FERTILITY AND DURATION OF FERTILE PERIOD IN BROILER BREEDER HENS INSEMINATED WITH VARIED SEMEN DOSES

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ABSTRACT
One hundred and twenty Marshall broiler breeder hens aged 32 weeks were used to assess the effect of varying insemination doses on egg fertility and duration of fertile period. The hens were randomly allotted into five treatments of twenty four hens each in a completely randomized design. Semen was harvested from 10 cocks, using abdominal message technique, pooled and evaluated for semen quality. Hens in T1 were inseminated with 0.02 mL semen (containing $5x10^6$ motile spermatozoa), hens in T2, T3, and T4 were inseminated with 0.04, 0.06 and 0.08 mL of semen, respectively, while hens on T5 were exposed to natural mating at a ratio of one cock to four hens. Both mating processes were repeated for two successive days. Eggs were collected daily and incubated weekly for four weeks to determine egg fertility as influenced by semen doses and oviductal sperm age. Data were analysed using descriptive statistics and ANOVA at $\alpha_{0.05}$. At the first week, fertility in T1 (94.3±1.9%), T2 (94.5±3.2%), T3 (95.2±1.9%) and T4 (97.1±2.9%) were significantly higher than T5 (76.9±3.0%). Fertility up till 7 days of oviductal sperm age in inseminated hens was above 90%, but reduced to 87.0±4.7% and 74.2±9.3% at days 8 and 9, respectively and declined to zero fertility in day 22. It could be concluded in this study that semen insemination dose of 0.02 mL is lease economic dose with optimum fertility in broiler breeder hens. The maximum duration of fertility period in broiler breeder hens was 21days, while efficiency in fertility reduced after 8days.
Keywords: Artificial insemination, fertile period, insemination dosage, egg fertility

INTRODUCTION
Broiler breeder production is one of the profitable business in Nigeria due to the ban in the importation of frozen chickens. This recent development by the government has led to an increase in the demand of day old chicks for production of broiler chickens.

Interestingly, most broiler breeder farms in Nigeria still widely employ the natural mating system in the production of fertile eggs that will yield day old chicks. This system however, is marred with associated problems which includes transfer of disease from male to female, incomplete successful mating leading to reduced fertility due to body weight gain of cocks during natural mating (Attia *et al*., 1993) and higher number of cock to hen ratio. Also, during natural mating a single cock deposit much more semen than what is needed to fertilize an egg which leads to semen wastage and economic loss at large to farmers.

Fertility is of major concern to broiler breeder farmers. To increase fertility in poultry, adoption of artificial insemination (AI) is of paramount importance since AI is attributed with several advantages compared to natural mating (Penfold *et al* 2000). The merit of A.I among others includes increase in number of settable eggs, best overall fertility and hatchability, thus reducing the cost of production of day old chicks (Brillard, 2003). Artificial insemination has been used in poultry industry in the developed countries (Surai and Wishart 1996), However in Nigeria measures have not been put in place in poultry industry to regulate artificial insemination protocol and practices. Artificial insemination technology in poultry has been hypothesized to lengthen insemination interval with lesser semen dose for insemination (froman *et al.*, 2011). Despite the promising of AI in poultry industry in Nigeria, there still indiscriminate use of semen in broiler chicken breeding programs, thus leading to semen wastage.

This is because the management technology and other useful information on insemination dosage in broiler breeder hens are not readily available to the farmers and even the commercial farmers depend on their past experiences.

Researches that have been carried out on A.I in broiler breeders chickens mostly were in temperate regions which may not be directly adoptable by tropical farmers Burrow and Quinn (1937) reported insemination dose of 0.05 mL of undiluted semen; Dose containing 5.5 $x10^6$ spermatozoa have been reported to increase fertility (Lake and Ravie, 1988). There is therefore dearth of information on

insemination schedule in broiler breeder chickens in Nigeria. Also, proper documentation on insemination schedule particularly on least viable semen dose for optimum fertility under Nigeria condition is lacking. Therefore, this study was aimed at investigating the appropriate semen dosage, for optimal fertility in broiler breeder hens.

MATERIALS AND METHODS

Experimental location

The experiment was conducted at the poultry unit of the Teaching and Research farm and the Animal Physiology Laboratory of the Department of Animal Science, University of Ibadan, Nigeria.

Experimental animal management and semen collection

One hundred and twenty Marshall broiler breeder hens aged 32 weeks were randomly allotted into five treatments (T1-T5) of twenty- four hens each in a completely randomized design. Semen was harvested from 10 cocks, using abdominal message technique (Burrow and Quinn 1937), pooled and evaluated for semen quality.

Insemination, data collection and analysis

Hens in T1 were inseminated with 0.02 mL semen (containing $5x10^6$ motile spermatozoa). Hens in T2, T3, and T4 were inseminated with 0.04, 0.06 and 0.08 mL semen, respectively while hens on T5 were exposed to supervised natural mating at a ratio of one cock to four hens and each hen was allowed to be mated once per day. Both mating processes were repeated for two successive days. Eggs were collected daily and incubated weekly for four weeks to determine egg fertility and duration of fertile period as affected by semen doses and oviductal sperm storage. Analysis was done on square root transformed data using general linear model of SAS (2003) while means where significant were separated using Duncan's Multiple Range Test of the same software.

RESULTS

Spermatozoa characteristics in pooled semen inseminated for the two days are shown in Table 1. Average sperm concentration, liveability and sperm motility were 0.28 $x10^9$ cells/ml, 96.8% and 90%, respectively.

Table 1: Characteristics of pooled semen administered to the hens

Semen parameters	Mean values (± Standard deviation)
Sperm concentration (x 10^9 cells/mL)	0.28±0.13
Liveability (%)	96.8±3.7
Sperm motility (%)	90.0±0.0

Table 2. Shows the effect of different semen insemination dosage and natural mating on fertility of hens. Fertility result for the first week ranges from 94.29±1.91% to 95.17±1.91% in the inseminated groups and was significantly ($p<0.05$) higher than that of the natural mating groups (76.89±2.95%). Fertility in week two and three was not significantly different ($p<0.05$) among the treatments. Though drops to zero in all the treatments at weeks four.

Table 2: Egg fertility (%) in broiler breeder hens inseminated with varied semen doses for four weeks

Weeks after insemination	Semen dose inseminated (mL)				
	0.02 (T1)	0.04 (T2)	0.06 (T3)	0.08 (T4)	Natural mating (T5)
1	94.29±1.91[a]	94.53±3.23[a]	95.17±1.91[a]	95.17±1.91[a]	76.89±2.95[b]
2	66.60±9.01	56.03±4.41	55.17±7.54	47.01±9.32	41.89±8.52
3	15.50±6.32	12.89±4.50	9.37±4.40	10.42±3.79	6.22±2.17
4	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00

[ab] Means of treatments along a row with different superscripts differed significantly ($p<0.05$). SE-standard error.

The duration of fertile period and oviductal spermatozoa age effect on fertility of the inseminated groups of hens are presented in Fig 1. Fertility was at maximum at the first week after insemination with 95.3% but there was a steady and significant drop in fertility on a daily basis to about 25% at 14th day, after which it declined till it finally reached 0% at 22 days.

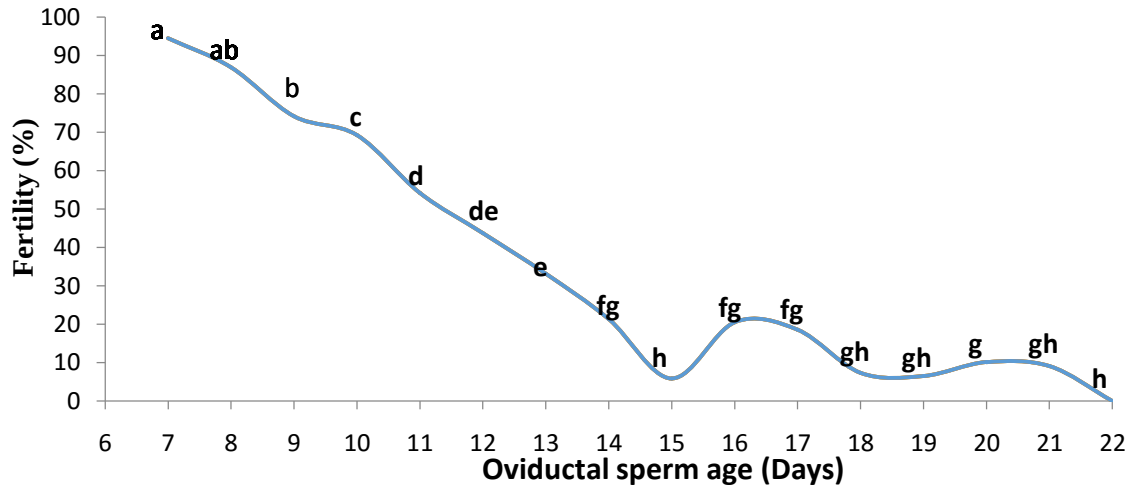

Figure 1: Duration of fertile period in inseminated broiler breeder hens

DISCUSSION

The mean values of sperm concentration observed was 0.28±0.13 ($x10^9$ /ml). The values for sperm concentration was $5.5x10^6$ /ml reported by Lake and Ravie (1988) for breeder cocks. This suggests that the concentration of sperm cells in the semen was high and thus sufficient for the intended purpose. Liu *et al.* (2009) noted that semen quality parameters such as concentration, liveability and morphology are good predictors of the fertilizing ability of sperm cells.

The result of the semen evaluation for 0.02, 0.04, 0.06 and 0.08mL of raw semen contained approximately, 5 $x10^6$, 10 $x10^6$, 15 $x10^6$ and 20 $x10^6$ motile sperm cell respectively. Brillard and Bakst (1990) reported that the length of fertile period in chickens is determined by the number of spermatozoa that enters the sperm storage tubules (SST). This Suggest that an increase in the number of spermatozoa inseminated may maintain a high level of fertility for an extended period. Contrarily, Campton and van krey (1979) suggest that only a finite number of sperm cells are capable of entering the sperm storage tubules within a given period. The suggestion supports the observation from this

study as increasing administration of semen dose across treatment groups did not translate to increase in fertility. Thus, suggesting that insemination dose above 0.02mL (approximately 5 $x10^6$ motile sperm cell) is in excess of the maximum number of spermatozoa which can be accommodated by the SST at a given period.Also, by inseminating a semen dose of 0.02mL would mean that more hens will be inseminated. Semen wastage will be reduced and cost of production will be lowered. The fertility rate of hens on natural mating was observed to be lower throughout the trail compared to the inseminated groups. This could probably be that the volume of semen ejaculated for the two consecutive mating days did not contain enough sperm cells that was sufficient to fill the sperm SST probably due to wastage as a result of inadequate contact during natural mating.

Fertility significantly decreases with increasing oviductal sperm age up to 21 days. However, optimum fertility level was observed in inseminated groups which was obtained within first 7days post-insemination. At days 8 and 9 fertility ranged from 86.98 to 74.1% and slightly decreased to 69.2% at day 10. There was a sharp reduction on day 15 (5.83%) which later increased to (20.52%) at day 16 and subsequently 0% fertility was attained at day 22 post - insemination. This observation was in line with the work of Tabatabaei *et al.,* (2009) where optimum fertility was obtained at days 1 to 7, while fertility drops to zero at day 19 in indigenous chickens and day 17 for Ross chickens. The duration of fertile period in chicken was reported as 21days by Brillard (1993); while Bramwell (2002) reported 22 days for broiler breeder hens which corroborated this finding in the tropics.

CONCLUSION AND RECOMMENDATION

In the adoption of artificial insemination in broiler breeder hen, Semen insemination dose of 0.02mL containing $5x10^6$ motile spermatozoa is recommended as an economic dose using undiluted semen. The duration of fertile period in broiler breeder hens is 21days while efficiency in fertility reduces after 8 days.

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