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The Effect of Various Types of Brooding on the Growth of the Chickens and Related Characters

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Thirty six hundred chicks were hatched during December 1963 and April 1964 for Fayoumi, White Plymouth Rock and New Hampshire breeds. Subgroups (200 chicks each) of the three breeds were brooded under four housing systems. The first began with floor brooder until 8 weeks of age then shifted to a broiler house for another 4 weeks. The second in batteries for 3 weeks and finished in the broiler house for anorther 9 weeks. The third was brooded in the broiler house throught the whole period of experiment and the last was brooded in batteries all the way from hatch to 12 weeks old. Body weights, gains, growth rate as well as feed efficiency and mortality rates were compared forall groups. Results obtained gave the following indications.

1. The December hatched chicks for New Hampshire and White Plymouth Rock were of heavier body weights at 12 weeks of age when compared with the April hatch. The Fayoumi were on the reverse.
2. The final averages attained at 12 weeks of age, were better in all floor brooding for W.P.R. an N.M., Battery brooding in April hatch was most suitable for the Fayoumi.
3. Feed efficiency was better for the chicks brooded for the full period in the broiler house. Fayoumi chicks were of low efficiency at all ages.
4. Mortality was less for battery brooding and tended to decrease by age except where unhealthy conditions occurred. Fayoumi was more viable than the other breeds.

Among the several factors that affect growth rate of chickens are, the breed used season of hatch and brooding type. The chicks that hatched early in the season (September) grew much faster than the later hatched ones. The poorestgrowth was observed in chicks hatched in May, June and onwards. This is related to the prevailing environmental conditions during the growth period of each hatch (Kamar, 1954 , Ghany 1955, Kotbey, 1958 and Moustafa, 1963). Heavy breeds grew faster than the light breeds including the indigenous breeds such as Fayoumi and White Baladi birds (Amer, 1956 and Moustafa, 1963). Most of the studies on brooding types were in

favour of battery brooding with regard to growth rate, while other types of brooding gave contradicting results (Pingle, 1961 ; Robert 1963 and Abdou, 1965).

The efficiency of food utilization is related to growth rate. Accordingly, the efficiency of food utilization showed similar trend like growth rate with respect to month of hatch (Moustafa, 1963 and Abdou, 1965). The fast growing breeds or individuals usually utilize their food more efficiently than the slower ones (Fox and Bohern, 1952; Rizk and El-Ibiary and El-Ibiary, i1960 and Moustafa, 1963). At any stage of life, feed efficiency was better n battery brooding than in floor brooding especially in older ages (Hinds, 1942 and Mehrohof *et el.*, 1943).

Mortality rate is normally higher in late hatches when the hot weather of summer monthes approach (Miharlesru and padurau, 1955). In general, viability is better in monthes of good weather than in those of cold or hot weather (Moustafa, 1963 and, Abdou, 1965). Breeds differ in their viability according to locality and managemental conditions (Amer, 1956; Rizk and EL-Ibiary, 1960 and Moustafa, 1963). Cage or battery brooding shows less mortality rate than any other type of brooding (Pingle, 1961, Abdu, 1965 and Logan, 1965) .

Material and Methods

Thirty six hundred day-old chicks hatched on December and April from Fayoumi, New Hampshire and White Plymouth Rock were used. On hatching all chicks were wing banded and vaccinated against New Castle. The chicks were divided into groups of 200 chicks for month of hatch breed and housing treatment. Chicks were distributed on similar hatching weight basis. Chopped wheat straw was used as litter in floor brooding. Artificial lighting was used to give 14 hr light daily. Ventilation was secured through electric fans. When battery brooding was used, chicks were started in a Jamesway battery, accomodating 500 chicks, up to 3 weeks of age. The brooding room was kept at 75°F while the temperature was 95°F under the hover for the first week and then reduced by °F every week onward in the December hatch. The four housing methods used were as follows :

Treatment 1

The chicks were raised in multiple pen brooder house (decribed in treatment2),from hatch up to 8 weeks of age then transfered to the broiler house (of treatment 3) until 12 weeks of age.

Treatment 2

The chicks were started in batteries. At 3 weeks, they were transfered to a multiple pen brooder house built of concrete and bricks. The house is divided into 12 pens, each accomodating 200 chicks, up to 8 weeks of age. After 8 weeks, the chicks were removed to the brolier house (of treatment 3), until 12 weeks of age.

Treatment 3 (*First hatch*)

The chicks were brooded from hatch up to 12 weeks of age in a broiler house, a three story building, built up of concrete and bricks. Every floor has two twin sections, each of which holds about 1500 chicks. The first floor was used for the experimental work.

Treatment 4 (*Second hatch*)

The chicks were started in battery brooders. At 3 weeks of age, they were removed to a bigger carry over batteries up to 12 weeks of age.

Starting ration of 19.07% crude protein, 915 metabolizable energy (cal. Lb.), and 687 productive energy (cal./Lb) was used for 8 weeks. Then a finishing ration of 21.24% crude protein, 962 metabolizable energy (cal./Lb) and 711 productive energy (cal./Lb) was used up to 12 weeks of age. Vitamine mixture (1kg per ton) was added in the two rations.

Individual weights were recorded at bi-weekly intervals. Relative growth rate was calculated for bi-weekly intervals. Feed efficiency was calculated by dividing the food consumed in a certain period by gain in live weight through this period. Percent mortality was also computed, bi-weekly analysis of variance was calculated.

Results and Discussion

Absolute body weight

In general, heavier weights were attained in December hatch than in the April one (Table 1). This agrees with results found previously by other workers (Kamar, 1954; Heninger *et al.*, 1960 and Adams *et al.*, 1962), who observed depressed growth rate under hot summer weather. However the White plyomuth Rock and the New Hampshire showed consistantly better weights in December than April hatch, the Fayoumi ended with far better weights in April hatch for both treatments 1 and 2. Meanwhile, the weights attained for the Fayoumi in the battery system were markedly high in comparison with all other treatments of the Fayoumi. The best housing method for New Hampshire was for treatment 1, when the chicks were brooded in multiple pen brooder house than in broiler house. The heaviest weights of plymouth chicks were recoded for treatment 3, when the chicks were brooded in broiler house.

Considering breeds, the best results were attained by the Plymouth chicks at all ages. However it was noticed that absolute body weights for the first four weeks were better in battery brooding than for floor brooding. This result was reversed in the later period of growth. Differences between average body weights at 8 and 12 weeks of age for housing treatments, breeds and hatches showed high significant differences (Table 2). Under the conditions of the present study, the significant interactions between various responses of breeds for housing methods suggested the importance of the suitability of variable methods of housing to different breeds under different seasonal conditions.

TABLE 1. Absolute average weights in g at bi-weekly intervals for the different housing treatments and breeds of the two experimental seasons.

Treatments and breeds	Age intervals in weeks (December Hatch)							Age Intervals in weeks (April Hatch)						
	0	2	4	6	8	10	12	0	2	4	6	8	10	12
1. *Floor* (0), *broiler house* (8)*														
Fayoumi	30	84	195	273	424	474	622	28	65	126	237	391	522	676
New Hamps	30	107	258	379	639	798	993	38	103	175	334	551	717	985
White P.R	41	111	306	439	725	942	1213	39	100	180	307	510	727	1007
Mean. .	37	101	253	364	596	738	942	35	89	160	293	484	655	889
2. *Battery* (0), *floor* (3) *broiler house* (8) :														
Fayoumi	30	106	189	348	367	487	591	28	65	150	256	408	593	748
New Hamps	40	120	239	367	613	790	932	38	106	182	296	444	646	806
White P.R	41	134	253	346	619	804	1015	39	92	180	257	431	649	851
Mean. .	37	120	227	320	533	694	846	35	88	171	270	428	629	802
3. *Broiler house* (0) :														
Fayoumi	30	83	213	271	413	537	666							
New Hamps	40	107	253	413	618	797	969							
White P.R	41	113	280	423	792	995	1227							
Mean. .	37	101	249	369	608	776	954							
4. *Battery* (0) :														
Fayoumi								28	69	157	271	428	638	793
New Hamps								38	95	195	326	456	668	837
White P.R								39	103	200	321	470	680	872
Mean. .								35	89	184	306	451	662	834

* Fig. in brakets indicate age in weeks at moving to same housing systen.

TABLE 2. Analysis of variance of absolute body weights at 8 and 12 weeks of age for the different sources of variation in the housing treatments.

Age in weeks	Source of variation	Degrees of freedom	Mean square	F value
8	Treatment (T) . . .	2	909.859	95.75**
	Season (S)	1	8.087.546	852.19**
	Breed (B)	2	1.925.582	202.65**
	T × S	2	6.571	.69**
	T × B	4	11.943.529	204.54**
	S × B	2	10.043.399	1056.97**
	T × S × B	2620	9.502	—
	Total . .	2633		
12	Treatment (T) . . .	2	1.198.723	329.96*
	Season (S)	1	1.753.510	482.65**
	Breed.	2	25.207.392	6938.44**
	T × S	2	389.609	107.77*
	T × B	4	15.798.244	4348.55*
	S × B	1	13.694.089	4047.39**
	T × S × B	2438	3.633	
	Total . .	2450		

(**) Highly significant.
(—) Not significant.

Actual gain

Birds hatched in December were able to gain more weights during their early period of growth than did those hatched in April. This could be attributed to the general effects of atmospheric conditions during the growing period. However, the retardation in body gain in April hatches were later compensated when birds grew older. The differences in body gain due to breed or keeping methods showed almost the same trend observed in absolute body weight.

Relative growth rate

The foregoing results in body weights and gains are also substantiated when considering the relative rates of growth (Table 3). The relative increase in the rate of growth during the early periods of life in the December hatch is obvious when compared to the April hatch. Also the initiative growth ability of chicks started in the battery (Treatment 2) is obvious when compared to floor brooding.

Feed efficiency

Breed differences were distinctly observed in this connection (Table 4). The Fayoumi birds consumed more feed per unit body weight in nearly all stages of life and within the various treatments. The New Hampshire chicks had better feed utilization ability than the Plymouth Rock in most cases. The efficiency of feed utilization does not parallel the variability in growth rate, which suggests that the multiple factors affecting growth rate, are not necessarly those affecting feed efficiency. It is hard to follow consistant trends in feed efficiency due to season of rearing in similar comparisons. Feed efficiency of the December groups seemed to be better for birds grown fully in the broiler house than when rearing was shifted to various housing. To some extent this is true for the straight run battery birds of April. It seemed that the stress factors exerted when shifting the birds during the brooding stage resulted in a lower efficiency in feed utilization, may be because of disturbed adjustment to confinement.

Mortality rate

With exception of the abnormal death rate, due to temperature failure that took place in the New Hampshire and plymouth Rock chicks of the treatment(1)of December hatch, it could be judged that mortality tended to be less in December hatch than in April (Table 5). Mortalities were lower in battery system than the floor ones. This is in agreement with the findings of other workers such as Mehrhof *et al.*, (1943) and Abdou (1965). It is also apparent that birds are liable to die more within their first 2 weeks of life. There was a tendency for increased mortality within the last weeks of the experiment. This was due to cases of feather picking and mild cases of coccidiosis or other minor respiratory infections. This tendency occurred earlier in April hatch than in December one.

TABLE 3. Relative rate of growth at bi-weekly intervals for the treatments of rearing and breeds of the two seasons of brooding.

Treatment and breed	Periods in weeks (Dec. hatch)						Periods in weeks (April hatch)					
	0..2	2—4	4—6	6—8	8—10	10—12	0—2	2—4	4—6	6—8	8—10	10—12
1. *Floor* (0) +*broiler house* (8)* :												
Fayoumi	94	74	33	43	11	17	78	64	61	43	28	25
New Hampshire	91	83	38	51	22	21	82	52	62	51	25	31
White P. Rock	92	93	35	49	24	27	87	57	58	49	35	32
Mean	92	85	35	48	19	22	86	58	59	49	29	29
2. *Battery* (0)+*floor* (3)+ *broiler house* (8) :												
Fayoumi	111	57	27	37	28	19	78	83	52	46	36	23
New Hampshire	100	66	42	50	25	16	94	50	48	40	37	22
White P. Rock	107	61	31	57	25	13	81	64	35	50	40	27
Mean	106	61	33	48	26	19	84	66	45	45	38	24
3. *Broiler house* (0) :												
Fayoumi	94	87	23	41	26	21						
New Hampshire	91	80	48	49	25	19						
White P. Rock	94	85	40	67	22	23						
Mean	93	89	37	52	24	21						
4. *Battery* (0) :												
Fayoumi							85	78	53	45	39	21
New Hampshire							79	69	49	33	37	22
White P. Rock							90	64	46	38	37	25
Mean							85	70	49	39	38	23

* Fig. in brackets indicate age in weeks at moving to followed housing systems.

TABLE 4. Feed efficiency (k.) at four weeks intervals, from 0—8 and 0—12 weeks of age per breeds and housing treatments in the two seasons

Treatment and breed	Periods in weeks (Dec. hatch)					Periods in weeks (April hatch)				
	0—4	4—8	8—12	0—8	0—12	0—4	4—8	8—12	0—8	0—12
1. *Floor*(0)+ *broiler house* (8)*										
Fayoumi	2.84	4.82	5.32	4.21	4.32	4.09	4.80	4.45	4.87	4.87
New Hampshire	3.60	3.48	3.98	3.17	3.71	2.72	3.62	4.12	3.66	3.61
White P. Rock	2.78	3.77	4.51	3.53	3.77	2.86	3.86	8.67	3.89	3 87
Mean	2.74	4.02	4.60	3.64	3.93	3.22	4.09	4.08	4.14	4.19
2. *Battery* (0) + *floor* (3) + *broiler house*(8):										
Fayoumi	3.95	4.62	5.34	4.61	4.59	4.17	4.70	4.88	4.22	4.54
New Hampshire	2.84	3.36	3.35	3.47	3.65	2.96	3.52	4.05	3.29	3.69
White P. Rock	2.64	3.59	3.53	3.53	3.70	2.87	3.71	3.91	3.40	3.67
Mean	3.14	3.86	4.07	3.87	3.98	2.33	3.98	4.28	3.64	3.97
3. *Broiler house* (0)										
Fayoumi	3.89	4.50	4.32	4.19	4.50	—	—	—	—	—
New Hampshire	2.54	3.17	3.23	3.20	3.48	—	—	—	—	—
White P. Rock	2.64	3.12	3.51	3.17	3.52	—	—	—	—	—
Mean	3.02	3.59	3.72	3.52	3.83					
4. *Battery* (0)										
Fayoumi	—	—	—	—	—	4.01	4.60	4.74	4.55	4.50
New Hampshire	—	—	—	—	—	2.83	3.31	3.78	3.19	3.31
White P. Rock	—	—	—	—	—	2.91	3.46	3.57	3.29	3.36
Mean	—	—	—	—	—	5.25	3.79	4.03	3.69	3.72

* Fig in brakets indicate age in weeks at moving to followed housing systems.

TABLE 5. Bi-weekly mortality percent for treatments of rearing and breeds in the two seasons

Treatment and breeds	Periods in weeks (Dec. Hatch)							Periods in weeks (April Hatch)						
	0—2	2—4	4—6	6—8	8—10	10—12	0—12	0—2	2—4	4—6	6—8	8—10	10—12	0—12
1. *Floor* (0) + *broiler house* (8)*														
Fayoumi	2.5	1.5	0.5	0.5	0.5	4.5	10.0	9.9	4.0	4.0	2.5	3.5	1.5	25.0
New Hampshire	23.0	2.5	—	—	—	2.5	28.0	9.9	5.5	2.0	3.5	3.5	3.0	27.0
White P. Rock	32.0	1.0	2.0	2.5	1.5	1.5	42.0	10.0	5.0	2.5	2.0	4.5	4.0	26.6
Mean	14.2	1.7	6.8	1.0	0.7	3.8	26.7	10.0	4.8	2.8	2.6	3.8	2.8	26.6
2. *Battery* (0) + *floor* (3) + *broiler house* (8)														
Fayoumi	—	—	5.0	4.5	1.0	—	10.5	4.0	2.0	2.0	4.0	4.0	2.5	18.5
New Hampshire	7.5	1.0	—	—	0.6	10.0	19.0	8.5	2.0	2.0	2.5	3.5	3.0	21.5
White P. Rock	3.5	1.0	1.0	3.5	3.0	6.5	20.5	6.0	4.0	4.0	4.5	4.0	3.5	26.0
Mean	3.6	0.7	2.0	2.7	1.5	5.5	16.6	6.2	2.6	2.6	3.6	3.8	3.0	22.0
3. *Broiler house* (0)														
Fayoumi	3.5	3.0	3.0	6.5	4.0	5.0	25.5	—	—	—	—	—	—	—
New Hampshire	13.5	4.0	4.0	1.0	3.0	5.5	28.0	—	—	—	—	—	—	—
White P. Rock	6.5	4.0	4.0	1.0	2.0	7.0	20.5	—	—	—	—	—	—	—
Mean	7.8	3.6	3.7	2.8	3.0	5.8	24.6							
4. *Battery*														
Fayoumi	—	—	—	—	—	—	—	6.0	2.0	2.0	3.0	3.0	5.5	21.6
New Hampshire	—	—	—	—	—	—	—	5.0	3.0	3.0	3.0	3.0	3.0	20.0
White P. Rock	—	—	—	—	—	—	—	5.0	3.0	3.0	2.5	2.5	1.0	17.0
Mean	—	—	—	—	—	—	—	5.3	2.6	2.6	3.0	2.8	3.2	19.3

* Fig. in brackets indicate weeks of age in weeks at moving to followed housing systems.

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تأثير الأساليب المختلفة للرعاية على النمو والصفات المرتبطة فى الدجاج

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استخدم فى هذه الدراسة ٣٦٠٠ كتكوت حديث الفقس مفرخة فى ديسمبر وابريل من أنواع الفيومى والنيوهامشير والبلايموث روك الأبيض . قسمت الى مجاميع تضم كل مجموعة ٢٠٠ من كل نوع استخدمت فى أربعة أنظمة من الحضانة . الأول يبدأ بالتحضين الأرضى حتى ٨ أسابيع ثم نقلت لمدة أربعة أسابيع فى بيوت البدارى حتى نهاية الاثنى عشر أسبوعا . والثالث تم بالتحضين فى الفقس حتى نهاية الاثنى عشر اسبوعا فى بيت البدارى . أما الأخيرة فقد تمت الحضانة من الفقس حى سن أثنى عشر أسبوعا فى البطاريات .

وقورنت الكتاكيت فى المجاميع المختلفة حسب الوزن ومدى زيادته وسرعة النمو واستهلاك العليقة والتفوق فى أعمار مختلفة من هذه الدراسة وقد وجدت النتائج كالآتى :

١ ـ أظهر فقس ديسمبر تفوقا فى نمو النيوهامبشير والبلايموث روك عند مقارنته بفقس أبريل بعكس الفيومى .

٢ ـ كانت الاوزان التى تم الحصول عليها عند عمر ١٢ أسبوعا أفضل بصفة عامة فى معاملات التحضين الارضى بالنسبة لنوعى النيوهامبشير والبلايموث الأبيض . وبالنسبة لنوع الفيومى كانت الكتاكيت المهيأة فى بطاريات فى فقس أبريل هى أفضل المعاملات .

٣ ـ كانت أفضل المعدلات لاستهلاك العليقة عندما استخدم بيت البدراى طوال مدة التربية وكان الفيومى أقل الأنواع فى معدل الاستفادة الغذائية فى جميع الأعمار .

٤ ـ كانت أقل نسبة تفوق عندما استخدمت البطاريات ووضح أن نسبة التفوق أخذت تميل الى النقصان بتقديم العمر الا فى الحالات التى صادفتها ظروف صحية غير ملائمة . وكان الفيومى أقل الأنواع فى نسبة التفوق .