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The Effects of Age and Season on Semen Characteristics of White Leghorn Cocks under Sudan Conditions

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Abstract: White Leghorn cocks (Bovans) of 2 different ages (1-2 years) were used to study the effect of age and season on semen characteristics. An average of 8 males from each age were used and kept in individual cages in an open sided poultry house for 6 months. Average maximum and minimum daily temperature during summer and autumn seasons were 40.3, 24.4 and 39.3, 26.1, respectively. Semen was collected weekly by abdominal massage and evaluated for semen volume, motility, concentration and percentage of dead and abnormal spermatozoa. There was a significant difference ($p < 0.05$) between the two age groups in semen volume 0.22 ± 0.02 and 0.29 ± 0.25 mL; mass motility scores were 3.56 ± 0.06 and 3.17 ± 0.08 and the percentage of abnormal sperm 4.67 ± 0.14 and $5.62 \pm 0.16\%$ for one and 2 years, respectively. No significant difference was found in sperm concentration or percentage of dead sperms. Summer season caused a significant drop in semen volume by 8.7% in one year old and sperm concentration in two years old by 19.7%. It is also, caused an increase in percent dead sperm by 40.86 and 41.89% in 1 and 2 years, respectively.

Key words: Semen characteristics, hot climate, white leghorn cocks, sperm concentration

INTRODUCTION

In all species, increasing age negatively influences reproductive performance. In mammals, deterioration in reproductive performance at the end of the reproductive season partly results from a decrease in male fertility. Seasonal changes in numbers, motility, viability and morphology of spermatozoa have been reported in the latter part of the reproductive period in animals (Wilson, 1995). Decreases in fertility and hatchability are also observed in poultry when flocks are at the end of the first reproductive period (Keslo *et al.*, 1996; Surai *et al.*, 2000). These changes are accompanied by a decrease in the number and the viability of spermatozoa in chickens and in motility of spermatozoa in turkey (Bakst and Cecil, 1992).

The imported White Leghorn parent stock in commercial breeding farms in Sudan, usually spend one year in lay and then they are sold off. Owners of commercial breeding farms fear that age would reduce the fertility of cocks, especially at high environmental temperatures. Buvanderan (1967) showed that age of cocks did not influence the fertility in Rhodes Island Red. Aviziene and Kriukiene (1977) reported that cocks at 25, 62 and 106 weeks of age did not adversely affect the fertilizing capacity of pullets at 22 weeks of age. A report from Haije (1990) confirmed this fact also. However, these studies were carried out in temperate climate or under controlled environment. Season is another factor that might affect the fertilizing.

MATERIALS AND METHODS

Bovans parent males from Hendrix poultry breeder, of two different ages, 63 and 106 weeks were used in this experiment. Nine males from each age group were kept in an open sided poultry house. The experiment lasted 6 months from April to September. Maximum and minimum house temperatures during summer (April-June) and autumn (July-September) were 40.3; 24.4 and 39.3; 26.1°C, respectively. The feed and water were provided ad libitum. They received standard breeder ration as presented in Table 1. The birds were trained for semen collection by abdominal massage (Burrows and Quinn, 1937). Semen volume was measured using tuberculin syringe graduated to 0.01 mL. The mass motility was scored between 0-5 (Wheeler and Andrews, 1943). The sperm concentration was calculated according to the procedure of Allen and Champion (1955). The percentage of dead and abnormal spermatozoa was calculated over 200 sperms, from semen films stained with eosin and nigrosin stain (Clark *et al.*, 1984).

Statistical analysis: The values of semen characteristics of the two different ages were subjected to the Analysis of Variance (ANOVA).

RESULTS AND DISCUSSION

The Effect of age on semen characteristics at one year and two years of age are summarized in Table 2. The

Table 1: Composition of the diet (g/kg)

Ingredient	
Sorghum grains	562.50
Groundnut cake	100.00
Sesame cake	45.00
Wheat bran	150.00
Oyster Seas Shell	90.00
Breeder concentrate	50.00
Sodium chloride	2.50
Calculated composition/kg	
Crude protein (Nx6.25) (g)	181.10
Metabolizable Energy (MJ)	11.50
Lysine (g)	7.79
Methionine (g)	4.40
Calcium (g)	37.60
Available phosphrous (g)	3.50

semen volume obtained from the two age groups was close to the previous values reported by Lake (1978) and averaged 0.25 mL. Significant differences ($p < 0.05$) between the two age groups were observed. Higher values were obtained in the 2 years old cocks compared to the one year old. A difference could not be detected (Ramamurthy *et al.*, 1986). Jones and Lamoreux (1942) found variation in the semen volume of cocks at different age. Sperm motility (mass motility) was significantly different ($p < 0.05$) between the two groups. In the mean time, spermatozoa motility of older birds was still in the range of good quality semen.

In contrast, Ramamurthy *et al.* (1986) could not detect any effect of age on semen motility. The difference obtained in this study might be due to the frequency of collection, difference in handling procedure and to difference in ambient temperature at the time of motility estimation. The higher percentage of abnormal sperms, which was observed in older cocks, may be associated with lower motility. This positive correlation was detected by Kamar and Badreldin (1959) in fayomi cocks. Semen with percentage of abnormality less than 10% is generally considered to be of good quality (Hajje, 1990). The percentage of abnormal sperm obtained in this study remained within this limit.

There was no significant difference between the two age groups in the percentage of dead spermatozoa and sperm concentration. This is in contrast; Gleichauf (1974) found a decrease in spermatozoa concentration with increasing with increasing age. It was noticed that semen with viscous consistency gave indication of high concentration, while watery appearance was associated with low concentration; similar results were observed by McDaniel and Craig (1959).

The effect of season on semen characteristics: During summer the one year old cocks produced significantly ($p < 0.05$) smaller semen volume than in autumn months, whereas the two years old cock's semen volume was not affected by season (Table 3). Boone and Huston (1963) and Chung *et al.* (1989) found reduction in semen volume under high temperature and during hot season.

The mass motility was significantly ($p < 0.05$) reduced during summer in the one year old cock, these results confirm well the previous records (Kamar and Badreldin, 1959; Nakarga and Egbunike, 1989; Chung *et al.*, 1989) that sperm motility was lower during dry and hot season and high during rainy season and with decrease in temperature. Higher percentage of dead spermatozoa was observed during summer and this result was also obtained by Kamar and Badreldin (1959) who found higher percentage of dead sperm inn summer and also by Nayak and Misra (1991) who observed a decrease in semen quality with increase in ambient temperature. The increase in percentage of dead sperm during summer months might explain the reduction in sperm motility during summer months.

The sperm concentration in younger birds was not affected by season; however, the older birds showed a significant reduction in sperm concentration during summer season. This result is consistent with the earlier report by Boone and Huston (1963) that high temperature reduces the sperm concentration. The abnormal percentage was not harmfully affected by summer months.

Table 2: Means values of Semen characteristics from White Leghom parent cock as affected by age

Age of cock	Number of cocks	Volume (mL)	Mass motility Score	Sperm concentration (106/mm ³)	Dead sperm (%)	Abnormal sperm (%)
1 year	9	0.22±0.02	3.56±0.06	2.85±0.72 ^a	14.03±0.19 ^a	4.67±0.14 ^a
2 year	7	0.29±0.25	3.17±0.08	2.92±0.85 ^a	15.44±0.23 ^a	5.62±0.16 ^b

Means on the column having different superscripts are significantly different at $p < 0.05$

Table 3: Semen characteristics of White Leghom parent cock as affected by season

Age of cock	Number of cocks	Volume (mL)	Mass motility Score	Sperm concentration (106/mm ³)	Dead sperm (%)	Abnormal sperm (%)
Summer	1 year	0.21±0.03 ^b	3.42±0.08 ^b	2.81±1.03 ^{bc}	16.34±0.31 ^a	4.12±0.20 ^{bc}
	2 year	0.27±0.04 ^a	3.21±0.01 ^b	2.60±1.27 ^b	18.12±0.38 ^a	4.47±0.24 ^c
Winter	1 year	0.23±0.03 ^a	3.69±0.09 ^a	2.90±1.05 ^{bc}	11.60±0.23 ^b	5.20±0.20 ^b
	2 year	0.30±0.03 ^a	3.14±0.11 ^c	3.24±1.21 ^{ac}	12.77±0.27	6.61±0.23 ^a

Means on the column having different superscripts are significantly different at $p < 0.05$

Conclusion: In conclusion, it was evident from the conditions of this experiment that age has a positive effect on sperm concentration and dead sperm percentage. On the other hand, it had a negative effect on sperm motility and abnormal sperm percentage, but still they were in range of acceptable limits. These results confirmed previous records by Haije (1990) and Aviziene and Kriukiene (1977) that advance in age had no negative effect on semen quality.

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