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EFFECT OF SUPPLEMENTARY LIGHT INTENSITY AND AGE OF FLOCK ON SOME REPRODUCTIVE TRAITS IN DOMYATI DUCKS.

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ABSTRACT

An experiment was conducted to examine the effects of supplementary light intensity level on the reproductive performance of artificially-inseminated Domyati duck hens at different ages. One hundred and four, eighteen-week-old Domyati ducks were randomly distributed into four groups of 6 duck drakes and 20 duck hens each, housed separately in floor pens, and exposed to a daily photoperiod of 17 hours up to the end of the experimental period at 60 weeks of age. To maintain this daily 17-hour photoperiod, the length of natural daylight was supplemented with artificial light, providing light intensity levels of 1.5 (served as a control), 10, 45 or 90 lux at birds' head level of the four experimental groups respectively. At 32, 40 and 60 weeks of age, drakes' semen was collected and evaluated (as ejaculate volume, sperms' mass and advanced motility, sperms concentration, and percentage of dead, abnormal, coiled-tail and clumped sperms), duck hens were artificially-inseminated, and eggs fertility and hatchability were determined. Regardless of age, increasing supplementary light intensity level from 1.5 to 90 lux significantly increased eggs fertility and hatchability, and improved semen quality traits, but had no effect on ejaculate volume. Apart from the effect of supplementary light intensity level, similar improvement was observed in drakes' semen quality with advancing age from 32 to 60 weeks. Inconsistent improvement was observed, however, in eggs fertility and hatchability as experimental birds advanced in age. At 32 and 60 weeks of age significantly higher egg fertility percentages were observed than at 40 weeks, whereas at 32 and 40 weeks of age significantly higher hatchability percentages were obtained than at 60 weeks. The effects of supplementary light intensity level and age were significantly interrelated for eggs fertility and hatchability, as well as for all semen quality traits studied, except for ejaculate volume and percent of dead sperms. The best economic efficiency of incubation process was obtained at 40 weeks of age with duck exposed to a supplementary light intensity level of 10 lux.

It would be concluded that; economically, the use of a supplementary light intensity level of 10 lux is sufficient to achieve satisfactory percentages of fertility and hatchability for eggs of artificially-inseminated Domyati ducks. Most of semen quality traits were also improved under this supplementary light intensity level.

Keywords: Domyati ducks, supplementary light intensity, age of flock, semen quality, fertility and hatchability.

INTRODUCTION

Currently, commercial breeds of ducks such as Muscovy and Campbell as well as Mules are reared in relatively large farms mainly to provide meat rather than eggs. The local strains of Domyati and Sodani duck breeds have a little attention of the producers due to their low productivity and low egg fertility and hatchability. The proper lighting program practiced during the growing and laying periods may contribute in improving the productivity of these local breeds of ducks. A photoperiod of 14 or 16 h light/day with a minimum light intensity threshold level is very important in stimulating and maintaining reproduction. Artificial light is necessary to supplement the length of natural day light in traditional poultry houses. When artificial light is being used to provide long day lengths, the light intensity after dark must be sufficient to create a contrast between daylight and night (Meyer *et al.*, 1988). The recommended light intensity for laying houses is still 10 lux, although the physiological threshold for response to changes in photoperiod is closer to 2 lux (Morris, 2004). The exact minimum threshold level of light intensity for breeder ducks is unknown, yet practically a light intensity of 10 lux or less is routinely used. This light intensity is a typical for most commercial broiler and turkey breeder operations. Light intensities ranging from 2 lux (Morris, 1967) to 800 lux (Brake and Baughman, 1989) appeared to be equally effective in stimulating the reproductive performance of chickens. One of major problem encountered by the duck producers is low fertility in local flocks. Domyati drakes tend to be very aggressive that they can injure or even kill the duck hens. In addition, drakes are more expensive to raise and maintain due to their high feed consumption.

In some species of domestic birds, artificial insemination has been used to circumvent the peculiarities of their mating behavior, to minimize the number of breeding males, to achieve higher levels of fertility and hence to decrease the cost of production (Etches, 1996). In Egypt, however, artificial insemination is not commonly used, especially in duck farms.

The present study was carried out to investigate the effects of various levels of supplementary light intensity and age of flock on semen quality, egg fertility and hatchability of Domyati ducks, achieved by using artificial insemination. In addition, the economic efficiency of incubation process was determined.

MATERIALS AND METHODS

The present study was carried out at El-Serw Poultry Research Station, El-Serw, Domietta, belonging to the Animal Production Research Institute, Agricultural Research Center, Egypt.

Experimental birds and management:

Domyati ducklings were obtained from EL-Serw hatchery unit and housed in well ventilated brooding pens littered with wheat straw for the first 4 weeks of age. Brooding temperature was about 30^0 C at the first three days of age, using gas heaters, then it was decreased daily by 0.5^0 C until reached 25^0 C which remained constant up to 21 days of age. Thereafter, the ducklings were permitted to get to yards.

Ducklings were fed a starter ration from one-day old to 6 weeks of age and a grower one from 6-18 weeks of age, thereafter, a layer ration was offered from 18 weeks of age up to the end of study at 60 weeks of age. Composition and chemical analysis of all rations are shown in Table 1. Rations were offered to birds in a dry-mash form. Fresh and clean water was available all the time.

Experimental design and Light regime practiced:

During the first week of age, ducklings were kept under a 24-hour photoperiod per day; using an artificial light source, afterwards, the length of daily photoperiod was decreased 2 hours weekly until reached 14 hours daily at the 6^{th} week which remained constant up to 18 weeks of age, and then was increased one hour weekly to be 17 hours/day at 21 weeks of age; maintained constant to the end of the study, at 60 weeks of age.

Table (1): Composition and chemical analysis of the rations offered to the ducks throughout the experimental period.

Ingredients (%)*	Starter	Grower	Layer
Yellow corn	65.00	63.00	66.00
Soybean meal (44%)	30.45	15.50	21.50
Wheat bran	0.65	17.78	2.74
Dicalcium phosphate	1.80	1.25	1.50
Limestone	1.40	1.80	7.60
Vit. + Min. premix **	0.30	0.30	0.30
Salt (NaCl)	0.30	0.30	0.30
D.L. Methionine	0.10	0.07	0.06
Total	100	100	100
Calculated analysis *** :			
Crude protein ; %	19.12	15.04	15.5
ME (Kcal/kg)	2865	2687	2724
Total calcium ; %	1.03	1.04	3.41
Total phosphorus ; %	0.72	0.72	0.64
Methionine ; %	0.15	0.11	0.1
Lysine ; %	0.11	0.09	0.09

* All ingredients were available at El-Serw Station; where they were ground and then well mixed.

** Contents per 3 kg premix: Vitamin A 10,000,000 IU, vitamin D_3 1,000,000 IU, vitamin E 10 g, vitamin K_3 1 g, vitamin B_1 1 g, vitamin B_2 4 g, nicotinic acid 20 g, pantothenic acid 10 g, vitamin B_6 1.5 g, vitamin B_{12} 10 mg, folic acid 1 g, biotin 50 mg, choline 500g, zinc 45g, copper 3 g, iodine 0.3 g, iron 30 g, selenium 0.1 g, manganese 40 g and carrier $CaCO_3$ to 3000 g.

*** According to NRC (1994)

One hundred and four, eighteen-week-old, healthy birds were chosen randomly, distributed into 4 experimental groups of 6 duck drakes and 20 duck hens each, transferred separately to well-ventilated laying floor pens, weighed and leg-banded, and exposed to a daily 17-hour photoperiod from 21 weeks of age to the end of experiment at 60 weeks of age. To maintain this daily 17-hour photoperiod, the length of natural daylight was supplemented with artificial light. The source of supplementary artificial light was incandescent bulbs (fitted with reflectors) of 10 , 40 , 100 or 200 watts installed at a height of 2.1 m from litter, providing different light intensity levels of 1.5 (served as a control), 10, 45 and 90 lux at birds' head level of the 4 experimental groups respectively. Light intensity level was measured by using a photometer, as an average of 5 readings at 5 sites within the pen. The artificial supplementary photoperiod was divided to be one hour in early morning before sun-rise and the remainder was added at sunset , as recommended by North and Bell (1990) using an automatic switch timer. At 32, 40 and 60 weeks of age, drakes' semen was collected and evaluated (as ejaculate volume, sperms' mass and advanced motility, sperms concentration, and percentages of dead, abnormal, coiled-tail and clumped sperms), duck hens were artificially inseminated and eggs fertility and hatchability were determined. In addition, an evaluation of the economic efficiency of incubation process was made.

Semen collection and evaluation:

For semen collection, drakes were trained for artificial semen ejaculation by using the abdominal massage technique described by Kammerer *et al.* (1972). During and after 6 weeks of training, each drake was handled gently and the semen was collected at the base of copulatory organ in graduated tubes. Three tests were made to evaluate semen quality traits at 32, 40 and 60 weeks of age. Within each age, semen was collected twice a week from individual drakes in each experimental group. Semen volume was measured in milliliters using calibrated pipette. Mass motility was estimated microscopically by visual examination on a subjective scale of 1 to 5, where the bottom, the middle and the top of the scale represent poor, good and excellent motility, respectively (Etches, 1996). Advanced motility, which is the progressive movement of spermatozoa, was also determine by the microscopic examination of semen samples diluted with physiological saline (0.9 % NaCl). Each sample was ranked for the percentage of spermatozoa which was observed moving in straight lines across the field of vision with a normal vigorous swimming motion. The visual scoring of motion ranged from 0.0 (no motility) to 100 (vigorous motility). Sperm concentration was estimated by using an original haemocytometer to count the spermatozoa by adding 0.05 ml of fresh semen to 9.95 ml of a 2.9% sodium citrate solution to give a 1: 200 dilution rate, and semen concentration was calculated as follows:

Sperm concentration = $N \times 50 \times 200$ where,

N = Number of sperms per 5 squares of haemocytometer.

Percentage of dead spermatozoa was estimated by using the nigrosin/eosin staining procedure (Hackett and Macpherson, 1965). Preparation of the stain was carried out by dissolving 10 g nigrosin and 1.67 g eosin in distilled water to make 100 ml. Seven drops of stain were added to a test tube and warmed to 30^0 C in a water bath before one drop of fresh semen was added. The mixture was then shaken and left for 2-3 minutes. One drop of the mixture was removed by Pasteur pipette and placed at the end of a warm slide. A thin smear was made by drawing the edge of a second slide across the mixture. The stained slide was allowed to dry and was then examined under oil immersion using 100X objective of the phase contrast microscope. Spermatozoa either partially or completely stained were recorded as dead by counting the number present in 200 spermatozoa in different fields on a slide. Abnormal sperm percentage was estimated by observing 200 sperms on a slide prepared for dead determination. The examination was carried out under oil immersion lens (X 100) of the phase contrast microscope. Percentage of coiled-tail sperms was estimated in 200 sperms on a slide prepared for dead sperms determination. The clumping of sperms in semen samples was determined by using one drop of freshly undiluted semen in the same manner as advanced motility test as reported by El-Wardany *et al.* (1995) and Etches (1996). Clumping of sperms is a phenomenon in which spermatozoa adhere together, forming clumps or masses; like the bacterial colonies, which lead to a poor advanced motility.

Artificial insemination:

It was carried out for 20 duck hens per supplementary light intensity level. Clean undiluted mixed fresh semen collected from the 6 drakes of each supplementary light intensity level was used for inseminating the females in the morning at 10 a.m. using 0.05 ml semen/bird. Female ducks were starved 15 hours before insemination to make the process as clean as possible. Females were inseminated three times during the first week and every 3 days thereafter. Artificial insemination was applied by using a narrow soft plastic tube attached to a narrow rubber tube with insulin plastic syringe mounted on its end which was used as pump.

Eggs fertility and hatchability percentages:

The eggs were collected from each supplementary light intensity level at 32, 40 and 60 weeks of age. The number of eggs used for each age was 300 eggs/treatment. Hatching eggs were incubated in a forced air-draft incubator (Econoome) adjusted on 99.5^0 F and 60% relative humidity for the first 24 days and 98.5^0 F and 75% relative humidity during hatching time (4 days). Fertility percentage was determined in the tenth day of incubation by light candling test. Hatchability percentage was determined at the end of incubation period.

Data analysis:

Data were analyzed by using statistical program of the General Linear Models Procedure of SAS software (1996). Significant differences among treatment means were determined by Duncan's multiple range test (Duncan, 1955) with a 0.05 level of probability.

RESULTS AND DISCUSSION

Semen quality:

Data presented in Tables 2 and 3 show semen quality traits of the experimental duck drakes at 32, 40 and 60 weeks of age. It is worth noting that part of the objective of the current study was to use the semen produced from duck drakes exposed to the varying supplementary light intensities at different ages in artificial insemination because duck drakes are more expensive to raise than duck hens; due to their high feed consumption.

Effect of supplementary light intensity level on semen quality traits:

The semen volume of Domyati drakes was not significantly affected by the supplementary light intensity level; since they produced nearly similar values (Table 2). On the other hand, the supplementary light intensity level had significant ($P \leq 0.01$) effects on both mass motility and advanced motility. In comparison to the control (L1.5), the males of treatments L10, L45 and L90 lux were superior with respect to mass motility by 11.9, 16.7 and 16.7% respectively, yet the mass motility of the control (L1.5) is also considered good.

Table (2): Effects of light intensity level on ejaculate volume, sperm mass and advanced motility, and sperm concentration of Domyati duck drakes' semen at different ages

Treatments	Traits															
	Ejaculate volume (ml)				Mass motility (1–5)				Advanced motility (0–100)				Sperm concentration (×10⁹/ml)			
	Age (wks)			Average	Age (wks)			Average	Age (wks)			Average	Age (wks)			Average
Light intensity (lux)	32	40	60		32	40	60		32	40	60		32	40	60	
L (1.5)	0.21±0.02	0.17±0.3	0.24±0.03	0.21±0.01	3.4±0.19	4.2±0.15	5.0±0.03	4.2±0.17^{C}	69.5±2.8	81.9±2.9	95.5±0.8	82.3±2.9^{C}	0.96±0.02	1.72±0.17	3.34±0.14	2.01±0.30^{C}
L (10)	0.29±0.02	0.22±0.02	0.22±0.02	0.24±0.01	4.5±0.11	4.8±0.12	5.0±0.03	4.7±0.1^{B}	89.2±2.6	94.2±1.4	96.9±0.6	93.4±1.2^{B}	1.78±0.31	2.90±0.32	3.60±0.11	2.76±0.23^{B}
L (45)	0.21±0.02	0.21±0.02	0.21±0.02	0.21±0.01	4.9±0.12	4.8±0.15	5.0±0.03	4.9±0.1^{A}	94.7±1.9	95.7±0.7	97.5±1.0	96.0±0.8^{A}	4.00±0.60	2.34±0.50	3.31±0.14	3.22±0.30^{AB}
L (90)	0.26±0.03	0.24±0.04	0.24±0.01	0.24±0.01	4 9±0.09	5.0±0.02	5.0±0.0	4.9±0.03^{A}	94.5±1.2	96.9±0.6	98.0±0.3	96.5±0.6^{A}	3.02±0.43	3.37±0.30	3.76±0.17	3.38±0.20^{A}
Overall mean	0.24±0.01	0.21±0.01	0.23±0.01	0.23±0.06	4.4±0.14^{C}	4.7±0.08^{B}	5.0±0.01^{A}	4.7±0.3	87.0±2.4^{C}	92.2±1.5^{B}	96.9±0.4^{A}	92.0±4.1	2.44±0.31^{B}	2.58±0.20^{B}	3.50±0.10^{A}	2.84±0.80

A-C: For each variable, means within each column or row having similar letter(s) are not significantly different (P≤0.05).

Table (3): Effects of light intensity level on percentages of dead, coiled-tail and clumped sperms, and sperm abnormality of duck drakes' semen at different ages

Treatments	Traits															
	Dead sperms (%)				Total sperm abnormality (%)				Coiled-tail sperms (%)				Clumped sperms (%)			
	Age (wk)			Average	Age (wk)			Average	Age (wk)			Average	Age (wk)			Average
Light intensity (lux)	32	40	60		32	40	60		32	40	60		32	40	60	
L (1.5)	12.3±0.6	13.3±0.3	11.8±0.6	12.5±0.3^{A}	15.0±0.5	15.3±0.6	13.5±0.4	14.6±0.3^{A}	6.33±0.3	7.3±0.2	5.7±0.3	6.4±0.2^{A}	5.5±0.3	5.5±0.2	4.5±0.3	5.2±0.2^{A}
L (10)	9.7±0.4	10.0±0.4	9.5±0.2	9.7±0.2^{B}	12.0±0.4	11.5±0.2	10.8±0.3	11.4±0.2^{BC}	4.5±0.3	4.5±0.2	4.5±0.5	4.5±0.2^{B}	4.3±0.2	3.8±0.3	3.8±0.3	4.0±0.2^{B}
L (45)	10.0±0.5	9.5±0.4	8.3±0.5	9.3±0.3^{BC}	13.0±0.3	11.0±0.4	11.2±0.3	11.7±0.3^{B}	5.3±0.2	4.2±0.3	4.2±0.3	4.6±0.2^{B}	5.0±0.4	3.3±0.2	3.7±0.3	4.0±0.2^{B}
L (90)	8.8±0.7	8 7±0.3	8.3±0.2	8.6±0.3^{C}	11.8±0.5	10.0±0.5	10.8±0.3	10.9±0.3^{C}	5.0±0.7	4.2±0.3	4.0±0.3	4.4±0.3^{B}	3.5±0.5	3.8±0.2	3.3±0.2	3.6±0.2^{B}
Overallmeans	10.2±0.4^{A}	10.4±0.4^{A}	9.5±0.4^{B}	10.03±1.1	13.0±0.3^{A}	12.0±0.5^{B}	11.6±0.3^{B}	12.2±0.2	5.3±0.2^{A}	5.0±0.3^{AB}	4.6±0.2^{B}	5.0±0.9	4.6±0.2^{A}	4.1±0.2^{B}	3.8±0.2^{B}	4.2±0.8

A-C: For each variable, means within each column or row having similar letter(s) are not significantly different (P≤0.05).

The same trend was found with respect to advanced motility; where the previously mentioned groups significantly (P≤0.01) surpassed the control one by 13.5, 16.6 and 17.3% respectively. It was observed that L45 and L90 groups had nearly similar values of motility and both were better than that of the L10 group. The sperm concentration was gradually increased with increasing the supplementary light intensity from 1.5 up to 90 lux. In comparison to the control (L1.5) the sperm concentrations of L10, L45 and L90 groups were significantly (P≤0.01) better by 37.3, 60.2 and 68.2% respectively. The increasing of supplementary light intensity to be 10, 45 and 90 lux had significant (P≤0.01) inhibitory effects on dead sperm percentage compared with that of the control (L1.5) by 22.4, 25.6 and 31.2% respectively (Table 3). The percentages of coiled-tail and clumped sperms were significantly (P≤0.01) reduced with elevating the intensity of supplementary light to 10, 45 and 90 lux as compared with the control. The rates of improvement; as reductions in the percent of coiled-tail sperms of L10, L45 and L90 lux groups, were 29.7, 28.1 and 31.3% respectively, whereas the corresponding figures for the clumped sperms were 23.1, 23.1 and 30.8% in comparison to the control respectively. The total sperm abnormality (%) in the L10, L45 and L90 were significantly less compared with that of the control group by 21.9, 19.9 and 25.3% respectively.

Effect of age on semen quality:

Results in Table 2 showed no significant effect of Domyati drakes' age on semen volume, but both mass and advanced motility of spermatozoa and sperm concentration were significantly increased as the drakes become older (60 weeks of age). At 40 and 60 weeks of age, the improvement values were 6.8 and 13.6% in mass motility, 6.0 and 11.4% in advanced motility and 5.7 and 43.4% in sperm concentration, respectively, as compared with data obtained at 32 weeks of age. The dead sperms (%), recorded at 32 and 40 weeks of age (Table 3), were nearly equal, and both were significantly (P≤0.05) higher than that recorded at 60 weeks of age. Concerning the percent of abnormal sperms, the present results (Table 3) show that when the age of drakes was advanced to 60 weeks, the percentages of coiled-tail sperms and clumped sperms as well as total sperm abnormality, were significantly (P≤0.01) reduced.

The interactions between the effect of supplementary light intensity level and drakes age were significant in respect of all studied semen traits, but not for semen volume and percent of dead sperms.

It appears from these results that supplementary light intensity had pronounced effects on most of the semen quality traits studied. Earlier studies on semen production and quality from different species of poultry showed that light has the most important role on age at sexual maturity and different sexual behavioral activities of avian males (Ottinger and Mench, 1989).

It is well known that light intensity can modulate and improve some semen quality characteristics such as semen volume and sperm concentration in cocks (Harris *et al.,* 1984). In the present study semen volume was not significantly affected by different supplementary light intensities or by drakes age. However, the average values obtained for semen volume were slightly lower than those reported by Davtian (1986), Kurbatov *et al.* (1987) and Surai and Wishart (1996) in Pekin (0.4 ml) and in Muscovy drakes (0.28 ml). This may be due to species differences as the drakes of the present study were from Domyati local strain. On the other hand, spermatozoa concentrations of drakes in the present study were greatly higher than those reported by the previously mentioned authors, which may be due to the negative correlation between semen volume and concentration as reported by many authors (Sexton, 1983; Kurbatov, *et al.*, 1987 and EL-Wardany *et al.*, 1995).

That the other semen quality traits (sperm motility, abnormality, dead (%) ..etc) were significantly improved by increasing supplementary light intensity, may reflect the positive influence of light in stimulating the hypothalamic-hypophyseal-testicular-axis in drakes with the coincident increase in gonado-tropic hormones which enhance the spermatogenic activity in the testis. This result is in close agreement with those reported by Sturkie (1986) in different avian species. It is worth noting that there were no available studies concerning semen quality in Egyptian ducks as affected by housing light intensity level.

Egg fertility and hatchability percentages:

Data presented in Table 4 show fertility and hatchability percentages of eggs produced by the experimental Domyati duck hens at 32, 40 and 60 weeks of age.

Effect of Supplementary light intensity level on egg fertility and hatchability:

The eggs fertility percentage was significantly (P≤0.01) improved with increasing the intensity level of supplementary light compared with that of the control (1.5 lux). Equal egg fertilities (%) were obtained, however, for groups L10, L45 or L90 lux. Increasing the supplementary light intensity level from 1.5 to 90 lux had significantly positive effects on hatchability percentage, either expressed as % of fertile or total eggs. The use of supplementary light of 10, 45 and 90 lux resulted in an improvement in hatchability percentage by 7.6, 5.4 and 7.0% on the basis of fertile eggs and 13.8, 12.0 and 13.8% on the basis of total eggs compared with the control ones, respectively.

Effect of age on eggs fertility and hatchability:

It was observed that fertility percentage was higher at all ages studied ranging from 96.3 to 97.7%. The fertility percentages at 32 and 60 weeks of age were nearly equal and both were significantly (P≤0.01) higher than that obtained at 40 weeks of age. The hatchability of fertile eggs was significantly (P≤0.01) changed according to the age of parents; where it increased with advancing age from 32 to 40 weeks, and then decreased at 60 weeks of age. The same observation was found in hatchability (%) of total eggs, but its percentage at 60 weeks of age was not significantly different from that recorded at 32 weeks of age.

The interactions between supplementary light intensity level and ducks age on eggs fertility were significant (P≤0.01). The interactions of supplementary light intensity level by ducks' age on hatchability percentage were significant (P≤0.01); where the highest hatchability percentage was achieved under supplementary light intensity level of 10 lux at 40 weeks of age.

Table (4):- Effects of light intensity level on fertility and hatchability of fertile and total settable eggs of artificially inseminated Domyati duck hens at different ages

Treatments	Traits											
	Eggs Fertility (%)				Hatchability of fertile eggs (%)				Hatchability of total eggs (%)			
	Age (wks)			Average	Age (wks)			Average	Age (wks)			Average
Light intensity (lux)	32	40	60		32	40	60		32	40	60	
L (1.5)	93.3±0.03	90.7±0.03	94.7±0.03	92.9±0.6^{B}	81.4±0.03	86.8±0.03	81.7±0.03	83.3±0.9^{D}	76.0±0.03	78.7±0.03	77.3±0.03	77.3±0.4^{C}
L (10)	99.9±0.06	97.3±0.03	98.7±0.03	98.6±0.4^{A}	87.8±0.03	91.8±0.03	89.2±0.03	89.6±0.6^{A}	86.7±0.03	89.3±0.03	88.0±0.03	88.0±0.4^{A}
L (45)	98.7±0.03	98.7±0.03	98.7±0.03	98.7±0.01^{A}	87.8±0.03	90.5±0.03	85.1±0.03	87.8±0.8^{C}	86.7±0.03	89.3±0.03	84.0±0.03	86.6±0.8^{B}
L (90)	98.7±0.03	98.7±0.03	98.7±0.03	98.7±0.03^{A}	90.5±0.0	89.2±0.03	87.8±0.03	89.1±0.4^{B}	89.3±0.03	88.0±0.03	86.7±0.03	88.0±0.4^{A}
Overall mean	97.6±0.8^{A}	96.3±1.0^{B}	97.7±0.5^{A}	97.2±0.06	86.9±1.0^{B}	89.5±0.6^{A}	85.9±0.9^{C}	87.4±0.06	84.6±1.5^{B}	86.3±1.3^{A}	84.0±1.2^{C}	85.0±0.06

A-D : For each variable, means within each column or row having similar letter(s) are not significantly different (P≤0.05).

Table 5: Effect of light intensity level on the economic efficiency of incubation of eggs produced by Domyati duck hens at different ages

Treatments		Cost of one egg (L.E.)	No. of eggs incubated	Total cost of eggs (L.E.)= (A)	No. of hatched ducklings	Total income (L.E.)= (B)	Net return (L.E)= (B-A)	EE ;% =[(B-A)/A] × 100
Light intensity (lux)	L 1.5	0.38	75	28.5	62.5	62.5	34.0	119.3
	L 10	0.29	75	21.75	67.2	67.2	45.45	209.0
	L 45	0.30	75	22.5	65.9	65.9	43.4	192.9
	L 90	0.31	75	23.25	66.8	66.8	43.55	187.31
Age (wks)	32 wks	0.32	300	96	260.7	260.7	164.7	171.6
	40 wks	0.32	300	96	268.5	268.5	172.5	179.7
	60 wks	0.32	300	96	257.7	257.7	161.7	168.4

The present results are in partial keeping with those reported by Siopes (1984, 1991, 1992) and Hulet (1992), who found no significant differences in fertility and hatchability of eggs produced by turkey hens exposed to different light intensity levels during their laying period. However, Davis *et al.* (1993) studied the effect of light intensity on eggs fertility of breeder Pekin ducks when exposed to two different levels (10 versus 172 lux), and observed that light intensity of 172 lux improved eggs fertility more than 10 lux throughout their trial. Under the conditions of the present study the breeder Domyati ducks exposed to supplementary light intensity of 10 lux performed similarly to those subjected to the higher supplementary light intensity levels for eggs fertility and hatchability.

Concerning the effect of a flock age, several authors (Breslavets *et al.*, 1997; Suarez *et al.*, 1997 and Milosevic *et al.*, 1997) found significant differences in hatchability of eggs due to the effect of layers' age. Our results are in harmony with that obtained by Davis *et al.* (1993) who reported that percentage of fertile eggs of Pekin ducks ranged from 48.9% at 32 weeks to 98.9% during the 44^{th} and 49^{th} weeks of age. Meijerhof (1994) reported that hatchability percentage was significantly higher for eggs produced by 37-week- old hens (91.5%) than that of eggs produced later at 59 weeks of age (85.1%). In addition, Buhr (1995) stated that hatchability was higher for eggs from 34-week-old hens than for eggs from 49-week-old hens. Khalifah *et al.* (2004) reported that hatchability percentages were significantly reduced (87.8 versus 83.5%) when the age of breeder hens increased from 40 to 60 weeks of age.

Also, Tag El-Din *et al.* (2004) found that fertility percentages were 80.4, 83.7 and 86.5% for Campbell ducks and 81.6, 85.7 and 87.1% for Domyati ducks, whereas hatchability percentages were 79.6, 81.4 and 81.4% for Campbell ducks and 77.4, 79.0 and 81.3% for Domyati ducks at 30, 38 and 46 weeks of age respectively.

Economic efficiency (%):

The results of the effects of supplementary light intensity and age of flock on incubation economic efficiency of hatched Domyati ducklings at different ages are summarized in Table 5. Ducks exposed to supplementary light intensity of 10 lux had higher economic efficiency than those exposed to supplementary light intensity of 1.5, 45 and 90 lux by 75.2, 8.3 and 11.6% respectively. Ducklings hatched from eggs produced by ducks at 40 weeks of age had higher economic efficiency than those hatched from eggs produced by ducks at 32 and 60 weeks of age by 4.7 and 6.7% respectively.

Conclusion

From the previous results, it can be concluded that, economically, the use of a supplementary light intensity of 10 lux is sufficient to achieve satisfactory percentages of fertility and hatchability for eggs of artificially inseminated Domyati duck hens reared in floor pens. Most of semen quality traits were also improved under this supplementary light intensity level.

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تأثير شدة الإضاءة الإضافية وعمر القطيع علي بعض صفات التناسل في البط الدمياطي

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أجريت هذه التجربة لدراسة تأثير مستوي شدة الإضاءة الإضافية علي الأداء التناسلي للبط الدمياطي الملقح صناعياً عند أعمار مختلفة. تم توزيع عدد ١٠٤ طائراً عند عمر ١٨ أسبوعاً عشوائيا علي أربعة مجموعات تحتوي كل مجموعة علي ٦ ذكور و ٢٠ أنثي. تم تربية الجنسين منفصلين في عنابر أرضية و عرضت الطيور لفترة إضاءة قدرها ١٧ ساعة يوميا حتى نهاية التجربة في عمر ٦٠ أسبوعا ولتحقيق هذه الفترة الضوئية تم إطالة ضوء النهار الطبيعي باستخدام ضوء صناعي بشدة إضاءة ١,٥ لوكس (مجموعة المقارنة) أو ١٠ أو٤٥ أو٩٠ لوكس عند مستوى رأس الطائر للمجاميع الأربع على التوالي. تم جمع السائل المنوي من الذكور عند أعمار ٣٢ و٤٠ و٦٠ أسبوعا و تم تقييمه في صورة (حجم القذفة والحركة الكلية والتقدمية الإسبرمات وتركيز الإسبرمات والنسب المئوية الإسبرمات الميتة والمشوهة وذات الذيل الملفوف والمتجمعة). ولقحت الإناث صناعيا وتم تفريخ البيض لحساب نسبتي الخصوبة والفقس للبيض.

بصرف النظر عن عمر الطيور أدت زيادة شدة الإضاءة الإضافية من ١,٥ إلى ٩٠ لوكس إلي زيادة معنوية في نسبتي الخصوبة والفقس وكذلك تحسين في صفات السائل المنوي ولكن بدون تأثير على حجم القذفة. وبصرف النظر عن تأثير شدة الإضاءة الإضافية، حدث تحسن مماثل في صفات السائل المنوي مع تقدم الذكور في العمر من ٣٢ إلى٦٠ أسبوعا . وعموما لوحظ تحسن غير ثابت في نسبتي الخصوبة والفقس بتقدم الطيور في العمر. فعند عمري ٣٢ و٦٠ أسبوعا لوحظ ارتفاعا معنويا في نسبة الخصوبة عنها عند عمر ٤٠ أسبوعاً. بينما عند عمري ٣٢ و٤٠ أسبوعاً كانت نسبة الفقس للبيض أعلى معنويا عنها عند عمر ٦٠ أسبوعاً. كان للتفاعل بين شدة الإضاءة الإضافية وعمر الطيور تأثيراً معنويا علي كل من نسبتي الخصوبة والفقس وكذلك صفات السائل المنوي فيما عدا حجم القذفة ونسبة الإسبرمات الميتة. تم الحصول علي أفضل كفاءة اقتصادية عند تفريخ بيض الطيور في عمر ٤٠ أسبوعا والتي تم تعريضها لشدة إضاءة إضافية ١٠ لوكس.

ومن هذه الدراسة يمكن استخلاص أنه من الوجهة الاقتصادية فإن استخدام الإضاءة الإضافية بشدة ١٠ لوكس كانت كافية للحصول على نسبتي خصوبة وفقس مقبولة لبيض البط الدمياطي تحت نظام التلقيح الصناعي. وكذلك فان معظم صفات السائل المنوي تحسنت أيضا تحت هذا المستوى من شدة الإضاءة الإضافية الإضافية.