.302	1.898										
6wks	M.	13.807	3.359	1.663									
	F.	9.598	2.705	1.460									
	M+F	11.595	3.014	1.588									
8wks	M.	18.997	4.622	2.289	1.376								
	F.	13.496	3.803	2.053	1.406								
	M+F	15.683	4.076	2.148	1.353								
10wks	M.	24.047	5.846	2.895	1.740	1.265							
	F.	18.965	5.345	2.885	1.976	1.405							
	M+F	20.633	5.363	2.826	1.779	1.316							
12wks	M.	31.330	7.623	3.774	2.269	1.649	1.304						
	F.	25.367	7.149	3.858	2.643	1.880	1.338						
	M+F	27.375	7.115	3.749	2.361	1.746	1.327						
14wks	M.	36.565	8.896	4.405	2.648	1.925	1.522	1.167					
	F.	30.513	8.599	4.641	3.179	2.261	1.609	1.203					
	M+F	32.372	8.414	4.433	2.792	2.064	1.569	1.183					
16wks	M.	39.896	9.708	4.806	2.890	2.100	1.660	1.273	1.091				
	F.	34.452	9.709	5.240	3.589	2.553	1.817	1.358	1.129				
	M+F	35.516	9.231	4.864	3.063	2.265	1.721	1.297	1.097				
18wks	M.	46.324	11.271	5.581	3.355	2.439	1.928	1.479	1.267	1.161			
	F.	36.302	10.231	5.521	3.782	2.690	1.914	1.431	1.190	1.054			
	M+F	40.358	10.487	5.527	3.481	2.573	1.956	1.474	1.247	1.136			
20wks	M.	48.943	11.908	5.896	3.545	2.576	2.037	1.562	1.339	1.227	1.057		
	F.	38.449	10.836	5.848	4.006	2.849	2.027	1.516	1.260	1.116	1.059		
	M+F	42.971	11.168	5.885	3.706	2.740	2.083	1.570	1.327	1.210	1.065		
22wks	M.	49.295	11.993	5.939	3.570	2.595	2.052	1.573	1.348	1.236	1.064	1.007	
	F.	40.073	11.293	6.095	4.175	2.969	2.113	1.580	1.313	1.163	1.104	1.042	
	M+F	44.279	11.508	6.064	3.819	2.823	2.146	1.617	1.368	1.247	1.097	1.030	
24wks	M.	49.381	12.014	5.949	3.577	2.599	2.055	1.576	1.350	1.238	1.066	1.009	1.002
	F.	43.625	12.294	6.635	4.545	3.233	2.300	1.720	1.430	1.266	1.202	1.136	1.089
	M+F	45.982	11.951	6.296	3.966	2.932	2.229	1.680	1.420	1.295	1.139	1.070	1.038

Table 8 : Accumulative increase times in body weights of Males, Females and Males + Females for F_3. generation

Age.	Sex	1-Day	2 wks	4wks	6wks	8wks	10wks	12wks	14wks	16wks	18wks	20wks
2wks	M.	5.483										
	F.	5.566										
	M+F	5.516										
4wks	M.	9.250	1.687									
	F.	9.465	1.700									
	M+F	9.330	1.692									
6wks	M.	16.866	3.076	1.823								
	F.	16.610	2.984	1.755								
	M+F	16.756	3.038	1.796								
8wks	M.	24.035	4.384	2.598	1.425							
	F.	23.945	4.302	2.530	1.442							
	M+F	23.983	4.348	2.570	1.431							
10wks	M.	31.776	5.796	3.435	1.884	1.322						
	F.	31.468	5.653	3.325	1.895	1.314						
	M+F	31.641	5.736	3.391	1.888	1.319						
12wks	M.	36.782	6.709	3.976	2.181	1.530	1.158					
	F.	38.718	6.955	4.090	2.331	1.617	1.230					
	M+F	37.449	6.790	4.014	2.235	1.562	1.184					
14wks	M.	44.122	8.048	4.770	2.616	1.836	1.389	1.200				
	F.	42.682	7.668	4.510	2.570	1.782	1.356	1.102				
	M+F	43.568	7.900	4.669	2.600	1.817	1.377	1.163				
16wks	M.	44.532	8.031	4.760	2.611	1.832	1.386	1.196	1.000			
	F.	43.220	7.764	4.566	2.602	1.805	1.373	1.116	1.013			
	M+F	43.318	7.853	4.643	2.585	1.806	1.369	1.157	0.994			
18wks	M.	44.645	8.143	4.827	2.647	1.858	1.405	1.214	1.012	1.014		
	F.	43.806	7.870	4.628	2.637	1.829	1.392	1.131	1.026	1.014		
	M+F	44.310	8.033	4.749	2.644	1.848	1.400	1.183	1.017	1.023		
20wks	M.	45.549	8.308	4.924	2.701	1.895	1.433	1.238	1.032	1.034	1.020	
	F.	44.734	8.036	4.726	2.693	1.868	1.422	1.155	1.048	1.035	1.021	
	M+F	45.220	8.198	4.84.7	2.699	1.886	1.429	1.208	1.038	1.044	1.021	
22wks	M.	44.108	8.045	4.768	2.615	1.835	1.388	1.199	1.000	1.002	0.988	0.968
	F.	43.990	7.902	4.647	2.648	1.837	1.398	1.136	1.031	1.018	1.004	0.983
	M+F	44.029	7.982	4.719	2.628	1.836	1.392	1.176	1.011	1.016	0.994	0.974

Figure 1 : Body weight at different ages for Males , Males + Females and Females of F1.

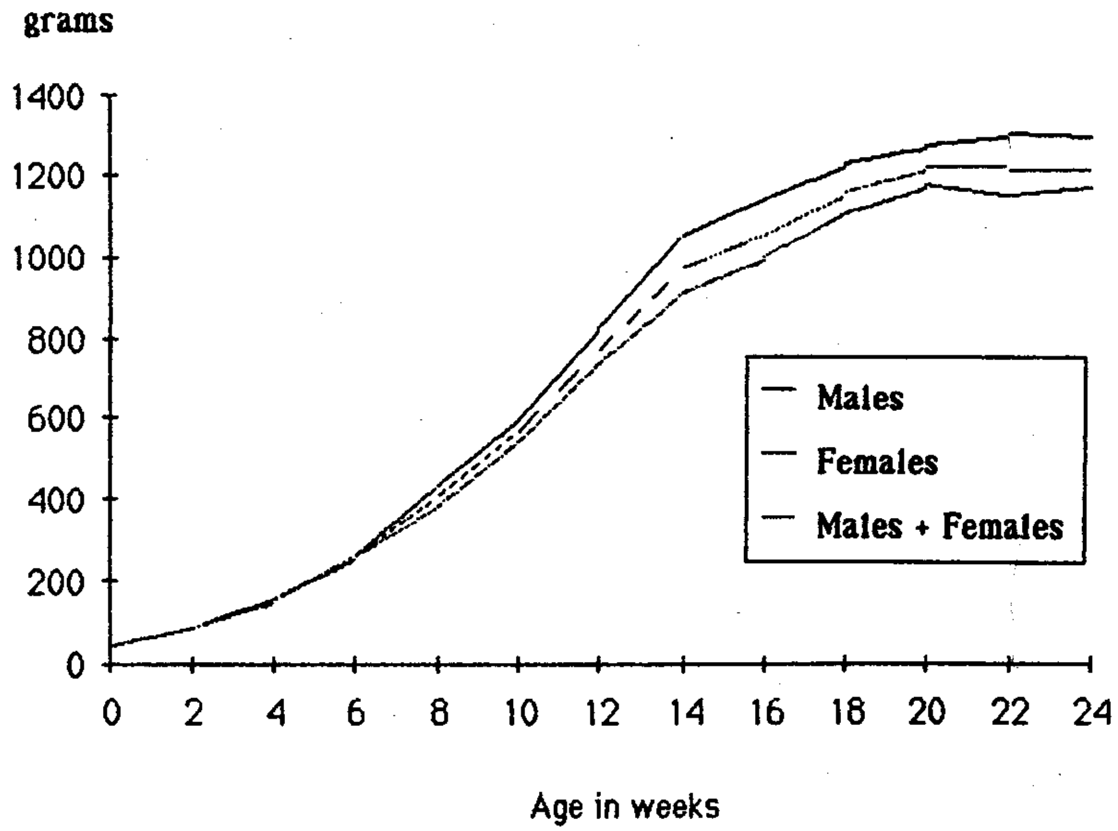


Figure 2 : Relative gain at different ages for Males ,
Males + Females and Females of F1.

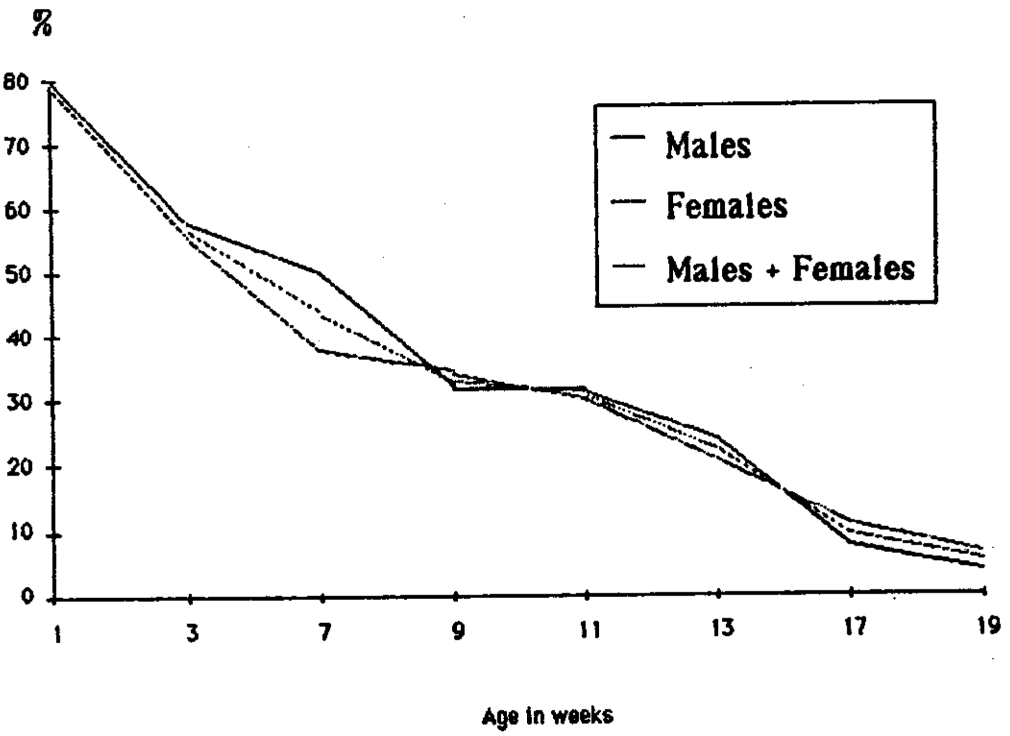


Figure 3 : Body weight at different ages for Males , Males + Females and Females of F2.

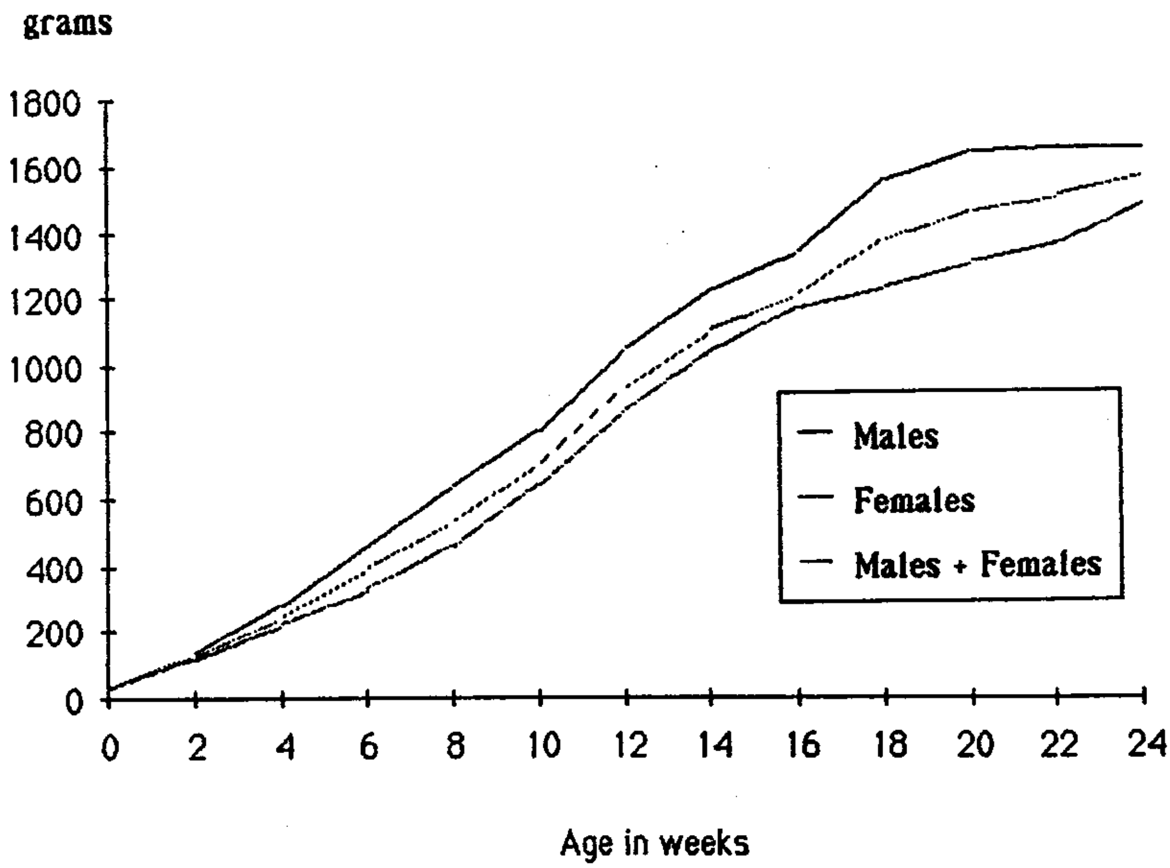


Figure 4 : Relative gain at different ages for Males ,
Males + Females and Females of F2.

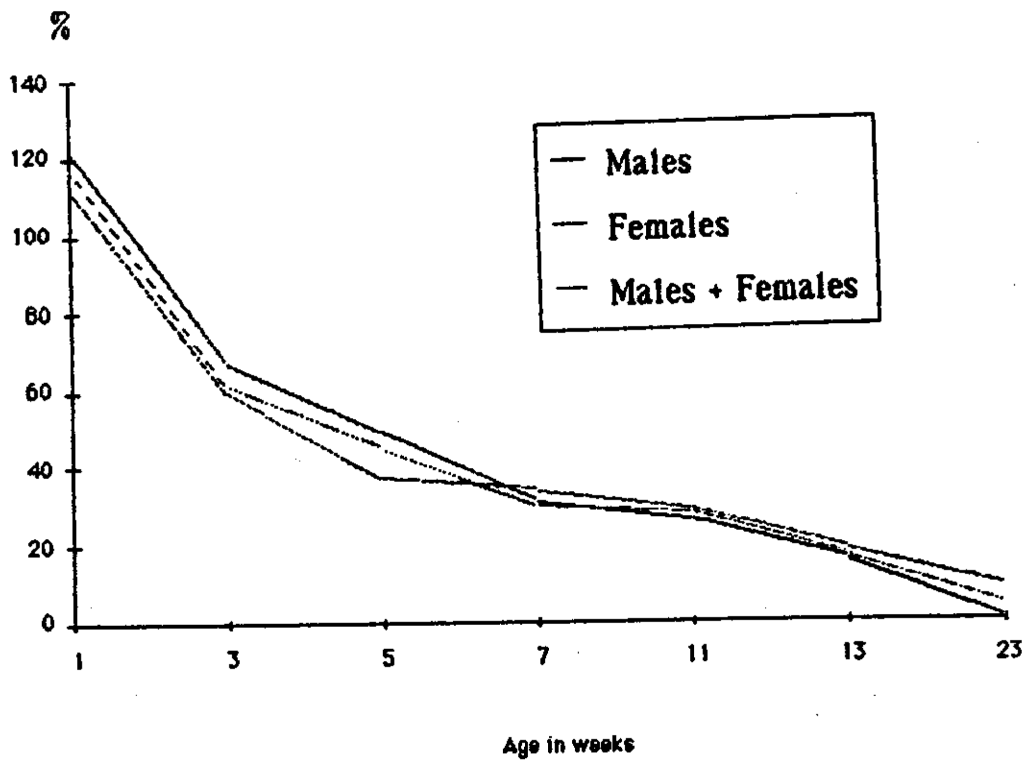


Figure 5 : Body weight at different ages for Males , Males + Females and Females of F3.

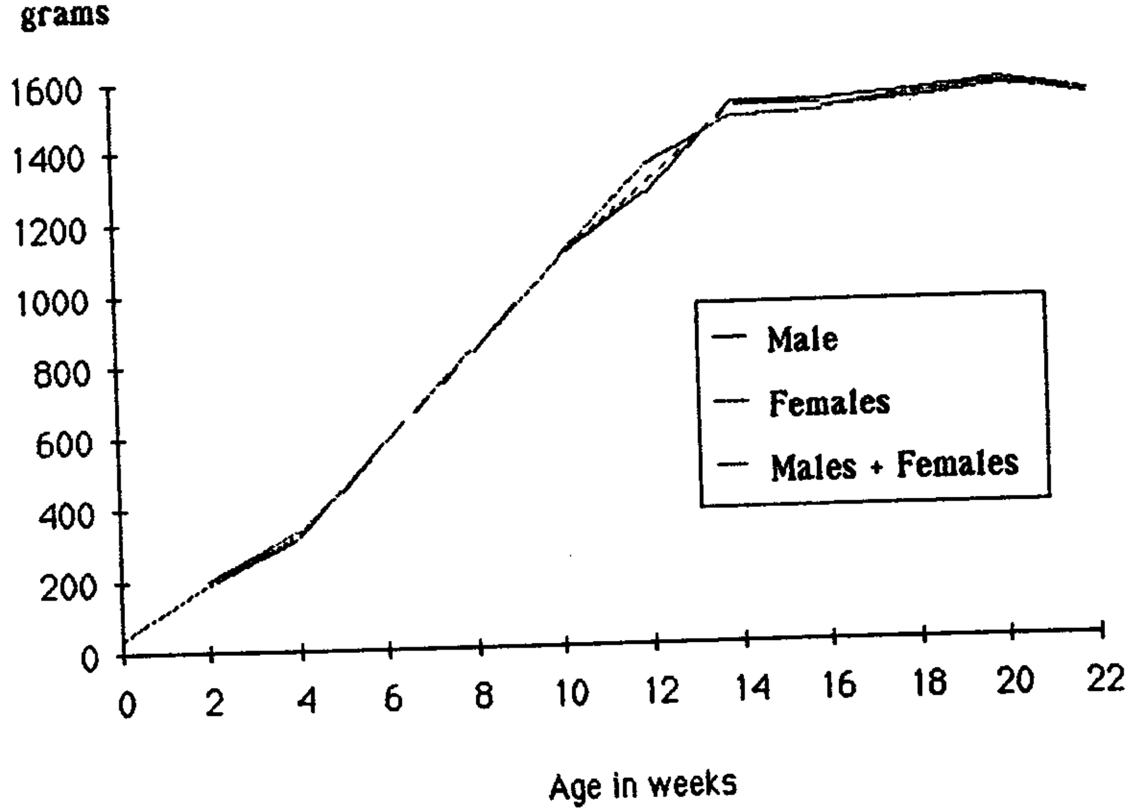
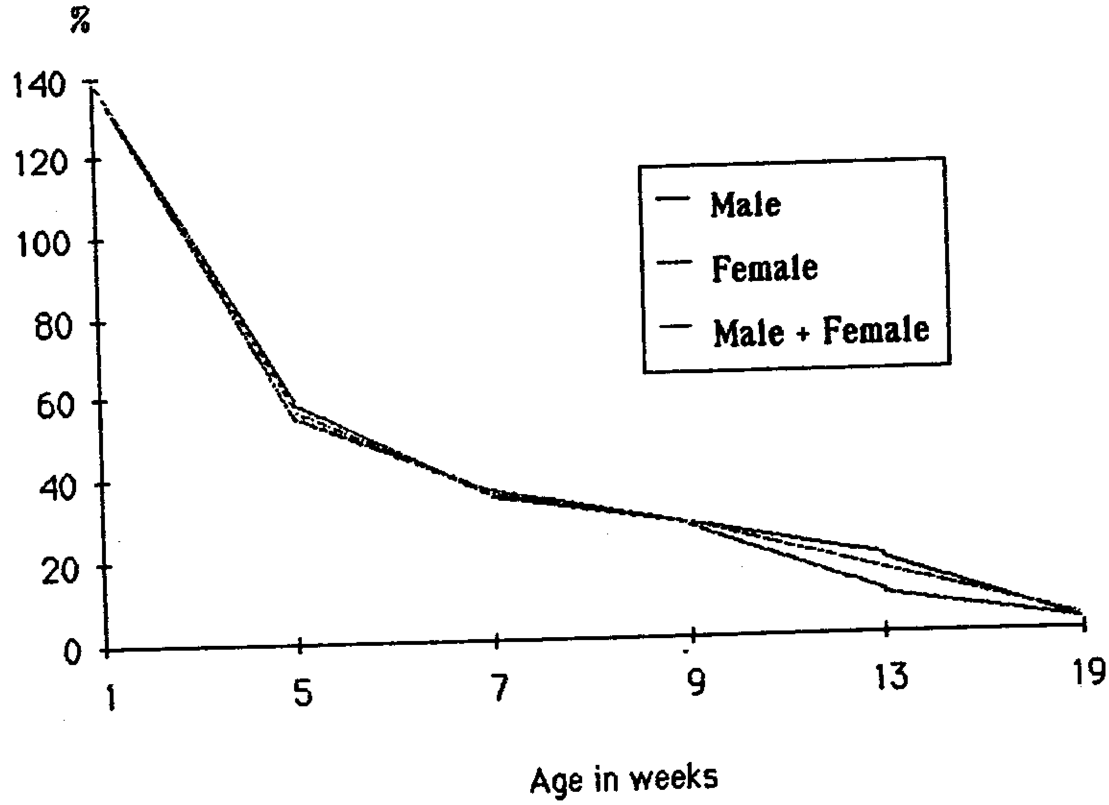


Figure 6 : Relative gain at different ages for Males , Males + Females and Females of F3.



The second stage of growth was during the period from 8 to 14 weeks of age which was characterized by nearly equal absolute gain (about 200 grams.) in body weight during each period of 8-10, 10-12 and 12-14 weeks of age. The respective relative gains during these periods were 29.3%, 25.3 % and 18.1 %. Meanwhile, the accumulative increase in body weight at 10 weeks of age was about 22 times that of one day old and 1.3 times that of 8 weeks of age. Also, body weight at 14 weeks of age was about 34 times that of one day old and about 2 times that of 8 weeks of age.

The third stage, was during the period from 16-24 weeks of age which was characterized by a graduate decrease in absolute gain which amounted to about 100.0 grams during the period of 14-16 weeks of age and decreased till it reached a bout 33.0 grams during the period of 22-24 weeks of age. The relative gain was consequently decreased gradually from 9 % during the period 14-16 weeks of age to about 2 % during the period 22-24 weks of age. Thus, body weight at 16 weeks of age was about 36 times that of one-day old and about 1.1 times that of 14 weeks of age. Also, body weight at 24 weeks of age was about 39 times that of one-day old and 1.3 times that of 14 weeks of age.

From these results, it could be concluded that relative gain in body weight was gradually increased from 1-day till ducklings reached 8 weeks of age after which this gain was gradually decreased. Thus, it could be stated that ducklings reach the market weight during the period 6-8 weeks of age. In other words, duckling producers should market their flocks when reached the maximum gain (at 8 weeks of age.) otherwise they will lose if they kept their flocks after this age. Also, it could be stated that adult weight was reached at 24 weeks, of age at which duckings reached sexual maturity.

Results obtained by Horton (1928), Titus (1928). Hamlyn et al., (1934), Heuser *et al*. (1951), Wessels and Wilbraham (1962), Mahelka (1964), Sochocka and wezyk(1971[a,b])and Olver *et al*. (1977) showed that the fastest growth rate of white Pekin ducklings occured during the first 8 weeks of age and concluded that fattening should be finished at 60-65 days of age. Nearly similar results were also obtained by kamar et al., (1969) who stated that absolute gain in body weight for purebred white Pekin reached its maximum during the period from 4 to 8 weeks of age. The relative gain were about 106 % and 40 % for the periods 0-2 and 6-8 weeks of age, respectively. Also, similar conclusion was derived by kiss (1969) and Bagot and karunajeewa (1978) who stated that growth in white pekin was most intensive during the first stage of development and declined during the second stage during which feather formation was taking place and was poorest in the third stage of growth.

I.2 Sex differences

Results persented in tables 9 ,10 and 11 showed that males were heavier in their body weight than females at all ages except one-day old body weight (about 35.5 grams). The analysis of variance and the t-test

Table 9: Analysis of variance for sex and generation effects on body weight at different ages.

Age	Sex Effect		Generations Effect		Error	
	d.f.	MS.	d.f.	MS.	d.f.	MS.
1- day	1	0.52	2	932.13**	749	25699.98
2-weeks	1	19896.00**	2	494533.00**	647	1449.97
4-Weeks	1	69201.00**	2	1305637.00**	631	5685.87
6-Weeks	1	617483.00**	2	4303783.00**	616	15015.15
8-Weeks	1	2075857.62**	2	7566701.34**	596	24240.88
10-Weeks	1	2658177.75**	2	11508329.73**	578	35082.83
12-Weeks	1	2768334.63**	2	11175928.65**	658	53351.08
14-Weeks	1	552343.64**	2	11879734.12**	556	77355.53
16-Weeks	1	4125586.17**	2	8498527.94**	538	50684.35
18-Weeks	1	4033795.08**	2	5595702.33**	509	48225.94
20-Weeks	1	2689971.74**	2	4427906.59**	460	47028.08
22-Weeks	1	2916478.45**	2	3828663.28**	388	27871.08
24-Weeks	1	783726.62**	1	5067633.98**	247	27095.45

* Significant P≤ 0.5.

** Highly significant P ≤ 0.01.

(Note : the three generations were un adjusted for sex effect)

Table 10 : Mean body weight* (± S.E.) of Males and Females as well as progeny of F_1, F_2 and F_3 geneations at different ages. (Note : the three generations were un adjusted for sex effect)

Age	Males		Females		F_1 Generation		F_2 Generation		F_3 Generation	
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
1-day	240	$35.7^{a} \pm 0.060$	573	$35.6^{a} \pm 0.17$	333	$37.4^{a} \pm 0.23$	239	$34.1^{b} \pm 0.20$	181	$34.5^{b} \pm 0.73$
2-wks	238	$125.39^{a} \pm 3.92$	413	$113.91^{b} \pm 2.50$	235	$86.45^{a} \pm 1.76$	200	$124.10^{b} \pm 3.07$	126	$190.27^{c} \pm 4.03$
4wks	237	$224.86^{a} \pm 7.25$	398	$203.27^{b} \pm 4.54$	318	$154.81^{a} \pm 3.33$	195	$234.31^{b} \pm 6.24$	122	$321.93^{c} \pm 8.51$
6-wks	237	$389.77^{a} \pm 12.56$	383	$324.82^{b} \pm 7.86$	312	$261.09^{a} \pm 5.63$	190	$353.20^{b} \pm 11.01$	118	$578.09^{c} \pm 13.28$
8-wks	237	$586.13^{a} \pm 16.17$	363	$463.81^{b} \pm 10.79$	310	$404.94^{a} \pm 9.64$	174	$497.03^{b} \pm 13.58$	116	$827.45^{c} \pm 17.02$
10-wks	237	$782.81^{a} \pm 19.89$	345	$645.25^{b} \pm 13.36$	309	$566.57^{a} \pm 11.37$	159	683.04 ± 14.98	114	$1091.55^{c} \pm 19.73$
12-wks	235	$996.12^{a} \pm 21.25$	337	$854.72^{b} \pm 15.68$	307	$773.51^{a} \pm 14.98$	151	$909.74^{b} \pm 18.64$	114	$1292.02^{c} \pm 17.88$
14-wks	235	$1224.46^{a} \pm 22.27$	325	$1023.21^{b} \pm 19.37$	307	$969.19^{a} \pm 16.58$	139	$1089.20^{b} \pm 18.07$	114	$1503.09^{c} \pm 35.74$
16-wks	228	$1292.85^{a} \pm 19.07$	314	$1116.12^{b} \pm 16.03$	298	$1057.01^{a} \pm 14.57$	131	$1220.38^{b} \pm 19.10$	113	$1507.71^{c} \pm 22.47$
18-wks	216	$1377.41^{a} \pm 17.46$	293	$1197.30^{b} \pm 15.88$	290	$1158.43^{a} \pm 13.81$	111	$1326.87^{b} \pm 20.20$	108	$1528.73^{c} \pm 25.67$
20-wks	197	$1415.61^{a} \pm 18.09$	267	$1261.27^{b} \pm 15.86$	269	$1217.38^{a} \pm 12.75$	103	$1405.00^{b} \pm 21.35$	92	$1560.06^{c} \pm 30.54$
22-wks	175	$1418.78^{a} \pm 17.05$	217	$1245.27^{b} \pm 14.32$	238	$1210.95^{a} \pm 13.20$	75	$1470.83^{b} \pm 22.52$	79	$1518.85^{b} \pm 13.31$
24-wks	98	$1368.52^{a} \pm 23.54$	153	$1253.98^{b} \pm 16.71$	190	$1218.19^{a} \pm 12.48$	61	$1549.47^{b} \pm 22.66$	-	-

* Means within the same classification followed by different letters are significantly different ($P \leq 0.05$), other wise they are not .

Table 11: Absolute, Relative and Accumulative* gains in Males and Females at different ages (over oll generations).

Age	Males			Females.		
	Absolute gain.	Relative gain%	Accumulative gain (Times)	Absolute gain	Relative gain%	Accumulative gain (Times)
1-dy-2 weeks.	89.7	111.4	3.51	78.3	104.7	3.20
2- 4 weeks.	99.5	56.8	6.30	89.4	56.4	5.71
4- 6weeks.	164.9	53.7	10.92	121.5	46.0	9.12
6- 8 weeks.	196.4	40.3	16.42	139.0	35.3	13.03
8- 10weeks.	196.7	28.7	21.93	181.5	32.7	18.13
10-12weeks.	213.3	24.0	27.90	209.4	27.9	24.01
12- 14weeks.	228.3	20.6	34.30	168.5	18.0	28.74
14- 16weeks.	68.4	5.4	36.21	92.9	8.7	31.35
16- 18weeks.	84.6	6.3	38.58	81.2	7.0	33.63
18- 20weeks.	38.2	2.7	39.65	64.2	5.2	35.44
20- 22weeks.	3.2	0.2	39.74	16.3	-1.3	34.98

* Accumulative gain times one- day body weight.

showed that sex had a significant effect on body weight; the differences between sexes, at all studied ages were, therefore, significant . At eight weeks of age, males and females averaged about 586 and 464 with a difference equal to 122 grams . At 14 weeks of age males and females reached average body weight about 1224 and 1023 with a difference equl to 201 grams . At 22 weeks of age, however, males weighed about 1419 grams while females weighed about 1245 grams, with a difference equal to about 174 grams.

These results, indicated that males gained absolutely more than females during the first 14 weeks of age after which females gained sliightly more than males. The absolute gain in body weight for males and females during the period of 1- day to 2 weeks of age was about 90 and 78 grams with 111.4 % and 104.7 % relative gain; respectively. The respective values during the period of 6-8 weeks of age were 196 grams (40.3 %) for males and 140 grams (35.3 %) for females. Also, the respective values during the period of 12-14 weeks of age were about 228 grams (20.6 %) for males and 169 grams (18.0 %) for females. The accumulative increase in body weight in males and females at 2,8 and 14 Weeks of age were 3.5 V.S. 3.2, 16.4 V.S. 13.0 and 34.3 V.S. 28.7 times that of one day old; respectively. Thus, males gained relatively more than females by about 2 % and accumulatively by about 3 times that of one day old over all ages up to 14 weeks of age.

Results abtained by Ash and mothers (1964), Rudolph and Fritsche (1965), Sockocka and wezyk(1971[a,b])Luhman and Vogt (1975), Singh *et al* (1976), Bochno *et al*. (1978), Kontecka (1979), Znaniecka and Bobrowska (1979) and Einarsson (1982) Showed that males of white pekin breed were slghtly heavier than females and exihibeted no sex differences in growth between sexes during the first 6 or 8 weeks of age. Moreover, length of fattening period and sex did not significantly affected carcass yield.

I.3 Generations effects

Results presented in tables 9,10 and 12 showeed that the difference in body weight between progeny of F_1, F_2 and F_3 generations were statistically highly significant at all ages. The F_1 progeny were heavier at one day old (37.4 grams.) than the F_2 (34. 1 grams) and the F_3 (34.5 grams) progeny. After this age; The F_1 progeny had the lowest while the F_3 progeny had the heaviest body weight at all ages, the F_2 progeny were, however inbetween. The average body weight of F_1, F_2 and F_3 progeny at 8 weeks of age was about 405, 500 and 830 grams, respectively. While at 14 weeks of age, the respective average body weight was about 970, 1090 and 1500 grams. At 22 weeks of age the F_1, F_2 and the F_3 progeny reached 1210, 1470 and 1520 grams, respectively. From these results, it was found that the F_3 progeny gained absolutely more than the F_1 and F_2 progeny during the periods 1- day to 2 weeks, 6-8 weeks and 12-14 weeks of age. The respective absolute gains were about 156, 250 and 211 grams. The

2207.0 V.S. 2083.2 grams; respectively. He concluded that average body weight of parents and offsprings had similar trend with the advance in age.

II. Estimated parameters

II.1. Lest square analysis of variance

Results given in table 13, 14 and 15 illustrate the least square analysis of variance of body weight at different ages for males, females and males + females of F_1, F_2 and F_3 generation. The results indicated that there were no significant differences between sires and between group of dams for body weight of males, females and males + females at most ages within each generation. This means that the sires and the dams were, more or less, genetically homozygous and therefore, inhereted their progeny almost similar genetic make up for body weight within each generation. In general, the sire X group of dams interactions were not statistically significant in all ages within each sex and each generation without fail. This means that the non- additive genetic component was not of significant effect on bodyweight in all ages within each sex and each generation.

Table 13 : Least square analysis of variance of body weight at different ages for Males , Females and Males + Females of F_1. generation.

S. O. V.		1 Day. d. f.	1 Day. MS.	2wks. d. f.	2wks. MS.	4 Wks. d.f	4 Wks. MS.	6 Wks. d.f	6 Wks. MS.	8 Wks. d.f	8 Wks. MS.	10 Wks. d.f	10 Wks. MS.	12 Wks. d.f	12 Wks. MS.
Sires.	M.	3	59.1	3	6082.70	3	29250.7	3	37613.5	3	155480.3	3	365824.0	3	533613.3
	F.	3	6.8	3	6123.50	3	9113.5	3	4466.6	3	21910.9	3	19682.3	3	47104.9
	M+F.	3	9.1	3	5386.90	3	13597.7	3	13175.6	3	30698.9	3	104548.6	3	253751.6
Group of Dams.	M.	3	53.7	3	10682.10**	3	27246.5	3	81843.3	3	137091.1	3	194288.3	3	286105.3
	F.	3	53.6	3	4406.10	3	10070.5	3	30528.4	3	64641.8	3	27505.8	3	93735.6
	M+F.	3	30.3	3	1613.10	3	1658.3	3	14911.5	3	66536.5	3	77567.4	3	49229.2
Sires X Dams.	M.	3	1.0	3	-1951.70	3	-5118.2	3	-10787.6	3	-23120.7	3	-41323.2	3	-18724.6
	F.	3	1.5	3	1530.20	3	1597.9	3	1706.0	3	203.1	3	1135.3	3	17782.4
	M+F.	3	-0.2	3	1130.10	3	1089.6	3	707.02	3	4659.2	3	4798.8	3	15834.3
Residual	M.	121	56.4	119	2813.30	118	11852.2	118	31182.7	118	84653.7	118	14242.9	116	254605.4
	F.	192	57.5	186	2941.69	180	9226.7	174	27706.1	172	57178.6	171	101601.0	171	170243.3
	M.+F.	323	59.4	315	3041.60	308	10544.5	302	29841.9	300	70496.1	299	120170.9	297	209765.6

cont.

S. O. V.		14 Day d. f.	14 Day MS.	16wks d. f.	16wks MS.	18 Wks d.f	18 Wks MS.	20 Wks d.f	20 Wks MS.	22 Wks d.f	22 Wks MS.	24 Wks d.f	24 Wks MS.
Sires.	M.	3	545832.8	3	72807.8	3	243755.5	3	223932.2	3	42389.1	3	30305.9
	F.	3	111369.5	3	159428.3	3	93505.9	3	129489.3	3	27342.7	3	11690.2
	M+F.	3	188787.9	3	43655.3	3	52976.6	3	258689.7	3	32646.9	3	13588.7
Group of Dams.	M.	3	122554.1	3	57402.0	3	378740.3	3	188859.6	3	173727.1	3	110178.9
	F.	3	87619.6	3	4869.9	3	141087.1	3	115064.2	3	54260.6	3	12784.2
	M+F.	3	110435.9	3	10605.3	3	122409.9	3	170249.4	3	97836.9	3	21016.4
Sires X Dams.	M.	3	-50653.93	3	-20886.3	3	-84608.6	3	-447.0	3	14314.0	3	7747.8
	F.	3	22050.9	3	13340.2	3	19008.9	3	15368.7	3	17652.2	3	5148.1
	M+F.	3	33173.9	3	25877.2	3	43609.1	3	39189.4	3	-3818.7	3	2063.2
Residual	M.	116	306116.9	110	219695.1	105	162828.3	99	133531.4	86	131076.3	66	93475.6
	F.	171	204050.6	168	158667.5	165	154622.0	150	112919.3	132	96351.2	104	77872.1
	M.F.	297	256720.9	288	195692.1	280	169305.4	259	128713.2	228	127349.7	180	91065.7

** Highly Significant $P \leq 0.01$.

Table 14 : Least square analysis of variance of body weight at different ages for Males , Females and Males + Females of F_2 generation.

S. O. V.	Sex	1 Day. d. f.	1 Day. Ms.	2wks. d. f.	2wks. MS.	4 Wks. d.f	4 Wks. MS.	6 Wks. d.f	6 Wks. MS.	8 Wks. d.f	8 Wks. MS.	10 Wks. d.f	10 Wks. MS.	12 Wks. d.f	12 Wks. MS.
Sires	M.	4	80.9*	4	15843.4	4	45740.0	4	104432.5	4	102516.6	4	150836.2	4	62822.5
	F	4	15.4	4	1956.4	4	7147.8	4	48348.7	4	14459.6	4	58056.9	4	115080.9
	M+F	4	35.8	4	5821.4	4	15720.2	4	30669.8	4	25503.3	4	40190.7	4	75437.1
Group of Dams	M.	4	46.4	4	16414.1	4	49737.2	4	122150.9	4	1140229.1	4	15746.6	4	66250.9
	F	4	24.6	4	317.9	4	20264.5	4	30391.0	4	26689.8	4	34607.4	4	28325.7
	M+F	4	31.8	4	6635.5	4	544646.7*	4	90194.1	4	97513.2	4	14790.9	4	14892.2
Sires X Dams	M.	4	15.8	4	-11606.9	4	-19944.3	4	-43251.0	4	-10406.6	4	90758.8	4	68827.3
	F	4	-2.9	4	135.5	4	566.0	4	-711.7	4	-9141.3	4	3789.1	4	63485.6
	M+F	4	-2.6	4	8090.1	4	27646.7	4	68950.9	4	147977.2	4	27015.7	4	38475.8
Residual	M	23	26.4	23	8984.1	23	40766.1	23	6614.0	23	71042.6	23	100431.5	23	134753.4
	F	190	41.0	151	6234.1	146	18757.6	137	45786.4	125	79507.9	110	81639.5	102	140947.6
	M+F	226	40.0	187	7566.4	182	22761.7	173	50076.9	161	9104.1	146	93974.8	138	147085.7

cont.

S. O. V.	Sex	14 Day d. f.	14 Day Ms.	16wks d. f.	16wks MS.	18 Wks d.f	18 Wks MS.	20 Wks d.f	20 Wks MS.	22 Wks d.f	22 Wks MS.	24 Wks d.f	24 Wks MS.
Sires	M	4	45503.9	4	33297.2	4	54334.2	4	9240.8	4	50567.2	4	16340.6
	F	4	53837.4	4	23423.8	4	13349.7	4	22207.9	4	3963.5	4	23911.2
	M+F	4	21350.5	4	12031.3	4	11789.7	4	26955.1	4	20168.2	4	8390.1
Group of Dams.	M	4	39682.7	4	293390.6	4	53334.9	4	9118.8	4	45730.2	4	15940.2
	F	4	72688.3	4	53382.6	4	24336.8	4	20633.0	4	7122.9	4	13811.2
	M+F	4	96389.2	4	61242.0	4	73290.6	4	21808.2	4	23353.2	4	14744.6
Sires X Dams.	M	4	35007.9	4	55785.5	4	1629.7	4	-7857.5	4	-44762.9	4	-15860.1
	F	4	7592.6	4	-17455.2	4	-10600.5	4	-17593.8	4	-3599.8	4	-23811.2
	M+F	4	45555.5	4	38073.4	4	22990.2	4	21093.2	4	17399.5	4	-6482.2
Residual	M	23	104469.3	23	160778.4	18	123500.8	16	140853.5	14	142948.9	9	332320.2
	F.	90	118376.1	82	100559.0	67	111506.6	61	149810.1	35	126314.4	26	134658.9
	M+F	126	116693.8	118	96714.1	98	99835.2	90	127183.4	62	83895.6	48	108586.3

* Significant $P \leq 0.05$.

Table 15 : Least square analysis of variance of body weight at different ages for Males, Females and Males + Females of F_3 generation.

S. O. V.	Sex	1 Day. d. f.	1 Day. MS.	2wks. d. f.	2wks. MS.	4 Wks. d.f	4 Wks. MS.	6 Wks. d.f	6 Wks. MS.	8 Wks. d.f	8 Wks. MS.	10 Wks. d.f	10 Wks. MS.
Sires	M.	4	20.8	4	9558.5	4	35869.3	4	89694.9	4	46866.2	4	161499.3
	F.	4	14.0	4	6579.7	4	28633.6	4	202745.8	4	366272.6	4	476419.0
	M+F	4	33.8*	4	5454.6	4	3639.1	4	56009.7	4	66879.4	4	92541.2
Groups of Dams	M	4	17.8	4	8541.0	4	16674.4	4	40042.8	4	46657.4	4	29436.9
	F	4	15.4	4	10888.1	4	19401.3	4	107846.3	4	32437.5	4	88056.2
	M+F	4	30.3*	4	7927.3	4	16858.4	4	51137.8	4	82715.7	4	65099.4
Sires X Dams	M	4	-7.4	4	5699.2	4	8503.8	4	4371.9	4	22995.1	4	19861.7
	F	4	-2.2	4	513.1	4	11907.6	4	-31985.2	4	-17698.0	4	-63011.2
	M+F	4	-6.9	4	10740.2	4	57667.6	4	58588.2	4	31383.9	4	8978.8
Residual	M	60	14.4	60	6554.9	60	32036.2	60	67474.6	60	99864.6	60	138167.0
	F	95	9.1	40	6841.2	36	39432.1	32	173133.4	30	321445.4	28	374479.3
	M+F	168	10.9	113	6917.0	109	32729.9	105	912211.0	103	154522.1	101	195112.6

cont.

S. O. V.	Sex	14 Day d. f.	14 Day MS.	16wks d. f.	16wks MS.	18 Wks d.f	18 Wks MS.	20 Wks d.f	20 Wks MS.	22 Wks d.f	22 Wks MS.	24 Wks d.f	24 Wks MS.
Sires	M	4	158487.0	4	128893.6	4	62939.5	4	154000.7	4	74881.3	4	83923.3
	F	4	2023152.0	4	2164388.0	4	764681.7	4	847317.5	4	1062498.0	4	1051876.0
	M+F	4	1155208.0**	4	908639.7	4	373391.1	4	233466.8	4	351762.6	4	353198.7
Group of Dams.	M	4	26833.3	4	126378.1	4	56841.8	4	169919.9	4	173891.6	4	89043.1
	F	4	200090.2	4	2152014.0	4	733470.5	4	873729.3	4	1034164.0	4	1042533.0
	M+F	4	53948.6	4	665869.7	4	211261.4	4	261896.1	4	227062.5	4	167693.8
Sires X Dams.	M	4	4341.1	4	-1737.1	4	-5736.2	4	-33466.5	4	-48761.2	4	-70302.1
	F	4	187443.5	4	-1809069.0	4	-607662.6	4	-705413.3	4	-878956.7	4	-890794.4
	M+F	4	281454.2	4	-294129.6	4	-113664.8	4	-57342.2	4	-10457.33	4	-59111.9
Residual	M	60	124649.6	60	70749.3	59	72558.4	57	89528.9	46	108217.0	39	114180.5
	F.	28	316918.5	28	3127223.0	28	104932.0	25	1296545.0	20	1352346.0	14	1321634.0
	M+F	101	268241.4	101	511794.4	100	211780.6	95	268584.6	79	311694.8	66	318807.7

* Significant $P \leq 0.05$ ** Highly Significant $P \leq 0.01$.

II.2. Components of variances

The components of variances were estimated by the application of factorial design with un equal number of subclasses. The genetic interpretion of these components can be derived from the following table in term of genetic variance.

Components.	6^2_a	6^2_d	6^2_{aa}	6^2_{ad}	6^2_{dd}	6^2_{sl}	6^2_m	6^2_e
Sire.	1/4	0	1/16	0	0	1/2	0	0
Dam.	1/4	0	1/16	0	0	0	1	0
Sirex Dam.	0	1/4	1/8	1/8	1/16	0	0	0
Within full sibs.	1/2	3/4	3/4	7/8	15/16	1/2	0	1

a = Additive, d = Dominance, sl = sex - linkage,
e = Environment, m = Maternal; aa, ad and dd represent epistatic interactions between loci.

The estimates of components of variances of body weight at different ages for, males, females and males + females of F_1, F_2 and F_3 generations are presented in tables 16,17 and 18.

In general, the estimates of 6^2_s in males progeny (over all ages) ranged from 7.29% to 18.33% with an average equal to 13.05% of the total variance; while those of 6^2_d ranged from 8.11% to 16.18% with an average equal to 11.38% . Mean while, 6^2_s in females progeny (over all ages)

Table 16 : Estimates of the components of variance of body weight at diffrent ages for Males , Femals and Males + Females of F_1 generation .

Compo-nemts	one Day old			2 wks.			4 wks.			6 wks.			8 wks.		
	M.	F.	M+F.	M.	F.	M+F.	M.	F.	M+F.	M.	F.	M+F.	M.	F.	M+F.
6_s^2	2.9	0.2	0.2	420.3	153.9	80.2	1739.4	255.9	240.2	2388.1	113.9	247.4	9224.5	771.2	507.3
6_d^2	2.7	1.6	0.6	650.5	98.5	20.9	1602.4	292.5	20.7	4700.8	1084.9	308.4	8566.9	2254.5	1359.4
6_w^2	56.4	57.5	59.5	2813.3	2941.9	3041.6	11852.2	9226.7	10544.4	31182.7	27704.1	29841.9	84653.7	57178.6	70496.1
6_p^2	62.0	59.3	60.2	3884.1	3194.3	3142.7	15193.9	9775.2	10805.3	38271.6	28902.9	30397.7	102445.2	60204.3	72362.8

Components as percentage (%)

6_s^2	4.76	0.32	0.27	10.82	4.82	2.55	11.45	2.62	2.22	6.24	0.39	0.81	9.00	1.28	0.70
6_d^2	4.32	2.64	0.98	16.75	3.08	0.66	10.55	3.00	0.19	12.29	3.76	1.01	8.36	3.74	1.88
6_w^2	90.92	97.04	98.75	72.43	92.10	96.78	78.00	94.38	97.59	81.47	95.85	98.18	82.63	94.97	97.42

Table 16 cont. : Estimates of the components of variance of body weight at diffrent ages for Males , Femals and Males + Females of F_1 generation .

compo-nemts.	10 wks.			12 wks.			14 wks			16 wks		
	M.	F.	M+F.	M.	F.	M+F.	M.	F.	M+F.	M.	F.	M+F.
6_s^2	19729.4	731.4	1957.8	26838.1	1035.0	4703.1	27876.6	3301.3	3151.2	5202.0	5794.5	382.9
6_d^2	12450.3	970.3	1604.2	18410.9	2736.9	707.3	8646.7	2594.3	1638.3	4392.1	35.9	25.1
6_w^2	42421.0	101601.1	120170.9	254605.4	170243.4	209765.6	306116.9	4204050.7	256720.9	21965.1	158667.5	195692.1
6_p^2	174600.7	103302.7	23732.9	299854.4	174015.5	215175.9	342640.2	209946.2	261510.49	229289.2	164497.9	196100.1

Components as percentage (%)

6_s^2	11.30	0.71	1.58	8.95	0.59	2.19	8.14	1.57	1.21	2.27	3.52	0.20
6_d^2	7.13	0.94	1.30	6.14	1.57	0.33	2.52	1.24	0.63	1.92	0.02	0.02
6_w^2	81.57	98.35	97.12	84.91	97.83	97.48	89.34	97.19	98.16	95.81	96.46	99.78

Table 16 cont : Estimates of the components of variance of body weight at different ages for Males , Females and Males + Females for F1. generation .

Components.	18 wks.			20 wks.			22 wks			24 wks		
	M.	F.	M+F.	M.	F.	M+F.	M.	F.	M+F.	M.	F.	M+F.
σ_s^2	18887.8	3016.8	314.2	13530.4	4391.9	5148.4	2496.9	494.9	966.6	2433.3	312.9	452.0
σ_d^2	27143.3	4817.7	2823.0	11601.0	4201.2	3350.6	10211.6	1822.8	2793.7	8376.9	821.3	657.0
σ_w^2	162828.4	154622.0	169305.5	13331.5	112919.4	128713.3	131076.3	96351.3	127349.8	93475.8	77872.8	91065.7
σ_p^2	208859.5	162456.5	172442.8	158662.9	121512.6	137212.3	143784.9	98668.9	181110.0	104285.9	79006.3	92164.8

Components as percentage (%)

σ_s^2	9.04	1.86	0.18	8.53	3.61	3.75	1.94	0.50	0.74	2.33	0.40	0.49
σ_d^2	13.00	2.97	1.64	7.31	3.46	2.44	7.10	1.85	2.13	8.03	1.04	0.71
σ_w^2	77.96	95.17	98.18	84.16	92.93	93.81	91.16	97.65	97.13	89.64	98.566	98.80

Table 17 : Estimates of the Components of variance of body weight at different ages of Males , Females and Males + Females of F_2 . generation .

Components .	One day old. M.	F.	M+F.	2 wks. M.	F.	M+F.	4 wks. M.	F.	M+F.	6 wks M.	F.	M+F.	8 wks M.	F.	M+F.
$6s^2$	52.4	1.1	1.1	9585.7	82.5	103.3	32641.3	297.7	757.3	51560.4	2571.1	712.5	47891.1	2130.8	68.2
$6d^2$	17.6	2.4	1.5	9777.5	55.3	0.0	26727.2	1225.4	1812.6	67300.5	5339.2	1138.1	5729.2	6226.8	693.4
$6i^2$	5.6	0.0*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1913.9	0.0	0.0	35065.4	0.0	257.6
$6w^2$	26.4	41.0	40.0	8984.1	6243.1	7566.5	40766.1	18757.6	2761.7	66314.0	45786.4	50076.9	71042.6	79507.9	91304.1
$6p^2$	102.1	44.4	42.6	28347.3	6371.9	7669.8	91134.5	2028.7	25331.6	207088.8	53696.7	51927.5	21128.2	87865.5	94423.3

Components as Percentage (%)

$6s^2$	51.32	2.35	2.47	33.8	1.03	1.35	25.94	1.47	2.99	24.90	4.79	1.37	22.66	22.43	0.07
$6d^2$	17.27	5.30	3.54	4.49	0.87	0.0	9.33	6.04	7.16	32.50	9.94	2.19	27.13	7.09	0.73
$6i^2$	5.52	0.0*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.58	0.0	0.0	16.59	0.0	2.50
$6w^2$	25.89	92.35	93.99	31.69	97.83	98.65	44.73	92.49	89.85	32.02	85.27	69.44	33.62	90.48	96.70

* Negative estimales are considered to be zere

Table 17 cont : Estimates of the Components of variance of body weight at different ages of Males , Females and Males + Females of F_2 . generation .

Compo-	10 wks			12 wks.			14 wks.			16 wks		
nents .	M.	F.	M+F.	M.	F.	M+F.	M.	F.	M+F.	M.	F.	M+F.
$6s^2$	57452.7	5422.4	1670.4	1741.8	3293.8	2764.3	18017.5	5775.1	258.1	9437.9	3987.6	0.0
$6d^2$	60811.7	11275.2	460.7	19469.3	1017.6	1839.6	11094.1	16332.9	6250.1	4659.9	17887.9	5349.7
$6i^2$	148527.1	0.0*	0.0	79647.9	0.0	0.0	36273.6	0.0	0.0	32837.5	0.0	0.0
$6w^2$	100431.5	81639.5	9974.8	134753.5	140947.7	147085.8	104469.3	118376.2	116693.9	160778.4	100559.0	96714.1
$6p^2$	367222.9	98337.1	96105.9	251292.5	145259.1	151689.7	169854.5	140484.3	123202.1	2077713.9	122434.5	102063.8

Components as Percentage (%) .

$6s^2$	15.65	5.51	1.74	6.93	2.27	1.82	10.61	4.11	0.02	4.55	3.26	0.0
$6d^2$	16.57	11.47	0.48	7.75	0.70	1.12	6.53	11.63	5.08	2.24	14.61	5.24
$6i^2$	40.45	0.0	0.0	31.70	0.0	0.0	21.36	0.0	0.0	15.18	0.0	0.0
$6w^2$	27.34	83.02	97.78	53.62	97.03	96.97	61.50	84.26	94.72	77.40	82.13	94.76

* Negative estimales are considered to be zere

Table 17 cont : Estimates of the Components of variance of body weight at different ages of Males , Females and Males + Females of F_2 . generation .

Components.	18 wks.			20 wks.			22 wks			24 wks		
	M.	F.	M+F.	M.	F.	M+F.	M.	F.	M+F.	M.	F.	M+F.
σ_s^2	29614.1	2529.1	1003.1	6397.6	6519.6	2558.2	39212.8	2234.4	56074.4	13787.9	24395.8	3880.0
σ_d^2	26433.7	7448.8	6248.3	5838.1	5916.2	2461.9	32360.6	5439.2	7784.3	13220.6	24395.8	5911.4
σ_i^2	10241.4	0.0*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
σ_w^2	123500.9	111506.7	99835.3	140853.6	149810.1	127183.5	142948.9	126314.5	83895.6	323320.2	134658.9	108586.3
σ_p^2	189780.3	121484.6	107086.7	153089.4	162245.9	132203.6	214522.4	1333988.1	97287.2	359328.8	183450.5	118377.8

Components as Percentage (%)

σ_s^2	15.60	2.08	0.94	4.18	4.02	1.94	18.28	1.67	5.76	3.84	13.30	3.28
σ_d^2	13.92	6.13	5.83	3.81	3.65	1.86	15.08	4.06	8.00	3.68	13.30	4.99
σ_i^2	5.40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
σ_w^2	65.08	91.79	93.23	92.01	92.33	96.30	66.64	94.27	86.24	92.48	73.40	91.73

* Negativee estimals are Considced to be zero.

Table 18 : Estimats of the Components of variance of body weight at different ages of Males, Females and Males + Females of F_3. generation.

Components	One Day old.			2 wks.			4 wks.			6 wks		
	M.	F.	M+F.	M.	F.	M+F.	M.	F.	M+F.	M.	F.	M+F.
$6s^2$	2.90	1.53	1.98	634.80	1491.90	116.33	5022.17	4268.63	203.88	16959.11	66428.92	3510.30
$6d^2$	2.67	1.44	1.64	532.59	2302.51	164.84	116.80	3258.23	473.53	5192.01	38215.13	3000.96
$6w^2$	14.42	9.10	10.86	6554.93	6841.22	6917.03	1176.81	39432.07	32729.91	67474.68	173133.52	91211.04
$6p^2$	19.99	12.07	14.48	7722.31	10635.63	7198.20	32036.21	46958.93	33407.33	89625.79	277777.57	97722.30

Components as Percentage (%).

$6s^2$	14.48	12.69	13.69	8.22	14.03	1.62	12.90	9.09	0.61	18.92	23.91	3.59
$6d^2$	13.38	11.93	11.35	9.90	21.65	22.29	2.95	6.94	1.42	5.80	13.76	3.07
$6w^2$	72.14	75.38	74.96	84.88	64.32	96.09	81.17	83.97	97.97	75.28	62.33	93.34

Table 18 cont : Estimats of the Components of variance of body weight at different ages of Males, Females and Males + Females of F_3 . generation .

Components	8 wks			10 wks.			12 wks.			14 wks		
	M.	F.	M+F.	M.	F.	M+F.	M.	F.	M+F.	M.	F.	M+F.
$6s^2$	4929.83	102981.68	6825.15	14853.46	142240.61	7928.44	14750.78	337636.27	70432.45	17053.89	1158111.76	85118.68
$6d^2$	748.37	14028.28	7685.65	1072.82	39552.2	6863.05	2237.14	4129.12	2395.24	18712.58	1149542.37	66615.63
$6w^2$	99864.73	321445.4	154522.11	138167.08	374479.3	195112.61	124649.63	316918.55	268241.52	70749.34	3127224.42	511794.41
$6p^2$	108542.93	438455.36	169032.91	154093.36	556272.11	209904.10	141637.55	658683.93	341069.20	106515.81	5434878.55	663528.72

Components as Percentage (%)

$6s^2$	4.54	23.49	4.04	9.64	25.57	3.78	10.41	51.26	20.65	16.01	21.31	12.83
$6d^2$	3.45	3.20	4.55	0.70	7.11	3.27	1.58	0.63	0.70	17.57	1.15	10.04
$6w^2$	92.01	73.31	91.41	89.66	67.32	9.95	88.01	48.11	78.65	66.42	57.54	77.13

Table 18 cont : Estimats of the Components of variance of body weight at different ages of Males , Females and Males + Females of F_3 . generation .

Components	16 wks			18 wks.			20 wks.			22 wks		
	M.	F.	M+F.	M.	F.	M+F.	M.	F.	M+F.	M.	F.	M+F.
$6s^2$	11108.4	397615.1	39047.2	27630.7	450503.9	27426.1	21570.4	569813.3	38356.5	28013.6	572334.9	44416.1
$6d^2$	9214.2	387762.9	25735.2	23100.1	457039.5	26231.4	34542.6	558989.7	23574.8	31971.9	56436.9	27156.3
$6w^2$	72558.5	1049432.9	211780.7	89528.9	1296545.9	268584.6	108217.1	1352346.9	311694.8	114180.7	121633.8	318807.8
$6p^2$	92881.1	1834811.0	276562.9	140259.8	2204089.4	322242.2	164330.1	2481149.9	373626.1	174166.1	2368205.4	390380.2

Components as Percentage (%)

$6s^2$	11.96	21.67	14.12	19.70	20.44	8.51	13.13	22.97	10.27	16.08	24.17	11.38
$6d^2$	9.92	21.13	9.30	16.47	20.74	8.14	21.02	22.53	6.31	18.36	23.83	6.96
$6w^2$	78.12	57.20	76.58	63.83	58.82	83.35	65.85	45.50	83.42	65.56	52.00	81.66

ranged from 1.71% to 22.55% with an average equal to 9.85% of the total variance; while those of 6^2_d ranged from 2.25% to 14.56% with an average equal to 8.61% . However, relatively lower values of 6^2_s and 6^2_d were estimated from the data of adjusted sex. The 6^2_s ranged from 1.29% to 8.76% with an average equal to 4.01%, while 6^2_d ranged from 1.07% to 5.62% with an average equal to 3.52% from the total variance. In conclusion, both sires and dams contributed by a relatively higher additive genetic effect on male than on female progeny by about 3% of their variances.

In addition, the contribution of sires during the first 14 weeks of age on body weight of male progeny ranged from 8.83% to 23.98% with an average 14.65%; while it ranged from 4.82% to 15.22% with an average 9.78% during the period form 16-24 weeks of age. Mean while, the contribution of dams during the first 14 weeks of age on males ranged from 6.54% to 21.45% with an average 12.17% of the total variance; while it ranged from 7.47% to 16.44% with an average 10.55% during the period from 16-24 weeks of age. It is clear then, that the additive genetic effect had a relatively higher contribution to the total phenotypic variance of body weight of males during the first 14 weeks of age and decreased during the last period of life. Peviously it was concluded that absolute gain in body weight was gradually increased from 1-day old up to 14 weeks of age after which this gain was gradually decreased , which means that growth rate was higher in younger ages than in oldor ages . Thus, the additive genes in male progeny expressed themselves more obviously during the first 14 weeks of age than the last period during which the gain in body weight was decreased .

Mean while, the contribution of sires during the first 14 weeks of age on body weight of female progeny ranged from 1.54% to 22.67% with an average of 9.92% of the total variance; while it ranged from 1.98% to 22.31% with an average of 9.72% during the period from 16-24 weeks , of age . Mean while , the contribution of dams during the first period on females ranged from 2.50% to 10.80% with an average of 7.58% ; while it ranged from 1.87% to 22.06% with an average of 10.76% during the second period of age. These results indicated that sires contributed relatively equal additive genetic effect on body weight of female progeny during the whole peroid from 1-day old up to 24 weeks of age. However, dams contributed relatively lower additive genetic effect during the first period compared to the second period with a difference equal to 3.18% of the total variance.

In males, maternal effect during the first 14 weeks of age was of a little magnitude (0.94%) compared to the last period of age from 16-24 weeks of age (2.10%) with an average, over all ages, equal to 1.52%. However, maternal effect in females was of nearly equal values during the two periods of age (1.37% V.S. 1.43%) with an average equal to 1.39%. However, there was a trend of existing maternal effect on body weight during the first 6 weeks of age of female progeny though the estimates were very low which ranged from 0.27% to 1.81%. The maternal effects mights be due to non-random environment which were common to female progeny of particullar groups of dams. On the contrary, sex linkage in males and females was of relatively higher effect during the first 14 weeks of age (4.55 V.S. 8.52%) and of lower effect during the period from 16-24 weeks of age (0.95 V.S. 0.32%). The respective averages of sex linkage were 3.52 V.S. 6.47% of the total variance. This means that sex linkage might be of important effect in determining body weight of drakes and ducks during the first 14 weeks of age while maternal effect was of negligable effect.

Nearly similar results were reported by Sochocka and wezyk (1971[a,b]) who found that maternal coefficients forbody weight at 8 weeks of age ranged from 0.06 to 0.16 and from 0.02 to 0.05 in males and females of Pekin breed. The respective estimates of maternal cofficcients for 20 weeks body weight ranged from - 0.15 to 0.23 and from 0.08 to 0.20. They conccluded that body weight in this breed was controlled by sex- likage effect more than maternal effect at 8 weeks of age. Meanwhile, Kamar *et al*. (1969) reported that the hatch weights of crossbred between Pekin and khaki- campbell were almost similar to those of their maternal breeds, indicating the presence of maternal effect. However, maternal effect was absent after this age. Also, Godfrey *et al*. (1953) and Smith and Jaap (1957) observed no maternal effects after 4 or 8 weeks of age in chickens.

Considering the additive effect on body weight of progeny of F_1, F_2 and F_3 generations; the corresponding estimates of $6^2{}_s$ and $6^2{}_d$ (over all ages) in males were higher in F_2 progeny (18.33% V.S. 16.18%) followed by F_3 (13.45% V.S. 9.84%) and F_1 (7.29% V.S. 8.11%) progeny. However, these estimates in females progeny were higher in F_3 (22.55% V.S. 14.56%) followed by F_2 (5.28% V.S. 9.03%) and F_1 (1.71% V.S. 2.25%) progeny. Similar to female progeny, the adjusted sex had the same trend of having higher estimates of $6^2{}_s$ and $6^2{}_d$ for the F_3 progeny (8.76% V.S. 5.62%) followed by F_2 (1.98 V.S. 3.86%) and F_1 (1.29% V.S. 1.07%) progeny. Thus, these results indicated that sires contributed relatively higher additive genetic effect on body weight of F_2 male progeny and F_3 female progeny than the contribution of dams.

II.3. Heritability estimates

Heritability expresses the proportion of the total variance that is attributable to the average effects of genes which determines the degree of resemblance between relatives. The most important function of the heritability in genetic studies is its productive property which expresses the raliability of the phenotypic performance as a guide to the breeding value. Only the phenotypes of individuals can be directly measured, but it is the breeding value that determine its influence on the next generation. Therefore, the knowledge of the degree of correspondance between the phenotypic and the breeding values could be utilized in changing the characteristics of the population. This degree of correspondence is measured by the heritability which is expressed as the ratio of the additive genetic variance to the tatal phenotypic variance (Falconer, 1961).

The estimates of heritability very greatly according to the amount of genetic variance due to sire or dam. The sire component of variance theoretically contains $^1/_4$ of the additive variance, $^1/_{16}$ additive x additive variance and $^1/_2$ sex- linkage variance. The dam component has the same first two terms as the sire component plus all the maternal effect. Thus, if the heritability estimate derived from the sire component is larger than that of the dam component, this will be due to sex- linkage effect; otherwise it will be due to maternal effect.

The heritability estimates (along with their standard errors) due to sire, dam and sire + dam for body weight at different ages for males, females and males + females of F_1, F_2 and F_3 generations are presented in tables 19, 20 and 21.

In general the estimates of h^2_s, h^2_d and h^2_{s+d} in male progeny (over all ages) ranged from 0.291 to 0.622, 0.324 to 0.575 and 0.308 to 0.614 with averages equal to 0.474, 0.434 and 0.459; respectively. While those respective estimates in female progeny ranged from 0.068 to 0.813, 0.077 to 0.582 and 0.079 to 0.739, with averages equal to 0.343, 0.317 and 0.346. The estimates of h^2_s, h^2_d and h^2_{s+d} in the adjusted sex, however,

Table 19 : Estimats of heritablity (± S.E.) due to sire , dam and sire + dam for body weight at different ages for Males , Females and Males + Females of F_1. generation .

Components	One Day old.			2 wks.			4 wks.			6 wks		
	M.	F.	M+F.	M.	F.	M+F.	M.	F.	M+F.	M.	F.	M+F.
Sire	0.190 ±0.037	0.013 ±0.003	0.011 ±0.002	0.433 ±0.065	0.193 ±0.053	0.102 ±0.080	0.458 ±0.077	0.105 ±0.026	0.089 ±0.020	0.250 ±0.041	0.016 ±0.005	0.033 ±0.007
Dam	0.173 ±0.035	0.106 ±0.025	0.039 ±0.008	0.670 ±0.114	0.123 ±0.042	0.027 ±0.010	0.422 ±0.076	0.120 ±0.031	0.008 ±0.003	0.491 ±0.090	0.150 ±0.032	0.041 ±0.009
Sire+Dam	0.182 ±0.008	0.059 ±0.004	0.025 ±0.002	0.551 ±0.022	0.158 ±0.014	0.064 ±0.006	0.440 ±0.016	0.112 ±0.006	0.048 ±0.003	0.370 ±0.014	0.083 ±0.005	0.037 ±0.002

Table 19 Cont. : Estimats of heritablity (± S. E.) due to sire, dam and sire + dam for body weight at different ages for Males, Females and Males + Females of F_1. generation .

Componemts	8 wks.			10 wks.			12 wks.			14 wks.		
	M.	F.	M+F.	M.	F.	M+F.	M.	F.	M+F.	M.	F.	M+F.
Sire	0.360 ±0.061	0.051 ±0.010	0.033 ±0.007	0.452 ±0.084	0.028 ±0.006	0.063 ±0.014	0.358 ±0.072	0.024 ±0.008	0.078 ±0.020	0.325 ±0.065	0.063 ±0.016	0.048 ±0.012
Dam	0.334 ±0.056	0.150 ±0.033	0.041 ±0.009	0.285 ±0.047	0.038 ±0.008	0.052 ±0.011	0.246 ±0.040	0.063 ±0.017	0.013 ±0.004	0.101 ±0.016	0.049 ±0.013	0.025 ±0.008
Sire+Dam	0.346 ±0.012	0.101 ±0.005	0.037 ±0.002	0.369 ±0.012	0.033 ±0.005	0.058 ±0.002	0.302 ±0.008	0.043 ±0.006	0.050 ±0.003	0.213 ±0.010	0.056 ±0.006	0.037 ±0.003

Table 19 Cont. : Estimats of heritablity (± S. E.) due to sire , dam and sire + dam for body weight at different ages for Males , Females and Males + Females of F_1 generation .

Components	16wks.			18 wks.			20 wks.			22 wks			24 wks		
	M.	F.	M+F.	M.	F.	M+F.	M.	F.	M+F.	M.	F.	M+F.	M.	F.	M+F.
Sire	0.091 ±0.014	0.141 ±0.029	0.008 ±0.004	0.362 ±0.055	0.74 ±0.018	0.007 ±0.007	0.341 ±0.066	0.145 ±0.036	0.150 ±0.037	0.069 ±0.017	0.020 ±0.012	0.029 ±0.005	0.93 ±0.021	0.016 ±0.007	0.020 ±0.004
Dam	0.077 ±0.012	0.001 ±0.003	0.001 ±0.003	0.520 ±0.087	0.119 ±0.028	0.065 ±0.014	0.292 ±0.059	0.138 ±0.034	0.098 ±0.026	0.284 ±0.068	0.074 ±0.023	0.085 ±0.017	0.327 ±0.074	0.042 ±0.009	0.029 ±0.007
Sire+Dam	0.048 ±0.010	0.071 ±0.006	0.005 ±0.003	0.441 ±0.021	0.096 ±0.006	0.036 ±0.005	0.317 ±0.009	0.142 ±0.006	0.124 ±0.003	0.177 ±0.014	0.047 ±0.010	0.057 ±0.003	0.207 ±0.019	0.029 ±0.012	0.024 ±0.005

Table 20 : Estimats of heritablity (± S. E.) due to sire , dam and sire + dam for body weight at different ages for Males , Females and Males + Females of F_2 . generation .

Components	One Day old.			2 wks.			4 wks.			6 wks		
	M.	F.	M+F.	M.	F.	M+F.	M.	F.	M+F.	M.	F.	M+F.
Sire	2.053 ±0.116	0.94 ±0.008	0.099 ±0.017	1.353 ±0.099	0.052 ±0.009	0.054 ±0.031	1.038 ±0.078	0.059 ±0.011	0.120 ±0.032	0.996 ±0.078	0.192 ±0.030	0.055 ±0.038
Dam	0.691 ±0.056	0.212 ±0.017	0.141 ±0.018	1.380 ±0.096	0.035 ±0.002	0.038 ±0.041	1.173 ±0.079	0.242 ±0.041	0.286 ±0.073	1.300 ±0.084	0.398 ±0.024	0.088 ±0.069
Sire+Dam	1.372 ±0.044	0.153 ±0.006	0.120 ±0.005	1.366 ±0.094	0.044 ±0.008	0.046 ±0.033	1.105 ±0.068	0.151 ±0.008	0.203 ±0.035	1.148 ±0.057	0.295 ±0.008	0.071 ±0.045

Table 20 cont : Estimats of heritablity (± S. E.) due to sire , dam and sire + dam for body weight at different ages for Males , Females and Males + Females of F_2 . generation .

Components	8 wks			10 wks.			12 wks.			14 wks		
	M.	F.	M+F.	M.	F.	M+F.	M.	F.	M+F.	M.	F.	M+F.
Sire	0.906 ±0.070	0.097 ±0.007	0.003 ±0.045	0.626 ±0.069	0.221 ±0.024	0.070 ±0.016	0.277 ±0.053	0.091 ±0.040	0.073 ±0.018	0.424 ±0.048	0.164 ±0.019	0.008 ±0.015
Dam	1.085 ±0.073	0.283 ±0.016	0.029 ±0.065	0.662 ±0.067	0.459 ±0.019	0.019 ±0.012	0.310 ±0.051	0.028 ±0.027	0.049 ±0.010	0.261 ±0.042	0.465 ±0.034	0.203 ±0.037
Sire+Dam	0.996 ±0.039	0.190 ±0.011	0.016 ±0.058	0.644 ±0.061	0.340 ±0.011	0.044 ±0.014	0.294 ±0.083	0.059 ±0.030	0.061 ±0.014	0.343 ±0.081	0.315 ±0.015	0.106 ±0.021

Table 20 cont : Estimats of heritablity (± S. E.) due to sire , dam and sire + dam for body weight at different ages for Males , Females and Males + Females of F_2 . generation .

Components	16 wks			18 wks.			20 wks.			22 wks			24 wks		
	M.	F.	M+F.	M.	F.	M+F.	M.	F.	M+F.	M.	F.	M+F.	M.	F.	M+F.
Sire	0.182 ± 0.045	0.130 ± 0.013	0.000 ± 0.015	0.624 ± 0.046	0.083 ± 0.009	0.037 ± 0.011	0.167 ± 0.014	0.161 ± 0.014	0.077 ± 0.013	0.731 ± 0.060	0.067 ± 0.006	0.231 ± 0.021	0.153 ± 0.017	0.532 ± 0.037	0.131 ± 0.009
Dam	0.090 ± 0.041	0.584 ± 0.031	0.210 ± 0.031	0.557 ± 0.044	0.245 ± 0.018	0.233 ± 0.037	0.153 ± 0.013	0.146 ± 0.016	0.074 ± 0.013	0.603 ± 0.053	0.162 ± 0.009	0.320 ± 0.023	0.147 ± 0.013	0.532 ± 0.043	0.200 ± 0.015
Sire+Dam	0.136 ±0.103	0.357 ±0.019	0.105 ±0.023	0.591 ± 0.109	0.164 ± 0.028	0.135 ± 0.022	0.160 ± 0.262	0.154 ± 0.031	0.076 ± 0.023	0.667 ± 0.480	0.115 ± 0.138	0.275 ± 0.081	0.150 ± 0.772	0.532 ± 0.441	0.165 ± 0.279

Table 21 : Estimats of heritablity (± S. E.) due to sire , dam and sire + dam for body weight at different ages for Males , Females and Males + Females of F_3 . generation .

Components	One Day old.			2 wks.			4 wks.			6 wks		
	M.	F.	M+F.	M.	F.	M+F.	M.	F.	M+F.	M.	F.	M+F.
Sire	0.579 ±0.077	0.507 ±0.052	0.548 ±0.063	0.329 ±0.100	0.561 ±0.057	0.065 ±0.065	0.516 ±0.065	0.364 ±0.065	0.024 ±0.070	0.757 ±0.069	0.957 ±0.081	0.144 ±0.035
Dam	0.535 ±0.061	0.477 ±0.059	0.454 ±0.057	0.276 ±0.085	0.866 ±0.107	0.092 ±0.071	0.188 ±0.030	0.278 ±0.055	0.057 ±0.071	0.232 ±0.029	0.550 ±0.055	0.123 ±0.033
Sire+Dam	0.557 ±0.028	0.492 ±0.013	0.501 ±0.014	0.302 ±0.050	0.714 ±0.029	0.079 ±0.060	0.713 ±0.021	0.321 ±0.052	0.041 ±0.070	0.494 ±0.015	0.753 ±0.042	0.133 ±0.027

Table 21 cont : Estimats of heritablity (± S. E.) due to sire , dam and sire + dam for body weight at different ages for Males, Females and Males + Females of F_3 generation .

Components	8 wks			10 wks.			12 wks.			14 wks		
	M.	F.	M+F.	M.	F.	M+F.	M.	F.	M+F.	M.	F.	M+F.
Sire	0.182 ±0.033	0.939 ±0.095	0.162 ±0.019	0.386 ±0.073	1.023 ±0.101	0.151 ±0.019	0.417 ±0.078	2.050 ±0.332	0.826 ±0.145	0.640 ±0.084	0.852 ±0.061	0.513 ±0.062
Dam	0.138 ±0.031	0.128 ±0.012	0.182 ±0.022	0.028 ±0.015	0.284 ±0.027	0.131 ±0.013	0.063 ±0.012	0.025 ±0.053	0.028 ±0.035	0.703 ±0.076	0.846 ±0.072	0.402 ±0.046
Sire+Dam	0.160 ±0.023	0.534 ±0.049	0.172 ±0.012	0.207 ±0.020	0.654 ±0.051	0.141 ±0.010	0.240 ±0.018	1.038 ±0.049	0.427 ±0.036	0.672 ±0.013	0.849 ±0.065	0.457 ±0.021

Table 21 cont : Estimats of heritablity (± S. E.) due to sire , dam and sire + dam for body weight at different ages for Males, Females and Males + Females of F_3 generation .

Components	16 wks			18 wks.			20 wks.			22 wks		
	M.	F.	M+F.	M.	F.	M+F.	M.	F.	M+F.	M.	F.	M+F.
Sire	0.478 ±0.048	0.867 ±0.062	0.565 ±0.061	0.788 ±0.81	0.818 ±0.64	0.340 ±0.034	0.525 ±0.047	0.919 ±0.089	0.411 ±0.050	0.643 ±0.061	0.967 ±0.142	0.455 ±0.060
Dam	0.397 ±0.040	0.845 ±0.072	0.372 ±0.037	0.659 ±0.083	0.829 ±0.080	0.326 ±0.038	0.481 ±0.092	0.901 ±0.100	0.252 ±0.34	0.734 ±0.064	0.953 ±0.133	0.278 ±0.030
Sire+Dam	0.438 ±0.017	0.856 ±0.064	0.469 ±0.020	0.723 ±0.022	0.824 ±0.076	0.333 ±0.013	0.683 ±0.043	0.910 ±0.100	0.332 ±0.017	0.689 ±0.116	0.960 ±0.232	0.367 ±0.046

were low. The respective estimates were 0.053 to 0.350 , 0.040 to 0.221 and 0.040 to 0.288 with averages equal to 0.161 , 0.135 and 0.146 .

These results indicated that relatively higher values of hiritability were estimated in both males and females, which means, that body weight in white Pekin ducks is a relatively high heridetary trait and is controlled by additive genes and, therefore, could be improved by individual selection. Also, the results revealed that the heritability estimates were relatively higher in male than those estimated in female progeny; which means that body weight in males is controlled additively more than in females and, therefore, males might be efficiently respond to selection than females and reach market weight at a relatively earlier age. These results, also, indicated that estimates of h^2_s in males and females were relatively higher than those of h^2_d , while estimates of h^2_{s+d} were in between. This means that sex- linked effect might be contributed to body weight than maternal effect.

Nearly similar results obtained by Stasko (1965) who indicated higher estimates of heritability in both males and females of white Pekin flock , also , the estimates were higher in males (0.39 to 0.56) than in females (0.31 to 0.40) at 8 weeks of age . While El-Sayiad (1983) reported that the estimates of h^2_s , h^2_d and h^2_{s+d} in combined sex of white Pekin ranged from -0.05 to 0.80 , 0.29 to 1.33 and 0.29 to 0.72 at hatch up to 24 weeks of age ; respectively . Meanwhile , the respective estimates obtained by Kosba *et al.* (1981) in white Pekin ranged from 0.12 to 0.47 , 0.30 to 0.75

and 0.23 to 0.89 at one day old up to 8 weeks of age . Also, Konticka (1979) reported that the estimates were (0.09 to 0.34) V. S . (0.10 to 0.39), (0.01 to 0.77) V. S . (0.15 to 0.51) and (0.09 to 0.55) V. S. (0.14 to 0.40) at 4 versus 8 weeks of age .

In addition , the estimates of h^2_s , h^2_d and h^2_{s+d} in male prongeny during the first 14 weeks of age ranged from 0.353 to 0.779 , 0.262 to 0.741 and 0.347 to o.785 with averages equal to 0.536 , 0.448 and 0.500 , respectively . However , relatively lower estimates were obtained during the period from 16-24 weeks of age . The respective values ranged from 0.191 to 0.579 , 0.300 to 0.685 and 0.245 to 0.632 with average equal to 0.380, 0.432 and 0.406 . Since higher values of additive variance and heritability were estimated during the first 14 weeks of age . Thus, body weight of male progeny could be improved by selection at early stage of their life . Results obtained by Sochocha and Wezyk (1971[b]) in males of white Pekin flock estimated h^2_s , h^2_d and h^2_{s+d} as 0.12 V.S . 0.35 , 0.50 V.S . 0.61 and 0.31 V.S. 0.48 at 8 versus 20 weeks of age .

Relatively lower values of h^2_s , h^2_d and h^2_{s+d} were estimated in female prongeny during the first 14 weeks of age than those estimated during the last period . The respective estimates of the first period (one day old up to 14 weeks of age) ranged from 0.062 to 0.773 , 0.100 to 0.432 and 0.081 to 0.665 with averages equal to 0.319 , 0.266 and 0.313 ; while those of the second period (from 16 - 24 weeks of age) ranged from

0.079 to 0.893 , 0.208 to 0.882 and 0.077 to 0.888 with averages equal to 0.389 , 0.475 and 0.410 . Nearly similar results were obtained by Sochocka and Wezyk (1971) in females of white Pehin ducks who estimated 0.12 V.S. 0.23 , 0.59 V.S. 0.83 and 0.35 V.S 0.55 at 8 weeks versus 20 weeks of age .

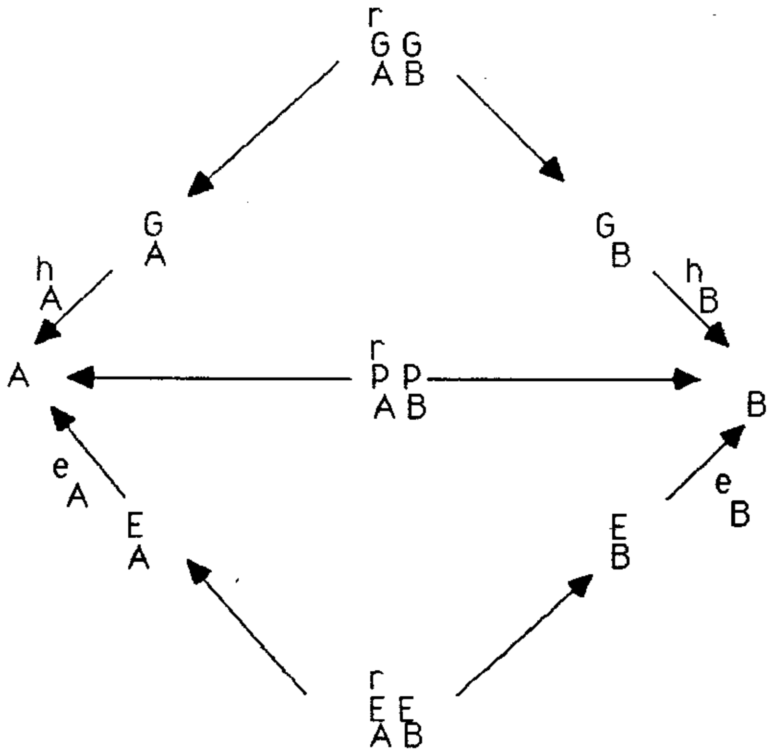
Considering the coeffecients of h^2_s , h^2_d and h^2_{s+d} in F_1 , F_2 and F_3 male progeny , the corresponding estimates were higher in F_2 generation (0.622 V.S. 0.575 V.S. 0.614) followed by F_3 (0.510 V.S . 0.403 V.S. 0.456) and F_1 (0.291 V.S. 0.324 V.S. 0.308) generations . However , these estimates in female progeny were higher in F_3 (0.813 V.S . 0.582 V.S. 0.739) followed by F_2 (0.149 V.S . 0.292 V.S. 0.221) and F_1 (0.068 V.S. 0.077 V.S. 0.079) generations . Similar to female progeny the adjusted sex had the same trend of having higher values of h^2_s , h^2_d and h^2_{s+d} for F_3 progeny (Tables 19 , 20 and 21) .

II.4. Correlation estimates

The association between two characters that can be directly observed is the phenotypic correlation . The phenotypic correlation is a function of the genotypic correlation , the environmental correlation, the correlation between the genotype and the phenotype and correlation between the environmental and the phenotype . Genetically correlated characters are the results of one of the three factors . Firstly , genetic correlation can be occur as a result of the pleiotropic action of genes and because of linkage relationship . Secondly , genetic correlation can be induced by artificial selection, i.e, in provement in one character will cause simultanaous changes in other characters in time. And thirdly , natural selection can create a relationship between a metric trait and fittness (Falconer, 1961) .

The correlation resulting from environmental causes is the effect of all of the environmental factors , some of which may tend to cause positive correlations and others negative correlations. Falconer (1961) explained the enviromental correlation as not only the correlation of environmental deviation, but also the correlation of environmental deviation together with non-additive genetic deviations . Thus , the genetic and environmental correlation correspond to the partitioning of the cavairiance into additive genetic component versus all the rest .

Lerner (1961) described the basis of correlation between two traits of an individual as shown in the following diagram .



The phenotype for a given character (A) is shown as being determined by its gentotype (G_A) and its environment (E_A) connected to (A) by paths (h_A) and (e_A) . Character (B) similarly has genotypic and environmental components . Thus , a phenotypic correlation between the two traits (A) and (B) in an indvidual may arise either because the traits are genetically correlated owing to common sources of genetic variation , or simply , because they developed in a common enviroment or both . Hence , the phenotypic correlation ($r_{p_A p_B}$) between the two traits (A) and (B) in terms of path coefficients is :

$$r_{P_A P_B} = h_A \, r_{G_A G_B} \, h_B + e_A \, r_{E_A E_B} \, e_B$$

It can be shown from this equation that if both characters have low heritabilities then the phenotypic correlation is determined chiefly by the environmental correlation. If the characters have high heritabilities then the genetic correlation is the more important . A difference in sign between the two correlations shows that genetic and environmental sources of variation affect the characters through different physiological mechanisms.

The genetic interpretion of the compnents of cavariance can be derived from the following table in term of genetic covariance :

Source	Cov_a.	Cov_d.	Cov_{aa}.	Cov_{ad}.	Cov_{dd}.	Cov_{aaa}.	Cov_e.
Cov_s.	1/4	0	1/16	0	0	1/64	0
Cov_d.	1/4	0	1/16	0	0	1/64	0
Cov_{sd}.	0	1/4	1/8	1/8	1/16	3/32	0
Cov_w.	1/2	3/4	3/4	7/8	15/16	56/64	1

a = Additive , d = Dominance , e = Environmental ,
aa , ad , dd and aaa represent epistatic interaction between loci .

Genetic , phenotypic and environmental correlations (along with their standard errors) among traits of body weight in males , females and adjusted sex are given in tables 22, 23, 24, 25 and 26 (Appendices 1 to 27).

The genetic correlation coeffecients among traits of body weight in adjusted sex based on full sibs were positively low in most cases (Table 24) . The estimates between body weight at 4 weeks of age and each of 12, 16 , 20 and 24 weeks of age were 0.130 , 0.121 , 0.308 and 0.106 ; respectively . While those between 8 weeks of age and each of 16 , 20 and 24 weeks of age were 0.117 , 0.243 and 0.193 ; respectively . In addition , the respective genetic associations between 12 weeks and each of 16 , 20 and 24 weeks of age were 0.173 , 0.278 and 0.209 .

Table 22 : Estimates of full-sib genetic (above diagonal) and phenotypic (below diagonal) correlations along with their ± S. E. among traits of body weight at different ages in Males (over all generations).

	1-Day	4 wks	8wks	12wks	16wks	20wks	24wks
1-day		-0.022 ±0.051	-0.182 ±0.053	0.006 ±0.048	-0.082 ±0.073	-0.197 ±0.127	-0.170 ±0.496
4 wks	0.069 ±0.123		0.185 ±0.042	0.105 ±0.055	0.007 ±0.083	0.228 ±0.154	0.115 ±0.424
8 wks	-0.065 ±0.123	0.486 ±0.097		0.137 ±0.056	0.051 ±0.076	0.204 ±0.165	0.111 ±0.426
12 wks	-0.002 ±0.118	0.250 ±0.115	0.481 ±0.097		0.189 ±0.133	-0.047 ±0.262	0.013 ±0.525
16 wks	-0.117 ±0.124	0.154 ±0.122	0.227 ±0.118	0.445 ±0.098		0.170 ±0.039	-0.186 ±0.230
20 wks	0.098 ±0.135	0.116 ±0.133	0.161 ±0.135	0.161 ±0.132	0.360 ±0.120		0.229 ±0.125
24 wks	0.104 ±0.162	0.075 ±0.163	0.196 ±0.157	0.173 ±0.159	0.027 ±0.153	0.466 ±0.131	

Table 23 : Estimates of full - sib genetic (above diagonal) and phenotypic (below diagonal) correlations along with their ± S.E. among traits of body weight at different ages in Females (over all generations) .

	1-Day	4 wks	8wks	12wks	16wks	20wks	24wks
1-day		0.094 ±0.079	0.089 ±0.054	0.058 ±0.094	-0.029 ±0.045	-0.001 ±0.046	0.134 ±0.213
4 wks	0.017 ±0.097		0.089 ±0.048	0.058 ±0.073	-0.029 ±0.045	-0.001 ±0.046	0.134 ±0.213
8 wks	-0.087 ±0.103	0.579 ±0.071		0.185 ±0.068	0.072 ±0.052	-0.029 ±0.062	-0.734 ±0.309
12 wks	0.097 ±0.106	0.429 ±0.089	0.619 ±0.070		0.109 ±0.064	0.148 ±0.182	-0.820 ±0.678
16 wks	-0.124 ±0.108	0.191 ±0.107	0.306 ±0.102	0.445 ±0.091		0.071 ±0.083	-0.836 ±0.691
20 wks	-0.125 ±0.120	0.161 ±0.121	0.168 ±0.120	0.267 ±0.115	0.495 ±0.085		0.210 ±0.542
24 wks	0.005 ±0.127	0.175 ±0.123	0.265 ±0.118	0.218 ±0.122	0.258 ±0.112	0.599 ±0.076	

Table 24 : Estimates of full-sib genetic (above diagonal) and phenotypic (below diagonal) corrleations along with their ± S.E. among traits of body weight at different ages in Males + Females (over all generations).

	1-Day	4 wks	8wks	12wks	16wks	20wks	24wks
1-day		-0.001 ±0.102	-0.172 ±0.084	0.157 ±0.062	0.070 ±0.132	0.071 ±0.074	0.111 ±0.221
4 wks	0.058 ±0.072		-0.002 ±0.114	0.130 ±0.086	0.121 ±0.093	0.308 ±0.101	0.106 ±0.243
8 wks	-0.061 ±0.075	±0.537 ±0.057		-0.597 ±0.076	0.117 ±0.081	0.243 ±0.070	0.193 ±0.287
12 wks	-0.007 ±0.075	0.340 ±0.068	0.588 ±0.051		0.173 ±0.057	0.278 ±0.055	0.209 ±0.213
16 wks	0.104 ±0.079	0.154 ±0.078	0.258 ±0.075	0.391 ±0.068		0.250 ±0.128	-0.339 ±0.358
20 wks	0.026 ±0.087	0.114 ±0.086	0.132 ±0.086	0.131 ±0.084	0.270 ±0.062		0.153 ±0.525
24 wks	0.047 ±0.100	0.125 ±0.099	0.223 ±0.100	0.254 ±0.095	0.252 ±0.094	0.547 ±0.071	

Table 25 : Estimates of envirnmental correlations among traits of body weight at different ages in Males (above diagonal) and Females (below diagonal) over all generations .

	1-Day	4 wks	8wks	12wks	16wks	20wks	24wks
1- day		-0.207	-0.070	-0.304	-0.007	-0.134	0.254
4 wks	-0.196		0.826	-0.216	-0.369	0.470	0.104
8 wks	-0.934	0.839		0.010	0.103	0.089	-0.257
12 wks	-0.326	0.694	0.861		0.649	0.336	0.311
16 wks	-0.408	0.324	0.517	0.713		0.573	0.069
20 wks	0.295	0.185	0.149	0.628	0.681		0.538
24 wks	0.110	0.262	0.369	0.172	-0.845	0.791	

Table 26 : Estimates of envirnmental correlations among traits of body weight at different ages in Males + Females over all generations .

	1-Day	4 wks	8wks	12wks	16wks	20wks
4 wks	0.079					
8 wks	-0.197	0.674				
12 wks	-0.119	0.418	0.668			
16 wks	-0.173	0.207	0.302	0.437		
20 wks	-0.044	0.155	0.099	0.204	0.597	
24 wks	0.022	0.144	0.099	0.243	0.243	0.693

The same trend of positively low phenotypic correlations among the same traits were also obtained (Table 24) . The estimates between body weight at 4 weeks of age and each of 8 , 12 , 16 , 20 and 24 weeks of age were 0.537 , 0.340 , 0.154 , 0.114 and 0.125 ; respectively . While those between 8 weeks of age and each of 12 , 16 , 20 and 24 weeks of age were 0.588 , 0.258 , 0.132 and 0.223 ; respectively .

Also , those between 12 weeks of age and each of 16 , 20 and 24 weeks of age were 0.391 , 0.131 and 0.254 ; respectively . It should be pointed out , here , that these correlations are in part outomatic . One would expect that genes which affect body weight at a given age would also, affect body weight at another age during the course of bird's life . Thus , it could be recommended that genetic selection for body weight would be carried out at an early age , which consequently would decreased the generation interval .

Similar results obtained by Sochocka and Wezyk (1971^b) on Pekin flock showed that there was a close association between weight at 8 and 20 weeks of age in ducks and drakes . The estimates of genetic correlation in drakes were r_{GS} = 0.93 , r_{GD} = 0.74 to 1.08 and r_{GSD} = 0.77 to 0.86 ; while respective estimates in ducks were 0.41 to 0.77 , 0.73 to 0.75 and 0.65 to 0.72 . Meanwhile the phenotypic association ranged from 0.33 to 0.49 in drakes and 0.38 to 0.47 in ducks . Also , Veremiyenko (1978) in two Pekin sire lines , two Ukrainian white dam lines and their crosses , found that the average daily gain was significantly correlated (0.56 to 0.84) with body weight at 10 days of age but not with body weight at 30 days of age . Body weight at 20 and 30 days of age were significantly correlated with weight at 50 days of age which ranged from 0.43 to 0.78 for all groups . Meanwhile Kontecka (1979) reported estimates of genetic (r_{GSD}), phenotypic (rp) correlations between 4 and 8 weeks live weight for 5 strains of Pekin flock which ranged from 0.617 to 1.235 and from 0.171 to 0.528 ; respectively . Also , El- Sayaid (1983) estimated genetic correlations in pekin flock based on full sibs as 0.49, 0.28 , 0.06 and - 0.04 between hatch weight and each of 6 ,12 ,18 and 24 weeks of age . While those between 6 and each of 12,18 and 24 weeks of age were 0.86, 0.73 and 0.5 ; the respective estimates between 12 and each of 18 and 24 weeks of age were 0.88 and 0.73 ; and between 18 and 24 weeks of age were 0.91 . Also, the estimates of phenotypic correlation were 0.34 , 0.27 , 0.16 and 0.12 between hatch weight and each of 6,12 , 18 and 24 weeks of age . While between 6 and each of 12 , 18 and 24 weeks of age were 0.80 . 0.60 and 0.38 . Also , between 12 and each of 18 and 24 weeks of age were 0.87and 0.86 and between 18 and 24 weeks of age was 0.65 .

The estimated environmental correlations among the studied traits of body weight were relatively positively high compared to the genetic and phenotypic estimates (Table 26) . The coefficients between body weight at 4 weeks of age and each of 8,12 , 16 , 20 and 24 weeks of age were o.674 , 0.418 , 0.207 , 0.155 and 0.144 ; respectively . While those between 8 weeks of age and each of 12 , 16 , 20 and 24 weeks of age were 0.668 , 0.302 . 0.099 and 0.099 ; respectively . The respective estimates between

12 weeks of age and each of 16 , 20 and 24 weeks of age were 0.437 , 0.204 and 0.243 . From these results ; it is clear that the environmental correlations among traits of body weight at earlier ages were relatively higher than those at older ages. At these early ages the bird is in its growing stage, thus any environmental inprovement in nutrition and other managerial factors would expect to enhance growth rate at these ages .

Results obtained by Sochocka and Wezyk (1971[b]) estimated environmental corrrelations in Pekin flock between weight at 8 and 20 weeks of age , in drakes were r_{Es} = - 0.89 to 0.74 , r_{ED} = - 0.02 to 0.25 and $r_{E_{SD}}$ = - 0.10 to 0.19 ; while those in ducks were 0.39 to 0.45 ,- 0.51 and 0.12 to 0.14 , respectively. Meanwhile Kontecka (1979) estimated the environmental correlations ($r_{E_{SD}}$) between 4 and 8 weeks live weight for 5 strains of Pekin flock which ranged from -0.056 to 0.569 .