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EFFECT OF AGE, HOUSING TYPE AND THEIR INTERACTION ON BROILER BREEDER PERFORMANCE DURING GROWTH AND EGG PRODUCTION PERIODS

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ABSTRACT: This study was conducted to investigate the effects of two housing types (open and semi-closed), broiler breeder age and their interaction on broiler breeder performance during growth period (1-24 wks of age) and egg production periods (25-60 wks of age). Hubbard classic broilers used as breeders in each housing types. During the growth period, body weight, feed intake per day and mortality percentage of males and females broiler breeders were significantly higher under open housing type compared to semi-closed housing type. Body weight, body weight gain, feed intake per day and feed conversion ratio of females and males were increased as breeder age increased. Body weight of males and females was significantly affected by interaction between housing type and age. Also, mortality percentage of males was significantly affected by interaction of housing type and breeder age. In production period, egg production percentage was numerically higher under semi-closed housing system as compared to open housing system, but this difference was not statistically significant. However, egg production (%) was significantly affected by breeder age. Body weight, body weight gain, feed intake per day and mortality percentage of female broiler breeders were significantly affected by breeder age. Results showed that body weight and mortality percentage were significantly higher for breeders managed under open housing type than those under semi-closed housing type. Mortality percentage of females was significantly affected by interaction between housing type and age. Moreover, high significant correlations were detected between some performance traits of the broiler breeders during egg production stage under the two housing types. Generally, the previous results revealed that the performance of the broiler breeders during growth and egg production stages was better in semi-closed houses compared with traditional open houses.

Key Words: Housing Type, Age, Breeders, Growth Period, and Egg Production Period.

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INTRODUCTION

Poultry industry has developed dramatically during the last three decades, but there are many managerial factors which are still needed to be studied to gain optimum performance, among these factors; choice of housing type and lighting management which are very important especially in case of egg layers and breeder hens (Ahmad et al. 2010). Optimal environmental conditions and accurate nutrient requirements should be provided to broiler breeder flocks to achieve their high genetic potential. Bell and Weaver (2001) reported that housing and management of poultry parent stock is mainly aimed at providing the conditions that ensure optimum performance of the birds.

Many factors influence broiler breeder performance. Reducing the total daily feed allowance may cause a decline in egg production and performance (Neuman et al.1998). In addition to these factors, other factors that are less well understood, such as the location of the breeder house and hatchery. Ahlers et al. (2009) decided that the chicken performance in developing countries could be lower than the standards due to relatively weaker housing conditions, lack of feed quality, vaccines, vaccinations and more importantly availability of trained staff.

To date, the relationship between different housing types and broiler breeder performance has not been clearly described. Therefore, the present study was carried out to investigate the effects of the two housing types, broiler breeder age and their interaction on broiler breeder performance during both growth and egg production periods.

MATERIALS AND METHODS

This study was carried out on Hubbard classic broiler breeders' strain during growth period (1-24 wks of age) and egg production period (25-60 wks of age). A comparison was made among broiler breeder hens under the two housing types (open and semi-closed), on the same level of nutrition under the same season. In open housing type, a total number of 3150 females and 1037 males during growth period; while number of females housed was 2670 and 915 males during production period. In semi-closed housing type, a total of 4000 females and 1490 males during growth period; while number of females housed was 3718 and 1301 males during production period. Males used to insemination were representing 10 % of number of females.

Birds in both housing types were reared in litter-floored houses, house size in each type was 960 m^2 (12×80 m) and stocking density was 4.5 birds /m^2. In open house, birds subjected to natural daylight throughout the growth period. At 22 wks of age, natural day light was supplemented with artificial light to give the required photoperiod. The photoperiod was increased gradually according to the age of birds till reached 15 hours per day to the end of egg production period. In semi-closed housing type, the divisions were covered with black plastic from floor to ceiling. Birds during growth period were given 8 hours of light daily only. At 22 weeks of age, pullets were given 9 hours of light increased weekly by 2 hours, until 15 hours of artificial light during egg production period.

Water was available all the time, vaccination under specific climatic conditions and during disease outbreaks was carried out; lighting schedule of breeder farm according to the age of birds was followed. A complete picture of the flocks from one day old to end of egg production period (60 wks of age) was studied. Collection of data related to broiler

breeder flocks, farm details and housing type was used. About 2 % from each females or males were randomly taken weekly to investigate experimental measurements. Measurements recorded were body weight, body weight gain, feed intake per day (g). Mortality rate was also recorded in each flock during two phases (rearing and production). Also, egg production percentage and feed conversion ratio were calculated.

Egg production (%) was calculated using the following equation given by North (1984);

$$\text{Hen-day egg production (\%)} = \frac{\text{Number of eggs produced on daily basis}}{\text{Number of hens available in the flock on that day}} \times 100$$

Feed conversion ratio (FCR) was measured as follows:

Feed consumption (F.C.) = feed consumed during one week.

Weight gain (Δwt) = weight gain in grams within one week

Feed conversion ratio = F.C. /Δwt

Statistical Analysis:

Data were analyzed using two-way analysis of variance with housing type, age and their interaction using the General Linear Model (GLM) procedure of SAS (2002) as following model;

$$Y_{ijk} = \mu + A_i + H_j + (A\,H)_{ij} + e_{ijk}$$

Y_{ijk} = Trait measured,

μ= Overall mean,

A_i = Age effect,

H_j = Housing type effect (i= 1, 2),

$(A\,H)_{ij}$ = Interaction between housing type and age,

e_{ijk} = Experimental error.

When significant differences among means were found, means were separated using Duncan's multiple range tests. Correlation coefficients (PROC CORR) were calculated to verify the relationship between some traits.

RESULTS AND DISCUSSION

A. Growth period

Female and male breeder performance:

Body weight, body weight gain, feed intake per day (g) and mortality percentage of females and males broiler breeders during different growth periods as affected by age, housing type and their interaction are presented in Figs. (1 and 2), Tables (1and 2). The results indicated that body weight of females and males during rearing period was significantly affected by age, housing type and their interaction. The body weight was significantly heavier under open housing type compared to semi-closed housing type. Body weight of females and males increased gradually with advancing of broiler breeder age. Body weight was significantly affected by interaction between housing type and age. That means the expression of this trait was different based on housing type and age periods.

Body weight gain of females and males was significantly affected by age; it could be observed that the highest value of body weight gain (172.17 g) for females and (169.92 g) for males were recorded during the period 18-24 wks of age. No significant difference in body weight gain of females and males due to housing types (open and semi-closed) was verified, also the same trend was observed to interaction effect.

Feed intake per day of females and males was significantly higher under open housing type (74.36 and 84.15 g) than semi-closed housing type (68.73 and 77.95 g), respectively. Feed intake was significantly affected by age.

Mortality percentage of females and males during different rearing periods was markedly higher under open housing type as compared to those housed in semi-closed housing type. Similar trend was noticed by Daghir (2001), Le-Bihan et al. (2001), Barnett et al. (2001) and Hameed et al. (2012). There is significant difference in

mortality percentage of males with age. The highest value of mortality percentage was recorded during period 6-12 wks of age, while the lower value was recorded during period 18-24 wks of age. Mortality (%) was significantly affected by interaction between housing type and age. That means that the mortality rate was differed according to housing type and age stages.

Feed conversion ratio of females and males was significantly affected by rearing period. Feed conversion ratio increases with advancing of age. Similar trend was obtained by Yasmeen et al. (2008). The highest value of females was recorded during period 18-24 wks of age, while the lowest value was recorded during period 1-6 wks of age (Fig. 3). Concerning males, the highest value of feed conversion ratio was recorded during the period of 12-18 wks of age, while the lowest value was recorded during the period of 1-6 wks of age (Fig. 4).

B. Production period

Egg production (%)

The egg production percentage was numerically higher under semi-closed housing type as compared to open housing type, but this difference was not statistically significant (Figure 5). Similar trend was reported by Hameed et al. (2012). On the other hand, egg production (%) was significantly affected by production period; the highest period of production was recorded during 35-40 wks of broiler breeder age, while the lowest period was recorded during 25-30 wks of age. Egg production curve gradually decline till reached to the end of egg production period (60 wks of age).

Body weight

Data presented in Table (3) show body weight of female' broiler breeders during egg production period as affected by age, housing type and their interaction. It was observed that body weight was significantly heavier at breeder managed under open housing type than that under semi-closed housing type. Concerning age effect, it could be noticed that body weight increased with advancing of age. The mean values were 3023, 3618, 3817, 3950, 4075, 4107, 4180 and 4168 g at 25, 30, 35, 40, 45, 50, 55 and 60 wks of age, respectively.

Body weight gain

No significant difference in body weight gain of broiler breeder under the two housing types (open and semi-closed) was detected; also the same trend was proved for the interaction effect. Conversely, there is highly significant difference for body weight gain due to age. It could be observed that the highest value of body weight gain (113.42 g) was recorded during the period of 25-30 wks of age, while the lowest value (10.5 g) was recorded during the period of 55-60 wks of age (Table 4).

Feed intake

Table (5) reveals feed intake per day of female' broiler breeders during different egg production periods as affected by age, housing type and their interaction. Feed intake per day was significantly affected by age. The highest value of Feed intake per day was recorded during the period of 30-45 wks of age, while the lowest value was recorded during the period of 25-30 wks of age.

Mortality

Effect of housing type and egg production period on mortality percentage of female broiler breeders is shown in Figure (6). Mortality percentage significantly affected by housing type, egg production period and their interaction. The mortality percentage of broiler breeders was significantly higher under open housing type compared to semi-closed housing type.

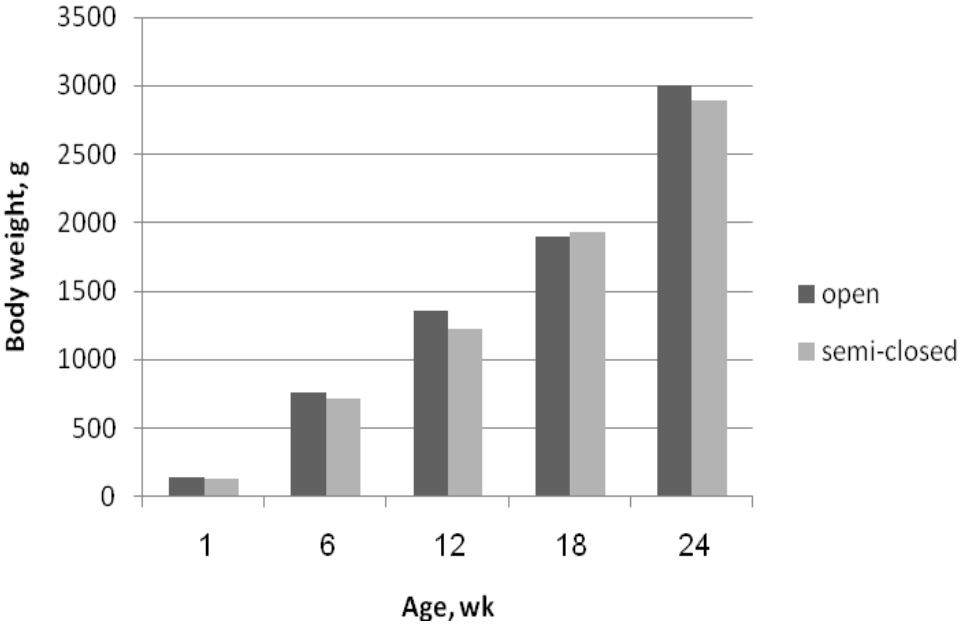
In this concern, Le-Bihan et al. (2001) and Barnett et al. (2001) Hameed et al. (2012) reported higher mortality under traditional housing and lower mortality under

controlled housing condition. Improvement in the housing system results in improved welfare health of the birds (Lewis and Morris, 2006; Ahlers et al., 2009). The highest value of mortality percentage was recorded during the period 55-60 wks of age, while the lowest value was recorded during the period 25-30 wks of age. It seems that the aged birds are more sensitive and exhausted compared to the younger one.

Correlation coefficients among traits

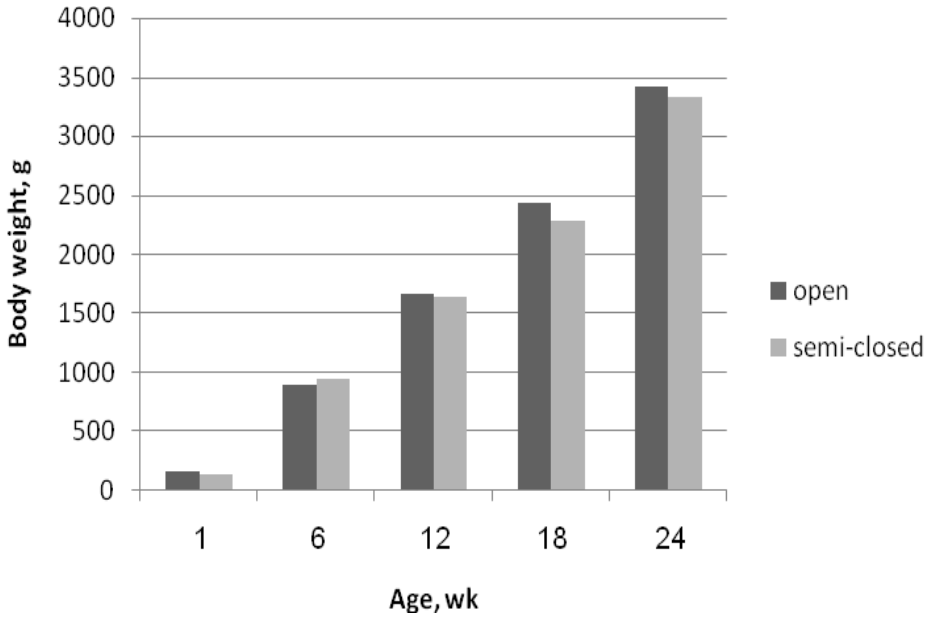
Correlation coefficients among some performance traits of broiler breeders during egg production stages under two housing types are presented in Table (6). Data revealed that there was highly significant positive correlation ($P \leq 0.001$) between egg production (%) and both body weight and feed intake per day under either open or semi-closed housing types. There was a highly significant correlation between egg production (%) and body weight gain under semi-closed housing type, while it was slightly negative correlated under open housing type. Also, there was significantly positive relationship between egg production (%) and mortality percentage under semi-closed housing type. Moreover, high negative correlation coefficient was detected between body weight and body weight gain. Conversely, the relationship was significantly high and positive between body weight and feed intake per day under the both housing types. Significant negative correlation between body weight gain and feed intake per day was detected under the two housing types. Body weight gain was significantly negative correlated with mortality percentage under open housing type; while, this correlation was not significant under semi-closed housing type.

In conclusion, Hubbard broiler breeder performance during growth and egg production periods under semi-closed housing system was better than open housing system.



	Sig.		
	A	H	A*H
Body weight, g	0.0001	0.0001	0.0001

Fig. (1): Effect of age and housing type on body weight of females broiler breeders.



	Sig.		
	A	H	A*H
Body weight, g	0.0001	0.0001	0.0001

Fig. (2): Effect of age and housing type on body weight of males broiler breeders.

Table (1): Body weight gain, feed intake per day (g) and mortality percentage of females broiler breeders during different growth periods as affected by age, housing type and their interaction (Means ± SE).

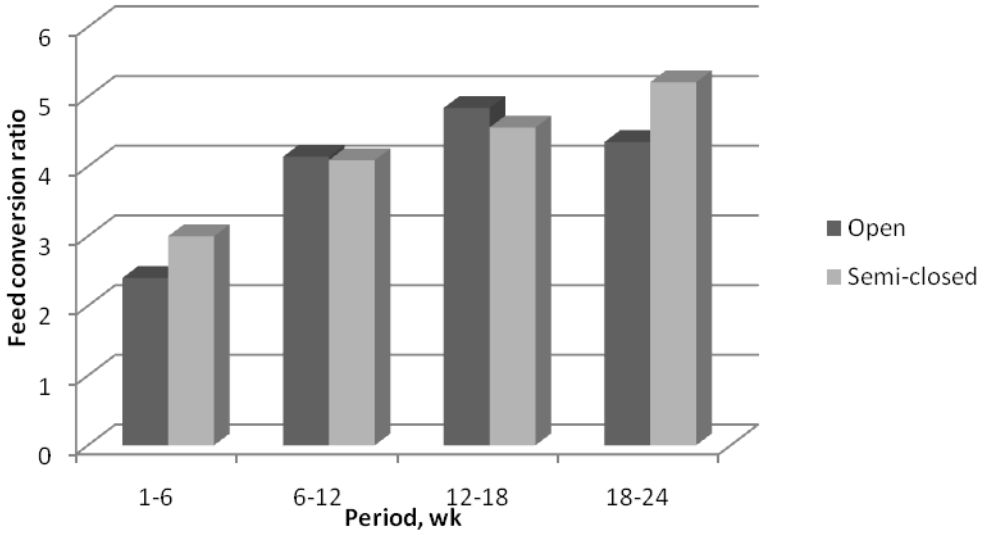
Trait	Age (A), wk	Housing type (H)		Overall	Sig.		
		Open	Semi-closed		A	H	A*H
Body weight gain, g	1-6	121.17±12.22	112.67±15.61	116.92[b]	0.01	NS	NS
	6-12	98.83 ±2.71	84.50±15.76	91.67[b]			
	12-18	90.00±6.96	118.00±18.17	104.00[b]			
	18-24	183.33 ±16.70	161.00±26.71	172.17[a]			
	Overall	123.33	119.04				
Feed intake per day, g	1-6	39.00 ±3.39	40.75 ±2.84	39.88[d]	0.0001	0.05	NS
	6-12	58.50 ±2.39	49.67 ±0.67	54.08[c]			
	12-18	77.83±3.02	71.17 ±4.65	74.50[b]			
	18-24	110.33 ±4.11	104.00±4.11	107.17[a]			
	Overall	74.36[a]	68.73[b]				
Mortality, %	1-6	1.15 ±0.61	0.28 ±0.11	0.71	NS	0.01	NS
	6-12	0.55 ±0.07	0.17 ±0.02	0.36			
	12-18	0.37 ±0.05	0.19 ±0.01	0.28			
	18-24	0.47 ±0.06	0.17 ±0.01	0.32			
	Overall	0.64[a]	0.20[b]				

[a, b, c and d] Means within the same main effects with different letters are significantly different, NS= Non significant.

Table (2): Body weight gain, feed intake per day (g) and mortality percentage of males broiler breeders during different growth periods as affected by age, housing type and their interaction (Means ± SE).

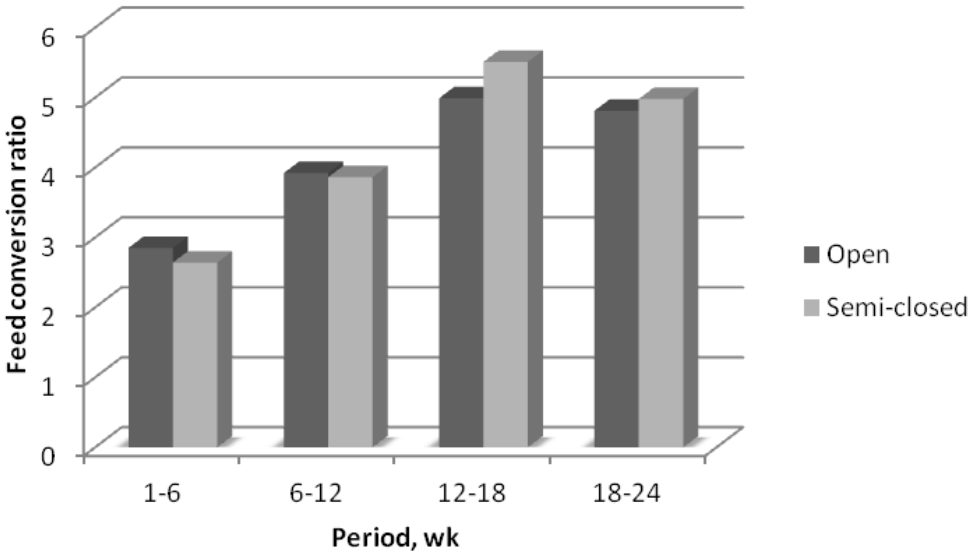
Trait	Age (A),wk	Housing type (H)		Overall	Sig.		
		Open	Semi-closed		A	H	A*H
Body weight gain, g	1-6	130.00±0.01	151.83 ±20.70	148.71[ab]	0.02	NS	NS
	6-12	129.17 13.93	114.33 ±9.64	121.75[b]			
	12-18	126.67 11.74	108.50 ±12.59	117.58[b]			
	18-24	165.33 12.99	174.50 ±32.67	169.92[a]			
	Overall	139.84	137.29				
Feed intake per day, g	1-6	51.00 ±2.00	48.33±2.91	49.40[d]	0.0001	0.05	NS
	6-12	68.00 ±2.98	60.33±1.26	64.17[c]			
	12-18	86.17 ±2.48	80.00±3.55	83.08[b]			
	18-24	109.33 ±2.60	108.33±3.28	108.83[a]			
	Overall	84.15[a]	77.95[b]				
Mortality, %	1-6	0.92 ±0.44	0.34 ±0.09	0.48[a]	0.0001	0.0001	0.0001
	6-12	0.88 ±0.07	0.18 ±0.02	0.53[a]			
	12-18	0.45 ±0.06	0.15 ±0.02	0.30[b]			
	18-24	0.32 ±0.05	0.22 ±0.02	0.27[b]			
	Overall	0.59[a]	0.22[b]				

[a, b, c and d] Means within the same main effects with different letters are significantly different, NS= Non significant.



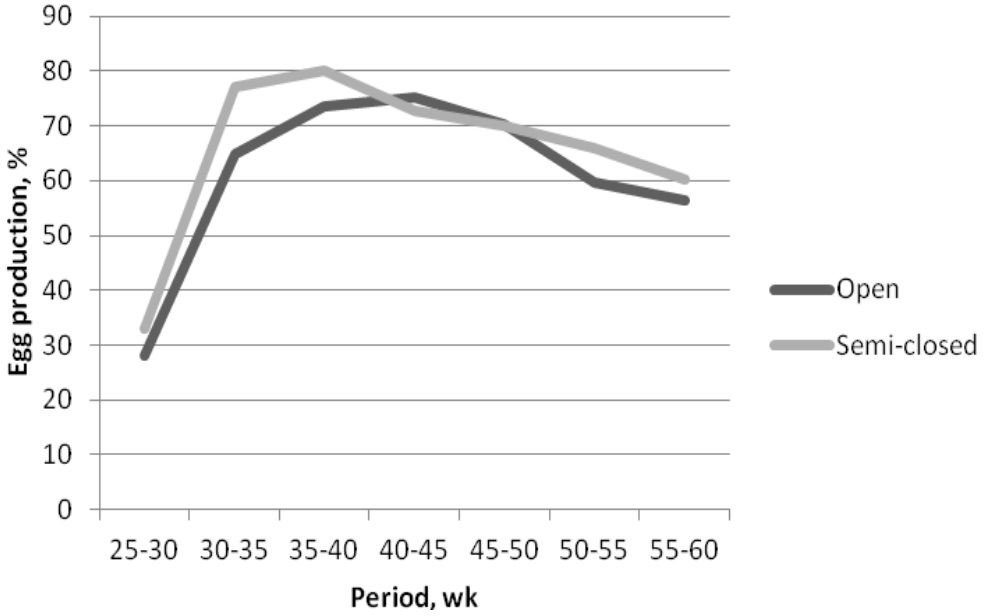
	Sig.		
	A	H	A*H
feed conversion ratio	0.01	NS	NS

Fig. (3): Effect of growth period and housing type on feed conversion ratio of females broiler breeders.



	Sig.		
	A	H	A*H
feed conversion ratio	0.02	NS	NS

Fig. (4): Effect of growth period and housing type on feed conversion ratio of males broiler breeders.



	Sig.		
	A	H	A*H
Egg production, %	0.02	NS	NS

Fig. (5): Effect of production period and housing type on egg production of broiler breeders.

Table (3): Body weight of females' broiler breeders during egg production period as affected by breeder age, housing type and their interaction (Means ± SE).

Trait	**Breeder age (A), wk**	**Housing type (H)**		**Overall**	**Sig.**		
Body weight, g		**Open**	**Semi-closed**		**A**	**H**	**A*H**
					0.0001	0.0001	NS
	25	3150 ±28.87	2896 ±55.43	3023.00[e]			
	30	3621±12.12	3615 ±66.40	3618.00[d]			
	35	3835±20.21	3800 ±28.87	3817.50[c]			
	40	3995 ±54.85	3905 ±60.62	3950.00[b]			
	45	4140 ±80.83	4010 ±23.09	4075.00[a]			
	50	4160±92.38	4055 ±31.75	4107.50[a]			
	55	3260±34.64	4100±57.74	4180.00[a]			
	60	4240±23.09	4097±51.96	4168.50[a]			
	Overall	3925.13[a]	3809.75[b]				

[a, b, c, d and e] Means within the same main effects with different letters are significantly different, NS= Non significant.

Table (4): Body weight gain of females' broiler breeders during different egg production periods as affected by age, housing type and their interaction (Means ± SE).

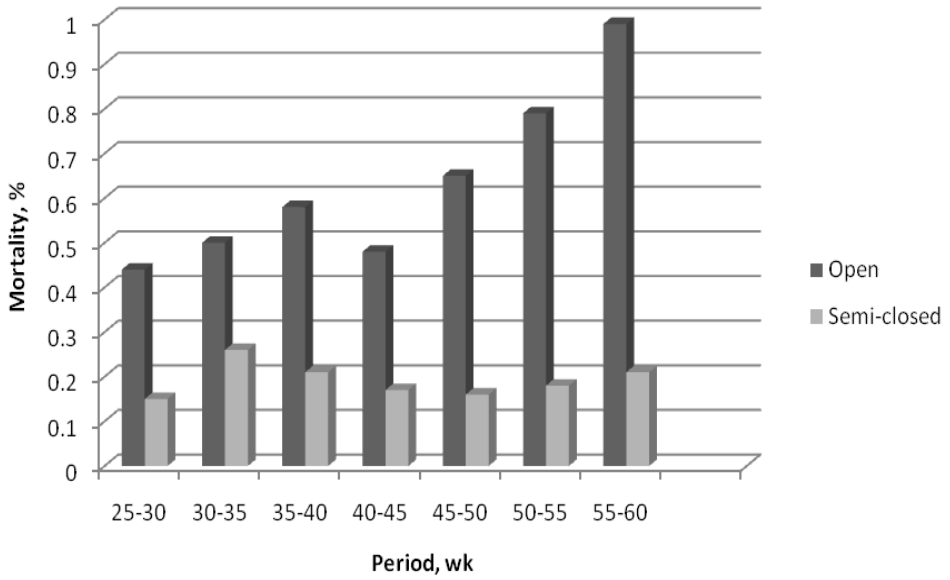
Trait	**Period (A), wk**	**Housing type (H)**		**Overall**	**Prob.**		
Body weight gain, g		**Open**	**Semi-closed**		**A**	**H**	**A*H**
					0.0001	NS	NS
	25-30	103.50 ±14.70	123.33±36.95	113.42[a]			
	30-35	77.80±9.93	26.00±7.31	51.90[b]			
	35-40	32.00±4.86	10.00±2.74	21.00[bc]			
	40-45	23.00±2.00	21.00±2.49	22.00[bc]			
	45-50	19.00±6.00	11.00 ±1.51	15.00[bc]			
	50-55	23.00±5.61	8.60±1.40	15.80[bc]			
	55-60	10.80±0.49	10.00±2.00	10.50[c]			
	Overall	43.03	33.91				

[a, b and c] Means within the same main effects with different letters are significantly different, NS= Non significant.

Table (5): Feed intake per day of females' broiler breeders during different egg production periods as affected by age, housing type and their interaction (Means ± SE).

Trait	Period (A), wk	Housing type (H)		Overall	Prob.		
		Open	Semi-closed		A	H	A*H
Feed intake per day, g					0.0001	NS	NS
	25-30	139.67 ±4.55	142.83 ±7.89	141.25[d]			
	30-35	173.00 ±2.17	175.00 ±0.10	174.00[a]			
	35-40	177.60 ±0.24	175.00 ±0.10	176.30[a]			
	40-45	177.20 ±0.20	172.60 ±1.12	174.90[a]			
	45-50	175.40 ±0.40	168.60 ±0.40	172.00[ab]			
	50-55	168.00 ±1.00	167.00 ±0.32	167.50[bc]			
	55-60	163.00 ±0.71	164.40 ±0.51	163.70[c]			
	Overall	166.92	165.83				

[a, b, c and d] Means within the same main effects with different letters are significantly different, NS= Non significant.



	Prob.		
	A	H	A*H
Mortality, %	0.001	0.0001	0.001

Fig. (6): Effect of egg production period and housing type on mortality percentage of female broiler breeders.

Table (6): Correlation coefficients among some performance traits of broiler breeders during egg production stage under two housing types.

Trait	**Body weight, g**	**Body weight gain, g**	**Feed/day, g**	**Mortality, %**	Housing type
Egg production, %	0.82***	-0.28	0.98***	-0.09	**Open**
	0.80***	- 0.75***	0.97***	0.39*	**Semi-closed**
Body weight, g	---------	-0.70***	0.92***	0.36	**Open**
	---------	-0.79***	0.90***	0.32	**Semi-closed**
Body weight gain, g		--------	-0.50**	-0.35*	**Open**
		--------	-0.82***	-0.27	**Semi-closed**
Feed/day, g			--------	0.04	**Open**
			--------	0.53	**Semi-closed**

(*) $p \leq 0.05$ (**) $p \leq 0.01$ (***) $p \leq 0.001$

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الملخص العربى
تأثير العمر ونوع المسكن والتداخل بينهما على أداء أمهات التسمين خلال مرحلتى النمو وإنتاج البيض

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قسم إنتاج الدواجن، كلية الزراعة – جامعة عين شمس، القاهرة – مصر
[٢] إستشارى قطاع الأمهات، شركة القاهرة للدواجن – مصر

أجريت هذه التجربة لدراسة تأثير نوعين من المسكن (مفتوح، شبه مغلق) وعمر أمهات دجاج التسمين والتداخل بينهما على أداء أمهات التسمين خلال مرحلة النمو (١-٢٤ أسبوع من العمر) ومرحلة إنتاج البيض (٢٥-٦٠ أسبوع من العمر). تم إستخدام سلالة أمهات Hubbard classic فى كلا النوعين من المسكن. خلال فترة النمو، وجد أن وزن الجسم، العلف المستهلك اليومى، نسبة النفوق لكل من ذكور وإناث أمهات التسمين كانت أعلى معنويا فى المسكن المفتوح بالمقارنة بالمسكن شبه المغلق. لوحظ أن كل من وزن الجسم، الزيادة فى وزن الجسم، العلف المستهلك اليومى، معامل التحويل الغذائى تزداد بزيادة عمر الأمهات. تأثر وزن الجسم للأناث والذكور خلال فترة النمو معنويا بالتداخل بين نوع المسكن وعمر الأمهات. أيضا، تأثرت نسبة النفوق للذكور معنويا بالتداخل بين نوع المسكن وعمر الأمهات. أما خلال فترة الإنتاج، وجد أن نسبة إنتاج البيض لدجاج أمهات التسمين كانت أعلى عند تربيتها فى المسكن شبه المغلق مقارنة بالمسكن المفتوح، ولكن هذا الفرق لم يكن معنويا. ومن ناحية أخرى وجد أن نسبة إنتاج البيض تأثرت معنويا بعمر الأمهات. أيضا لوحظ أن كل من وزن الجسم والزيادة فى وزن الجسم والعلف المستهلك اليومى ونسبة النفوق لإناث أمهات دجاج التسمين تأثرت معنويا بعمر الأمهات. أظهرت النتائج الحالية أن وزن الجسم ونسبة النفوق كانت أعلى معنويا للأمهات المرباه فى المسكن المفتوح مقارنة بمثيلتها المرباه فى المسكن شبه المغلق. تأثرت نسبة النفوق للإناث معنويا بالتداخل بين نوع المسكن وعمر الأمهات. وبالنسبة للتداخل، وجد أنه يوجد إرتباط معنوى مرتفع بين بعض صفات أداء أمهات دجاج التسمين خلال مرحلة إنتاج البيض المرباه تحت نوعين مختلفين من مساكن الدجاج. ومن خلال النتائج السابقة نستطيع أن نستخلص أن أداء أمهات التسمين لسلالة الهبرد خلال مرحلتى النمو وإنتاج البيض كان أفضل عند تربيتها فى مساكن شبه مغلقة وذلك مقارنة بالمساكن المفتوحة التقليدية.