

STUDIES ON CERTAIN BIOPHYSICAL ATTRIBUTES OF GRAMAPRIYA HYBRID COCK SEMEN

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114 semen samples of commercial dual purpose Gramapriya hybrid cock collected twice daily for ten weeks period by abdominal massage method were evaluated for physical and morphological characteristics. The ejaculate volume averaged to 0.39 ± 0.02 ml, while sperm concentration and total sperm count $2.49 \pm 0.03 \times 10^6$ / ml and $0.98 \pm 0.04 \times 10^9$ / ejaculate, respectively. The individual motility, live spermatozoa and morphological abnormal spermatozoa were 84.01 ± 0.04 , 91.01 ± 0.29 and 6.58 ± 0.22 per cent whereas mass motility graded to 3.95 ± 0.03 scale. The pH of semen tended to be alkaline 7.41 ± 0.01 . The correlation of certain physical characteristics was highly significant ($P < 0.01$) except the pH and the spermatozoa which differed at 5 percent level. The mass motility of the spermatozoa was decreased with increasing the pH and abnormal spermatozoa in semen. This is the first study which was proved some basic information about biophysical attributes of dual purpose Gramapriya hybrid cocks semen when compared with other exotic cocks.

Key words: Gramapriya Hybrid Cock, semen

The reproductive potential of best cocks has been optimized for rapid improvement of fertility following introduction of artificial insemination in poultry flocks. For this purpose the cock semen has been studied intensively for its morphological and biochemical attributes of native and exotic breeds (Singh *et al.*, 1985, Shukla and Tomar, 1987, Kundu and Panda, 1990, Nayak *et al.*, 1990 and Ajayi, *et al.*, 2011).

In the recent past, the project directorate on poultry has developed a new hybrid layer strain “Gramapriya” from Dahlen Red as female line. The information on various aspects of semen of Gramapriya strain is meager; therefore, the present investigation was undertaken with an idea to envisage a suitable artificial insemination (AI) protocol for the poultry farmers

MATERIALS AND METHODS

Six Gramapriya hybrid cocks of 38 weeks age maintained at the poultry demonstration unit, Dept. of Livestock Production and management were selected for the present study. Cocks were kept separately in California layer cages of Three Tier Housing system, fed *ad-libitum* with layer mash and water. Each cock was subjected to semen collection twice daily by abdominal massage method (Donoghue and Wishart, 2000).

A total of 114 semen samples were obtained in the morning hours (8 to 9 hrs) during the period of 4 months from November 2008 to February 2009. All ejaculates were evaluated for physical and morphological characteristics such as volume, color/appearance score, consistency (Mc Daniel and Craig, 1960), pH (Merck Specialties Private Ltd. India), mass motility (Herman and Madden, 1953), individual motility, sperm concentration (Tomar, 1984) and total spermatozoa count (Hafez, 1987). Differential staining technique described by Singh *et al.*, (1985) was used to determine the number of live and dead spermatozoa. The spermatozoon abnormalities were classified according to Alkan *et al.*, (2002). Data were analyzed statistically and correlation matrix for various seminal

characteristics was worked out (Snedecor and Cochran, 1994). Experiments were carried out in accordance with the Guidelines laid down by Institutional ethics committee and in accordance with local laws and regulations.

RESULTS AND DISCUSSION

The data pertained to various biophysical characteristics of gramapriya hybrid cock semen are presented in Table-1. The ejaculate volume was found to be 0.39 ± 0.102 ml which is in close agreement with findings of other strains of cock: White Leg Horn (Kundu and Panda, 1990), Rhode Island Red (Singh *et al.* 1985 and Kabir *et al.* 2007), Local cocks of Nigeria (Ezekwe *et al.* 2003), Gerke cocks (Tuncer *et al.* 2008) and Potchefstroom Koekoek (Makhafola *et al.* 2012). However, variations in ejaculate volume either higher or lower than the present findings have been reported by other workers. Higher ejaculate volume in Red Cornish (Nayak *et al.* 1990), White crested black polish cocks (Siudzinska and Lukaszewicz, 2008), Local cocks of Nigeria (Bah *et al.* 2001), White Leg Horn lines (Niranjan *et al.* 2001), Potchefstroom Koekoek (Molekwa and Umesiobi, 2009) and Nigeria indigenous cocks (Ajayi, *et al.* 2011). Whereas lower ejaculate volume in Denizli cock (Tuncer *et al.* 2006) and White Leghorn cocks (Sevine *et al.* 1983 and Elagib, *et al.*

2012) have been reported. Such variations might be attributed to breed, age, weight of cocks beside method of semen collection, season and testicular size of cocks (Podgorny *et al.* 1976, Machebe and Ezekwe, 2002, Tabatabaei, *et al.* 2010 and Elagib, *et al.* 2012.). While collecting the semen, the transparent fluid was avoided and funnel was kept abstained from the body of cock which might be an additional factor for low volume of semen in the present study. Niranjan *et al.* (2001) also observed the variation in ejaculate volume due to such method of semen collection.

The average mass motility of 3.98 ± 0.03 was discernible for colour/appearance score of semen in our study which is in close agreement with the findings of Niranjan *et al.* (2001) in both IWH and IWI lines of White Leghorn cock. Lower score in RIR (McDaniel and Craig, 1962, Kabir *et al.* 2007), WLH (McDaniel and Craig, 1962 and Kundu and Panda, 1990) and Broiler breeder cocks (Bratte, *et al.* 2011), while higher score in RIR cockerels (Singh *et al.* 1985) have also been reported earlier. Colour variations in semen might be attributed partly to either the presence of contaminants (Etches, 1996) or low sperm concentration as the higher Colour score correlated negatively with total sperm count ($r = -0.361$) in the present study.

Table- 1: Biophysical attributes of Gramapriya hybrid cock semen.

Physical attributes	Mean \pm S.E.	Range
Ejaculate volume (ml)	0.39 ± 0.02	0.1 – 1.2
Colour/appearance score	3.98 ± 0.03	3.0 – 4.5
pH	7.42 ± 0.01	7.2 – 7.6
Mass motility	3.95 ± 0.03	3.0 – 4.5
Individual motility (%)	84.01 ± 0.04	70 - 95
Spermatozoa concentration ($\times 10^9$ /ml)	2.49 ± 0.03	1.67 – 2.98
Total spermatozoa count ($\times 10^9$ /ejaculate)	0.98 ± 0.04	0.197 – 2.85
Live spermatozoa count (%)	91.01 ± 0.29	80.50 – 97.36
Abnormal spermatozoa count (%)	6.58 ± 0.22	3.18 – 10.71

The hydrogen ion concentration (pH) tended to be slightly alkaline (7.42 ± 0.01) with a range of 7.2 to 7.6 in the present study. Almost similar findings have been documented by Dube *et al.* (1977), Bah *et al.* (2001) and Siudzinska and Lukaszewicz,

(2008) and lower semen pH was reported by Mokhafola *et al.* (2012) in Necked neck cockerels. Although variations in hydrogen ion concentration on either side of isotonic level also exist in literature in other breeds and strains of cock, reported to be higher

(Shukla and Tomar, 1987, Tuncer *et al.* 2006 and Tuncer *et al.* 2008) and lower (Kundu and Panda, 1990, Sevine *et al.* 1983, Peters *et al.* 2008 and Ajayi, *et al.* 2011).

The finding of mass motility was in accordance with the findings of Kundu and Panda (1990) and Elagib *et al.* (2012) in White Leghorn cocks whereas, it differed from Rhode Island Red (Singh *et al.* 1985). However, lower scores have been reported by McDaniel and Craig (1962) in Rhode Island Red and Kundu and Panda (1990) in White Leghorn. Podgorny *et al.* (1976) studied the influence of breed and season on gross motility which was highest in summer for White Rock and in winter for White Cornish breed.

The individual motility of 84.01 ± 0.04 per cent with a range of 70 to 95 per cent was discernible in our study which is comparable to findings of earlier workers in different breeds and strains of cocks (Dube *et al.* 1977, Shukla and Tomar, 1987, Molekwa and Umesiobi, 2009 and Tabatabaei *et al.* 2009). However, in comparison to present findings other workers have reported either lower (Sevine *et al.* 1983, EL Sahn *et al.* 2003, Siudzinska and Lukaszewicz, 2008, Peters *et al.* 2008 and Ajayi, *et al.* 2011) or higher (Mohan *et al.* 1991 and Singh *et al.* 2007) values in different breeds, strains and also in Deshi cocks.

The mean sperm concentration ($2.49 + 0.03 \times 10^9$ /ml) was in accordance with those reported in Local cocks of Nigeria (Bah *et al.* 2001), Naked Neck, Frizzle and Normal genotypes (Machebe and Ezekwe, 2002), Gimmizah (G) and Silver Montazah strains (EL Sahn *et al.* 2003), Denizli (Tuncer *et al.* 2006), Deshi (Singh *et al.* 2007) and in Gerze (Siudzinska and Lukaszewicz, 2008) cocks. But it differed from findings of other works who reported sperm concentration either lower or higher in different breeds of cocks. Such variations seem to be obvious as the production of spermatozoa is highly specific trait and is influenced greatly by breed of cock and season (Kundu and Panda, 1990), method of semen collection (Niranjan *et al.* 2001), photoperiod, body weight and age of birds, amount of watery fluid from phallus (Podgorny *et al.* 1976) and testicular size (Machebe and Ezekwe, 2002).

The present observation of total number of spermatozoa $0.98 \pm 0.04 \times 10^9$ /ejaculate and live spermatozoa 91.01 ± 0.29 per cent as depicted in Figure -1 are in accordance with those reported in White leg horn cocks (Shukla and Tomar, 1987 and Kundu and Panda, 1990). IWH and IWI lines of White Leg Horn (Niranjan *et al.* 2001), Deshi cocks and indigenous broiler cocks (Singh *et al.* 2007 and Tabatabaei *et al.* 2009) have also been reported to have similar value of these two traits.

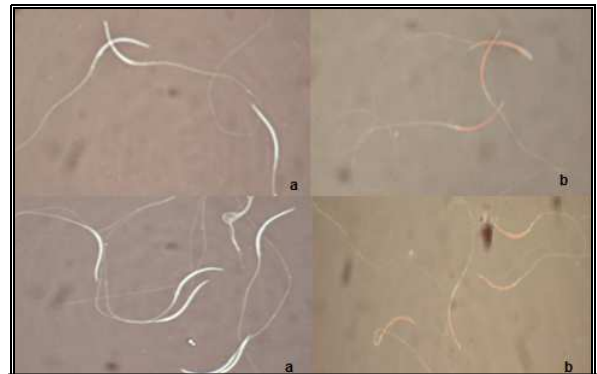


Fig - 1: Live (a) and Dead (b) spermatozoa after differential straining of Gramapriya hybrid cock semen

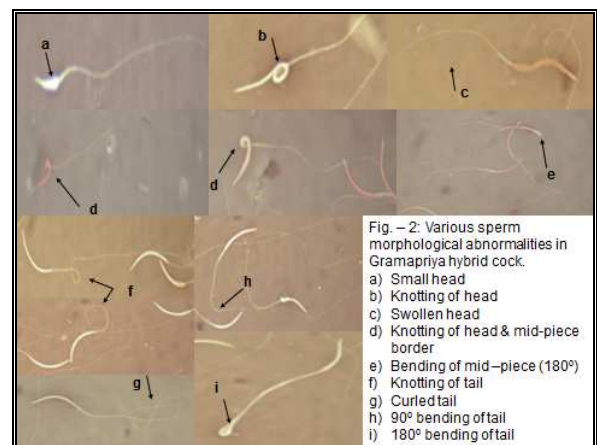


Fig - 2: Various sperm morphological abnormalities in Gramapriya hybrid cock.
 a) Small head
 b) Knotting of head
 c) Swollen head
 d) Knotting of head & mid-piece border
 e) Bending of mid-piece (180°)
 f) Knotting of tail
 g) Curled tail
 h) 90° bending of tail
 i) 180° bending of tail

On the other hand, abnormal spermatozoa ($6.58 + 0.22$ per cent) with the range of 3.18 to 10.71 per cent were similar to WLH (Shukla and Tomar, 1987), Denizli (Tuncer *et al.* 2006), local breeds of Nigeria (Bah *et al.* 2001), Gerze (Tuncer *et al.* 2008) whereas it contradict to findings of Dube *et al.* (1977), Elagib *et al.* (2012), Kabir *et al.* (2007), Tabatabaei *et al.* (2009 and 2010) and Ajayi *et al.* (2011) in WLH, RIR, Ross-308 Roosters and Nigeria indigenous cocks. The various abnormalities of head, mid piece and tail are shown (Fig. 2). Among these tail abnormalities (4.54 ± 0.22) were apparently abundant.

Table -2 presents the correlations of seminal characteristics. The finding revealed the positive relationship of individual motility with sperm concentration (+0.459) and mass motility with individual motility (+0.402), PH with abnormal spermatozoa (+0.431), ejaculate volume with total sperm count (+0.952). These findings suggested that increased individual motility was concomitant

with concentration and mass motility of spermatozoa and higher PH was associated with increased abnormal spermatozoa count. Kundu and Panda (1990), Peters *et al.* (2008) and Bah *et al.* (2001) have also reported a positive correlation of ejaculate volume with total sperm count, individual motility and sperm concentration as observed in the present study.

Table- 2 : Correlation matrix of Biophysical attributes of Gramapriya hybrid cock semen

	Volume	Colour/appearance score	pH	Mass Motility	Individual motility	Sperm concentration	Total sperm count	Live sperm count	Abnormal sperm count
Volume	1								
Colour /appearance score	-0.357**	1							
pH	0.0203	-0.116	1						
Mass Motility	0.139	0.092	-0.267**	1					
Individual motility	-0.026	-0.052	-0.174	0.402**	1				
Sperm concentration	-0.180	0.042	-0.126	0.152	0.459**	1			
Total sperm count	0.952**	-	-0.007	0.173	0.081	0.106	1		
Live sperm count	-0.113	0.157	0.214*	-0.121	-0.363**	-0.139	-0.163	1	
Abnormal sperm count	0.096	-0.096	0.431**	-0.563**	-0.251**	-0.088	0.067	0.032	1

** Highly significant (P <0.01)

* Significant (P <0.05)

On the other hand negative correlations of mass motility with pH and abnormal spermatozoa (-0.267), Colour/appearance score with volume and total sperm count (-0.357), abnormal spermatozoa with mass motility (-0.563) and individual motility (-0.251) were found to be highly significant (P<0.01) except the pH and live spermatozoa which were interrelated at 5 per cent level. Earlier workers also reported similar findings of significant negative correlation of mass motility with abnormal spermatozoa (Johari, *et al.* 1986 and Bah *et al.* 2001). Johari *et al.* (1986) reported that sperm concentration was significantly and negatively correlated with appearance score.

CONCLUSIONS

In conclusion, this is the first study which was proved some basic information about

semen collection procedure and biophysical attributes of dual purpose Gramapriya hybrid cocks semen, so we couldn't compare the data same breed cocks that compared data on other breed and strain cocks. The semen from the Gramapriya hybrid cocks had comparable results to that of exotics breed, strains and indigenous cocks after laboratory examination. This means they can compete favourably with the exotics in an A.I program. It will also help us do further research on freezing of Gramapriya hybrid cock's semen and artificial insemination studies with frozen semen. There was a positive correlation between individual motility and sperm concentration and between abnormal spermatozoa and pH. The mass motility of the spermatozoa was decrease with increasing the pH and abnormal spermatozoa. This research was to help other

experiments about the principal physical and morphological attributes of Gramapriya hybrid cocks by revealing their in vitro outcomes.

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