J. Agric. Sci. Mansoura Univ., 29(2): 609 - 621, 2004

EFFECTS OFBODY WEIGHT AND FEED RESTRICTED ON PRODUCTIVE PERFORMANCE AND DURATION OF FERTILITY IN CAGED LOCAL BREEDERS.

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ABSTRACT

The aim of this study was to evaluate the effect of size initial live body weight and feed restriction on productive performance and fertility duration of laying hens at the end of first year production. A total number of ninety-six of Gimmizah laying breeders (56 weeks of age similar hatching) was taken pedigree closed flock, and was classified according to initial body weight (X ± 1.0 SD) into three category groups (32 hens of each), where heavy body weights averaged (2.136kg±0.136); medium body weight (1.866±0.099) and light body weight (1.626±0.139) . Each category group was divided randomly into sub group (48 hens of each). The first sub-group fed ad-libitum a commercial layer ration with 16.13% CP and 2702.2 K cal ME/Kg feed and the other sub- group fed restricted diet to maintain breeder recommended body weight targets. All birds were individually cages housed. These results indicate that: - Layer feed ad-libitum system increased significantly ($P<0.001$) both finial body weight; weight gain; egg number; egg weight and egg mass g/day; but reduced duration of fertility during laying period production as compared with layer feed restriction system. Heavy birds decreased significantly ($P<0.01$) egg number; hen day percentage compared with the medium and light body weight, but egg weight and feed intake were increased, however duration of fertility was not affected by category initial body weight. Live body weight was significant ($P<0.01$) positive correlation with egg weight, feed intake and feed conversion (g feed / g egg) , while insignificantly negative correlation with egg number and duration of fertility. Duration of fertility was significant ($P<0.01$) positive correlated with egg mass g/day, while it negative correlated with feed conversion (g feed / g eggs). Multiple regression coefficients was significant ($P<0.01$) and the predicated value duration of fertility was 9.467 ± 0.0699 days. Fertility percentage dropped by 6.355 percent / day to reach 50 percent at ten days and zero percent at 15 days after termination of artificial insemination.

Conclusively it may be concluded that initial live body weight in Gimmizah laying hens did not effect on duration of fertility, but effect on productive performance only. However feed restriction system increased duration of fertility and declined egg production at the end of first year production. Also fertility percentage declined with increasing interval between termination of artificial insemination in Gammizah laying hens. So high fertility rate is archived in artificial insemination when it is performed twice per week.

Keywords: Initial body weight, feed restriction, fertility of duration, artificial insemination and productive performance.

INTRODUCTION

A correlated response to selection for rapid growth increased a body weight in heavy breeders in chicken. Feed restriction programs are routinely employed throughout of the broiler breeders. Katanbaf et al. (1989) found that percentages of hen-day ovulation and duration of fertility were lower for laying fed ad-libitum than restricted group. Robbins et al. (1988) provided evidence that ad-libitum feed during part or all of the laying period improved egg production. However, Robinson et al. (1991) reported that ad-libitum feeding during breeding resulted in lower egg production in broiler breeders. Kader et al. (1981) and Bish et al. (1985) showed that heavy birds produced fewer number of eggs, heavier eggs, consumed more feed per hen day and consumed more feed per dozen eggs than the medium and light birds, while the medium birds had greater means than the light birds. The duration of fertility is dependent, in part on the numbers of sperms residing in the sperm storage tubules after artificial insemination or copulation (Brillard, 1993). Bilgilil and Renden (1985) showed that high body weight was negatively correlated with duration of fertility. Variation in body weights of mature breeder hens is though to be associated with fat deposition and adverse effects of increased body weight on fertility may be explained by increased lipid deposition in the oviduct (McDaniel, et al .1981). Beaumont et al. (1992) suggested that there is a strong correlation between laying rate and duration of fertility in layer hen. Over weight have a reduced duration of fertility that may contribute to a reduced fertility in artificially inseminated and naturally mated flock (Goerzen et al. 1996). Fertility is negatively affected in hens that are excessively above target body weight (Yu et al. 1992).

It can be difficult to identify factors that have an effect on the duration of fertility in frequently inseminated hens.

The present study was under taken to investigate the effects of feed restricted and excess body weight on the productive performance and the fertility duration of laying hens.

MATERIALS AND METHODS

The experimental work was carried out at Gimmizah Research Station, Animal Production Research Institute, and Agricultural Research Center, Ministry of Agriculture, Egypt, in spring season.

A total number of ninety-six of Gimmizah laying breeders (56 weeks of age similar hatching) was taken pedigree closed flock, and was classified according to body weight ($\bar{X} \pm 1.0$ SD) ; into three category groups (32 hens of each) where heavy body weights averaged (2.136kg±0.136); medium body weight (1.866±0.099) and light body weight (1.626±0.139).Each category group was divided randomly into sub group (48 hens of each). The first sub-group was fed ad-libitum a commercial layer ration with 16.13% CP and 2702.2 K cal ME/Kg feed according to NRC (1994) (Table 1) and the other sub- group fed restricted diet to maintain breeder recommended body weight targets which calculated as the equation (NRC.,1981c) ME/hen/day = $(BW)^{0.75}$ (173-1.95C') +5.5 ΔBW +2.07EM. Where: BW= body weight (kg), C' = ambient temperature, ΔBW = change in body weight in g /day, and EM = Daily egg mass. All birds were individually cages housed and were inseminated artificially during the experimental period (56- 64 weeks of age). The birds have been offered photostimulated at 20-wk age by increasing day photoperiod from 8 to 16 hr. All birds were inseminated once at 1300 hr on each of 2 consecutive day with 0.05ml of pooled chicken semen. No further inseminations were conducted for the following 15 days period. The study period began the day following the second insemination. This was the earliest time an egg fertilized with sperm from the 1st insemination day could be oviposited. Prior to the start of study all of the hens inseminated weekly with 0.05 ml pooled chicken semen. All settable eggs for each hen were individually weighed and stored at room temperature (20 C° and RH 60-65%) weekly and placed in an incubator. After 18 day of incubation under standard conditions, the eggs infertile were removed, broken out and scored macroscopically as fertile with dead embryo (early embryonic dead) or clear (assumed infertile). The duration of fertility was defined as the number of days from the day after the second insemination to the last fertile egg before two consecutive infertile eggs. Hens producing no eggs were culled from the experiment. All eggs laid were daily collected, then each of egg number, egg weight, feed intake were recorded. Hen day egg production percentage (HD%) = egg number each hen/ days of period study x 100. Egg mass (g/day) =HD% x average egg weight/ 100. Feed conversion = g feed intake / g egg mass day.

Table (1): Ingredients and chemical analysis of basal diet.

Ingredients		**%**
Yellow corn		64.00
Soybean meal, 44 % CP		22.60
Wheat bran		4.00
Limestone		7.10
Dicalcium phosphate		1.50
Salt		0.30
Vit. & Min. mix.*		0.30
Methionine		0.20
Total		100
Calculated values:**		
Crude protein, %		16.128
ME,Kcal/kg	2702.18	
Calcium, %		3.17
Available phosphorus, %		0.39
Lysine, %		0.797
Methionine,%		0.464
Methionine + cysteine %		0.741
Chemical analysis ***		
Dry matter, %		88.627
Crude protein,%		15.873
Crude fiber,%		3.136
Ether Extract,%		2.432
NEF		55.318
Ash,%		11.373

* Vit.& Min. mix:. each 3kg contains: 10,000,000 IU Vit. A; 2,000,000 IU Vit D_3 10,000 mg Vit. E;1,000mg Vit. K; 1,000mg Vit. B1; 5,000mg Vit. B2; 1,500mg Vit B6; 10mg Vit. B12; 50mg; Niaci, 20 gm ; Panatothenic acid, 1gm, Biotin;l,000mg Folic acid;250,000mg choline; 80g manganese; 40g iron; 40g zinc; 2g copper; 2g iodine; 1gm Seleinium and 2g cobalt.

** Calculated according to NRC (1994).

*** Detrmined according to the methods of A.O.A.C (1994).

Data were analyzed according to General line Models (GLM) procedure and Duncan's Multiple range test were calculated by using SPSS version 8 (1997) computer program using factorial design as the following model:

Yijk = ى + Fj+ Lj +(FL)ij+ eik.

Where, Yijk = The observed dependent variable, ى = Over all mean, Fj = Effect of feeding system (j=1,2), Lj= Effect of category initial body weight (j= 1,...3), (FL)ij = The j th live body weight within i th feeding system (ij= 1,----6), and eijk = The random residual error. Multiple range tests were used to determine significance of the mean differences in all the studied traits according to Duncan (1955).

. Correlation coefficients between productive traits calculated. Multiple regression equation and prediction value of duration fertility on initial body weight, hen-day percentage egg number, egg mass, egg weight and feed conversion were calculated as the following equation:

ئ= a + bx_1 +bx_2 +bx_3________________etc.

Percentages were transformed to arcsine before being analyzed to approximate normal distribution.

RESULTS AND DISCUSSION

Productive performance:

It can be seen from Table 2 and Figure 1 that hens receiving ad – libitum fed were significantly (P<0.01) heavier finial weight than those receiving restricted groups. The general trend in this study for depressing effect of restricted fed on body weight is in agreement with reports of Snetsinger and Zimmerman (1974), Katanbaf et al. (1989) and Nofal et al. (2000). Final body weight affected significantly (P<0.01) by initial body weight, similarly with Abdel-Ghani (1996). The high variance associated with the average change of live body weight, which was related to some hens lost body weight during the study. Hens which fed restricted may be lost body weights despite the fact that the ad-libitum hens. These results are close agreement with those obtained by Goerzen et al.(1996) who found that finial body weights were significantly different between ad-libitum and restricted feed caged.

Data in Table 2 also showed that feed restriction decreased significantly (P<0.01) feed intake as compared with ad-libitum group. These finding agreed with revealed by Mbugua et al. (1985) cleared that feed restriction decreased feed consumption, while Hurwitz and Plavnik ;(1989) found that there were no significant differences feed intake between restriction and the ad libitum fed. Feed intake per hen/day differed significantly (P<0.01) between all size body weight categories. The heavy birds consumed significantly more feed than medium and light (Table2). These findings according to obtained by Kader et al. (1981) and Bish et al. (1985). Feed intake affected significantly (P<0.01) by interaction feeding system within each size initial body weight of hens (Figure 2). It may be due to increased feed intake in hens fed ad libitum and heavier initial body weight.

Table 2: Means (X±SD) of initial body weight, finial body weight, weight gain, feed intake and feed conversion (g feed / g egg mass) as affected by feeding system and category of live body weight, and their interaction from 56 to 64 weeks of age.

Items	Initial body weight (Kg)	Finial body weight (Kg)	Weight gain / or loss weight (g)	Feed intake (g /hen/day)	Feed conversion (g feed / g egg mass)
Feeding system :					
Ad-libitum	1.886±0.234	1.938±0.238 a	51.86±111.08 a	128.46±4.24 a	3.43±1.009
Restricted	1.862±0.229	1.776±0.255 b	-86.39± 97.74 b	89.98±0.18 b	3.06±1.323
Category of live body weight :					
Light	1.626±0.117 c	1.604±0.153 c	-22.42±132.55	106.48±18.21 c	3.23±1.018 ab
Medium	1.867±0.079 b	1.846±0.147 b	-21.59±107.20	109.57±19.15 b	3.13±0.956 b
Heavy	2.143±0.121 a	2.132±0.155 a	-10.81±139.17	110.65±21.56 a	3.50±1.460 a
ANOVA					
Feeding system (FS)	NS	***	**	***	NS
Body weight (B)	***	***	NS	***	*
FS x B	NS	NS	NS	***	NS

Means within the same column with different litters are differ significantly (P<0.05).
*** (P<0.001) ** (P<0.01) * (P<0.05) NS : Not significant.

It is evident from Table 2 that feed conversion (g feed / g egg mass) was not significantly affected by feed restriction. Similar results reported Hurwtiz and Plavnik .(1989) found that there were no significant differences feed conversion between restriction and the ad libitum group. Significant (P<0.05) effects of initial body weight category on feed conversion ratio, where heavy birds consumed more feed and egg mass was lower than medium /or light. Similar confirmed by Abd El-Ghani (1996).

Table 3 show that restriction-fed during laying periods Lower significantly (P<0.01) egg number than hen fed ad-libitum. These results similar with revealed by Blair et al. (1976), Ousterhout (1982) and Robbins et al. (1988) , they reported that hens fed ad-libitum gave more eggs than those fed restricted during laying period production. Size of birds effect significantly (P<0.01) on egg number, where heavy birds decreased significantly (P<0.01) egg number than in the medium and light birds, respectively (Table3). These results may be due to increased feed intake. Similarly with those obtained by Bish et al., (1985), and Nofal and Hassan (1999) who found that increased egg production rate by declined size body weight. ON the other hand, egg weight heavier significantly (P<0.01) in hens fed ad-libitum than restricted-group (Table 3) as indicated by Blair et al. (1976), Mc Danial et al. (1981) and Wilison and Harms (1986) they found that restricting feeding of broiler breeders resulted in decreased egg weight when compared to birds fed ad-libitum . However, contrary with those obtained by Goerzen et al. (1996) who found that average egg weight was not different between ad-libitum and restricted fed. A significant (P<0.01) linear positive increase in egg weight was observed with increasing body weight. Similarly, positive correlation between body weight and egg size were reported by Bish et al. (1985), Abdel-Ghani (1996) and Nofal and Hassan (1999). Although, ad-libitum group more significantly (P<0.01) egg mass /hen /day than that of restricted group (Table 3) as reported by Robbins et al., (1988) . However, size of bird did not significant effect on egg mass / hen /day. These results disagree with those finding by Abdel-Ghani (1996) who showed the lightest body weight produced significantly (P<0.05) less egg mass than those of the other body weight categories.

. Food restriction during the laying period gave lower significantly (P<0.01) hen- day percentage than that ad-libitum group (Table 3). These findings were accordance with obtained by Blair et al. (1976), Wilson et al. (1983) and Robbins et al. (1988) they reported that hens fed ad- libitum gave more eggs than those feed restriction during laying period production. Size of bird effect significantly (P<0.05) hen-day percentage production, where heavy birds were lower significantly (P<0.05) than of the medium and small birds (Table3). These results are close agreement with those revealed by Kader et al. (1981), Bish et al. (1985) and Abdel-Ghani (1996) they found that hen-day percentage of the heavy birds was significantly lower than those of the light and medium body weight.

It is evident in Table 3 that feed restriction layer increased significantly (P<0.05) duration of fertility than layer feed ad –libitum. These results agreed with those obtained by Goerzen et al. (1996) who found that feed restriction increased duration of fertility. It may be due to attributed to

Table 3: Means (X±SD) of egg number, egg weight, egg mass, hen-day %and duration of fertility as affected by feeding system and category of live body weight, and their interaction from 56 to 64 weeks of age.

Items	Egg number	Egg weight (g)	Egg mass (g/ hen/day)	Hen-day (%)	Duration of fertility (days)
Feeding system:					
Ad-libitum	36.90±7.11 a	56.81±2.61 a	37.45±7.43 a	65.89±12.70 a	9.967±2.139 a
Restricted	30.38±8.84 b	54.43±2.44 b	29.37±8.24 b	54.24±15.78 b	10.992±1.527b
Category of live body weight :					
Light	34.26±6.96 ab	53.84±2.03 c	33.00± 7.20	61.17±12.43 ab	10.333±1.808
Medium	35.27±8.32 b	55.68±2.04 b	35.06± 8.31	62.99±14.85 b	10.886±1.947
Heavy	30.86±6.96 a	57.36±2.41 a	31.66±10.60	55.12±15.78 a	10.122±1.981
Anova					
Feeding system (FS)	**	***	***	***	*
Body weight (B)	*	***	NS	*	NS
FS x B	NS	NS	NS	NS	NS

Means within the same column with different litters, differ significantly (P<0.05).
*** (P<0.001) ** (P<0.01), * (P<0.05), NS : Not significant.

decreased body weight and decline abdominal fat especially in heavy birds. However, duration of fertility was not affected by size of initial body weight.

Correlation coefficient values between some productive traits studied:

The present results in Table 4 observed that, initial body weight was significant ($P<0.01$) positively correlated with each of egg weight ($r = 0.326$), feed intake ($r = 0.227$) and feed conversion ($r=0.123$) , but correlated negative insignificantly with egg number ($r = 0.105$) and duration of fertility ($r = 0.030$) . However egg number was significant positively correlation with each of hen-day percentage ($r = 0.988$) , feed intake ($r = 0.280$) , egg mass g / hen/ day ($r=0.950$) and duration of fertility ($r = 0.225$) , while, associated significant ($P<0.01$) negatively ($r = 0.721$) with feed conversion . Hen- day percentage was associated positively correlation ($P<0.01$) with feed intake ($r = 0.288$), egg mass ($r = 0.951$) and duration of fertility ($r = 0.217$) , while it was associated significant ($P<0.01$) negatively correlation with ($r = 0.0719$) . Duration of fertility was significant ($P<0.01$) positively correlated with egg mass g/ hen / day ($r = 0.399$) and contrary negative correlated with feed conversion ($r = 0.275$).

Multiple regression analysis showed that duration of fertility (DF) was depend on hen-day percentage (HD%), egg mass (EM), feed conversion (FC), weight gain / or loss (WG g), egg weight (EW) and feed intake (FI) explained adjusted 82.8% from the variation in being calculated by the following multiple regression equation:

$DF= -21.542 + 0.4488^{**} (HD\%) - 0.734^{**} (EM) -0.096^{NS} (FC) + 0.00044^{NS} (WG\ g) + 0.497^{**}(EW)+ 0.0117^{NS}(FI)$. Multiple regression coefficients was statistically significant ($P<0.01$) and the predicted value of this equation was 9.467 ± 0.0699 days.

The relationship between duration of fertility after termination of artificial insemination and percent of fertile eggs:

Fertility percentage after termination of artificial insemination ranged from 94.38 percent on 2 Th day, dropped to 50 percent on day 10 and reach to zero at 15 day (Figure 3). The daily reduction in fertility percentage, expressed, as correlation and regression coefficients values were – 967 and – 6.355 percent per day, respectively. These results are similar to those obtained by Kulenkamp et al. (1967) and Charles et al. (1974) found that fertility percentage decreased with duration of fertility.

Conclusively, it could be concluded that size live body weight in Gimmizah laying hens did not effect on duration of fertility, but effect on productive only. However, feed restriction increased duration of fertility and declined egg production at the end of the first year production. Also, fertility percentage declined with increasing interval between termination of artificial insemination in Gammizah laying hens. So high fertility rate is archived in artificial insemination when it is performed twice per week.

Table4: Correlation coefficients between traits studied during 56-65of age in Gimmizah breeder: (N = 96)

	IBW	EN	EW	HD%	FI	FC	EM
IBW							
EN	-0.105						
EW	0.326**	0.003					
HD%	0.087	0.988**	-0.010				
FI	0.227**	0.280**	0.298**	0.288**			
FC	0.123*	-0.721**	0.045	-0.719**	0.187**		
EM	0.002	0.950**	0.210**	0.951**	0.346**	-0.704**	
DF	-0.030	0.225*	0.080	0.217**	0.026	-0.275**	0.399**

*** (P<0.001), ** (P<0.0), * (P<0.05).

IBW= Initial body weight; EN= Egg number; Egg weight; HD%= Hen day % ; FI= feed intake ; FC= feed conversion (g feed / g egg mass), EM= Egg mass (g / day) ; DF= Duration of fertility.

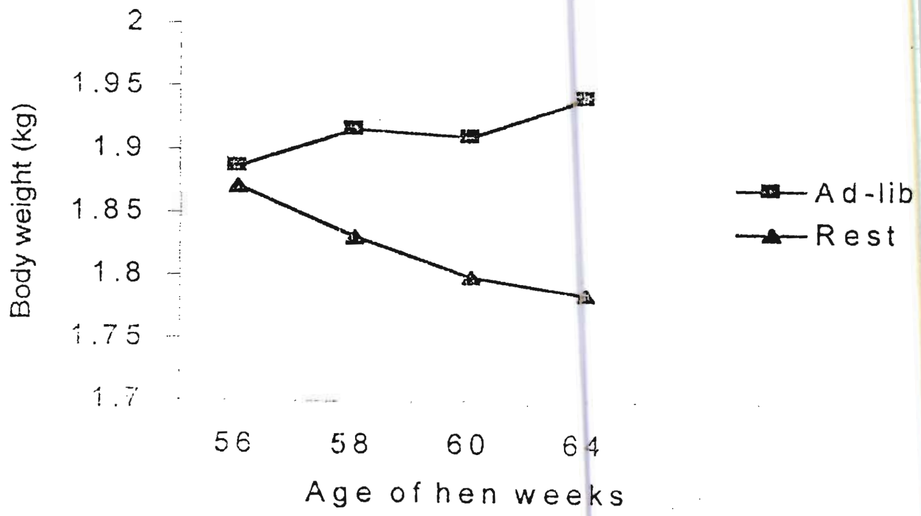

Figure 1: Body weight curves of the *ad-libitum* and restricted feeding system.

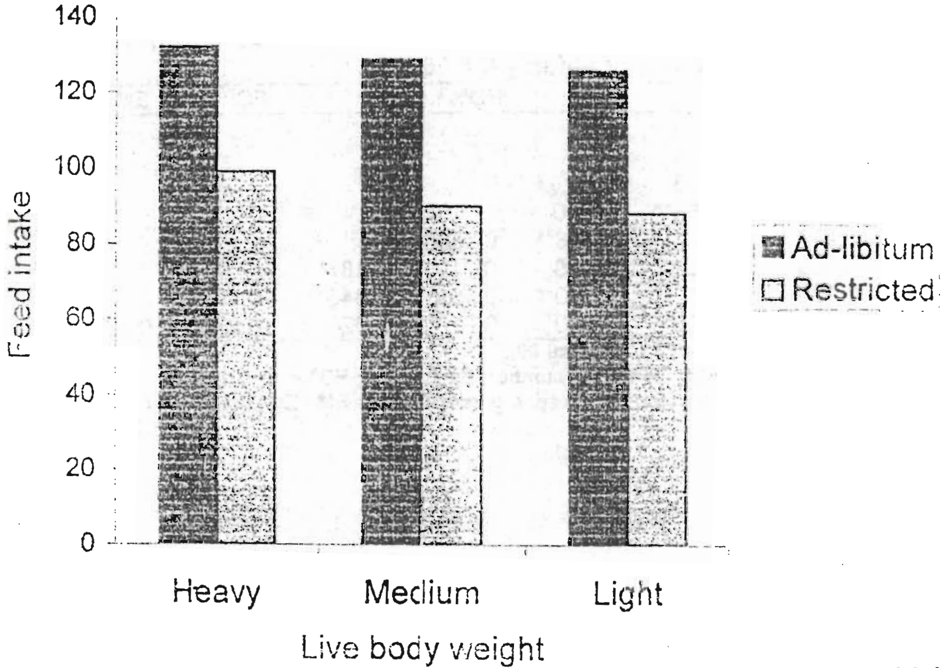

Figure 2: significant interaction effect between feeding system x initial live weight on feed intake.

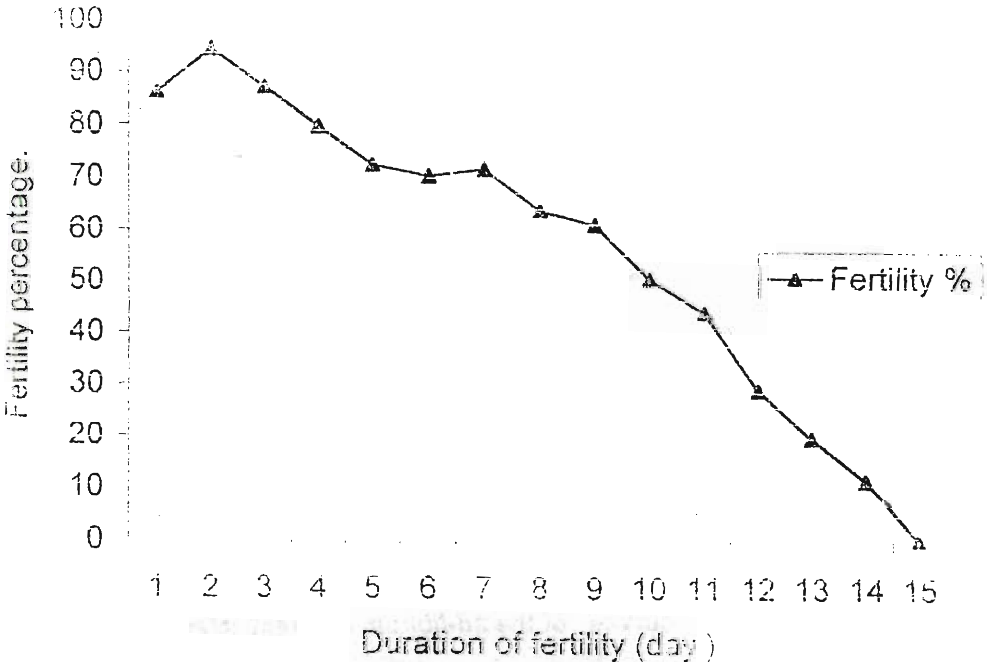

Figure 3: relationship between fertility percentage with duration of fertility after the artificial insemination

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J. Agric. Sci. Mansoura Univ., 29(2), February, 2004

تأثر الأداء الإنتاجي ومدة الخصوبة بوزن الجسم والتغذية المحددة لأمهات الدجاج المحلى في البطاريات .

محمد عيسى نوفل – حمدي عبد العزيز ابوخشبة – محمد عبد الباقي إبراهيم
معهد بحوث الإنتاج الحيواني – مركز البحوث الزراعية – الدقى –القاهرة – مصر

الغرض من هذه التجربة هو تقييم تأثير التغذية المحددة ووزن الجسم على الإنتاج ومدة الخصوبة في نهاية السنة الإنتاجية الأولى. تم تقسيم ٩٦ أم جميزة عمر ٥٦ أسبوع في البطاريات طبقا لوزن الجسم (المتوسط± الانحراف المعياري) إلى ثلاثة مجا ميع وزنية (٣٢ دجاجة / مجموعة) بحيث يكون ثقيل الوزن بمتوسط (٢,١٣٦ ± ٠,١٣٦ كم) ومتوسط الوزن (١,٨٦٦ ± ٠,٠٩٩ كم) خفيف الوزن بمتوسط (١,٦٢٦ ± ٠,١٣٩ كم) . وضعت في بطاريات فردية ثم قسمت كل مجموعة وزنية إلى تحت مجموعتين (٤٨ دجاجة / تحت مجموعة) الأولى منها تأكل للشبع والأخرى محددة التغذية من العليقه التي تحتوى ؟ ١٦,٢ بروتين٢٧٠٢ كيلو كالورى طاقة تمثيل/ كم عليقه . وكانت النتائج كالأتي .

١- يزداد وزن الجسم النهائي معنويا , النمو , عدد البيض, وزن البيضة وكتلة البيض فى اليوم في الطيور المغذاة للشبع ولكن تقل مدة الخصوبة خلال فترة إنتاج البيض عند المقارنة بالتغذية المحددة .

٢- الطيور ثقيلة الوزن يقل معنويا نسبة إنتاج البيض عن الوزن المتوسط والخفيف بينما ازداد وزن البيضة وكمية الغذاء المأكول وعدم تأثر مدة الخصوبة معنويا بوزن الجسم.

٣- يوجد ارتباط موجب معنويا بين وزن الجسم وكلا من وزن البيضة والغذاء المأكول وكفاءة التحويل بينما كان الارتباط مع عدد البيض ومدة الخصوبة سالبا وغير معنوي.

٤- يوجد ارتباط موجب معنويا بين مدة الخصوبة وكتلة البيض فى اليوم بينما كان الارتباط سالبا مع كفاءة تحويل الغذاء .

٥- معاملات الانحدار المتعدد كانت معنوية والقيمة المتوقعة لمدة الخصوبة كانت ٩,٤٦٧ يوما.

٦- نسبة الخصوبة تنخفض إلى ٥٠؟ بعد ١٠ أيام والى صفر؟ عند ١٥ يوم بعد إجراء التلقيح الصناعي.

التوصية

نستنتج أن وزن الجسم ليس له تأثير على مدة الخصوبة ويؤثر ذلك على الإنتاج فقط بينما التغذية المحددة تزيد مدة الخصوبة وتقلل الإنتاج في نهاية السنة الإنتاجية الأولى . ووجد أيضا أن انخفاض نسبة الخصوبة بزيادة الفترات بين التلقيح الصناعي في أمهات سلالة الجميزة . كما أن أفضل معدل خصوبة يكون عندما يتم التلقيح الصناعي مرتين أسبوعيا.