

REACTION TIME, SEMEN OUTPUT AND SEMEN QUALITY OF BUFFALO BULLS AFTER PRE-COLLECTION INJECTION OF PROSTAGLANDIN F₂ ALPHA (PGF₂ ALPHA)

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Summary

A study was conducted to determine the effect of prostaglandin F₂ alpha (PGF₂ alpha) on the reaction time and seminal characteristics of buffalo bulls. Semen was collected from three Murrah bulls in three periods: pre-treatment, treatment and post-treatment. During the treatment period each bull was administered 2 ml PGF₂ alpha (Synchrocept, Fenprostalene) im, 1 hour prior to semen collection. In the post-treatment, semen was collected 7 days after the last injection of PG. Semen samples were evaluated immediately after collection. Pre-collection injection of PGF₂ alpha has no significant effect on reaction time, semen volume, percentage motility, sperm concentration and total number of sperms per ejaculate. Fluctuations in semen color and consistency were observed. There is a significant ($p < 0.05$) increase in the mean percentage of normal spermatozoa during the treatment and post treatment periods. Likewise, administration of PG results into a significant ($p < 0.05$) rise on the average percentage of live sperms but this effect was not manifested in the post-treatment period. Improvement in mass activity was observed during the treatment and post-treatment periods.

(Key Words: Buffalo Bulls, Semen Quantity and Quality, Prostaglandin)

Introduction

The history of prostaglandins (PG) began when Kurzrock and Lieb in 1930 observed that the uterus reacted to human seminal plasma by contracting. This finding has been carefully developed with the ultimate isolation of PG from the seminal fluid, cervical fluid, uterus and other tissues of the body, and with measurements, attempting to relate levels of PG to animal reproduction and other biological activities. A good number of literatures has accumulated which clearly established the role of PG in female reproduction viz: sperm transport in the female reproductive tract, spontaneous abortion and labor, ovulation, luteolysis and postpartum uterine involution.

Today, PG have assumed considerable importance in female reproduction, as prostaglandin F₂ alpha (PGF₂ alpha) has shown to be an effective synchronizing agent in farm animals due to its luteolytic action. Most artificial insemination (AI)

programmes involve the pre-insemination administration of PGF₂ alpha to bring more number of animals into estrus. In so doing, more animals can be inseminated at a pre-determined time and in effect, other farm activities can be scheduled on desired time.

In contrast, little is known about the physiological role of PG in the male. Although it has been shown that the seminal fluid is one of the richest known mammalian sources of PG, very few studies have been conducted to relate the levels of PG, endogenous or exogenous, in male reproduction. Some experiments have shown that exogenous PG influence the process of erection and ejaculation (Hargrove et al., 1971; Karim and Hillier, 1975), sperm transport in the male reproductive tract (Goldberg and Ramwell, 1975; Hafs et al., 1974), sperm motility (Goldberg and Ramwell, 1975) and testosterone biosynthesis (Ellis and Hargrove, 1977).

This experiment was conducted to determine the effect of PGF₂ alpha on the reaction time and some seminal characteristics of buffalo bulls viz: color and consistency of the semen, semen volume, sperm motility, mass activity, sperm concentration, percentage of live spermatozoa and percentage of normal spermatozoa.

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Materials and Methods

Preparation of Experimental Bulls

Three Murrah bulls were used in this experiment. They were cleaned prior to semen collection in order to avoid contamination of the semen. Bulls were restrained for a few minutes before they were allowed to serve the artificial vagina.

It is also of importance to maintain sex drive at a level where bulls will continue to work on a routine semen collection scheduled one or more ejaculations per week. Hence, teaser animals were changed as needed.

Administration of PGF₂ alpha and Semen Collection

Semen collections were done in three different periods: pre-treatment (control), treatment and post-treatment period. To establish a standard figure for the pre-treatment periods, semen was collected and tested for any variation. During the treatment period, each bull was administered 2 ml (1.0 mg) PGF₂ alpha (Synchrocept, Fenprostalene) intramuscularly, 1 hour prior to semen collection. The collection was done twice a week from 6:00 to 7:00 in the morning. In the post-treatment period, semen was collected 7 days after the last injection of prostaglandin. Ten (10) collections were obtained per bull in each period. The samples were evaluated for color and consistency, volume, motility, concentration of sperm cells, mass activity, and percentage of live and normal sperms. Reaction time was noted with aid of a stop watch. Reaction time is the time taken by a breeding bull for ejaculation, after it is brought to female in heat in case of natural mating or to dummy, in case of semen collection in artificial vagina.

Statistical Analysis

The data were analyzed statistically using the analysis of variance technique (ANOVA) in a randomized complete block design (with sub-sampling) as explained by Gomez and Gomez (1976).

Results and Discussion

A. Color, consistency and mass activity

There is a good number of slightly creamy and thick creamy semen during the treatment period but the post-treatment period has the highest

frequency of creamy ones. Higher number of desirable color and consistency were observed during the treatment and post-treatment periods (figure 1 and 2). Although Herrick and Self (1962) believed that the color depends upon the concentration of the sperm, Singh (1962) reported that there is no practical importance in its evaluation. This holds true for consistency.

Samples collected during treatment and post-treatment periods were characterized by vigorous and excellent movement of sperms. Samples obtained during pre-treatment period was rich in number of sperms with slight and increasing movement (figure 3). Although mass activity was rated based on the nature and movement of waves which was greatly dependent on the concentration of spermatozoa, it is highly possible that it is also dependent on the number or the percentage of the live spermatozoa. This is based on the fact that higher sperm concentration is of no value if there is a large number of dead ones.

B. Reaction time, semen volume, sperm concentration, percentage of live sperms, percentage of normal sperms and motility

Table 1 shows the comparison of the average

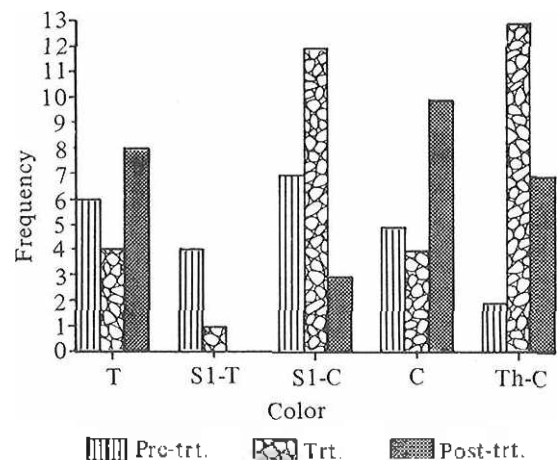


Figure 1. Pre-treatment, treatment and post-treatment frequency distribution of color.

- T = transparent
- S1-T = slightly transparent
- S1-C = slightly creamy
- C = creamy
- Th-C = thick creamy

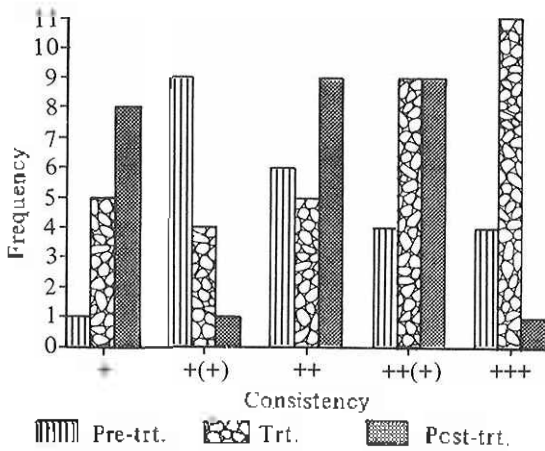


Figure 2. Pre-treatment, treatment and post-treatment frequency distribution of consistency.

- + = watery, easily flows through the collecting tube when tilted
- +() = almost watery
- ++ = thin
- ++(+) = thick
- +++ = very thick, with strong coherence

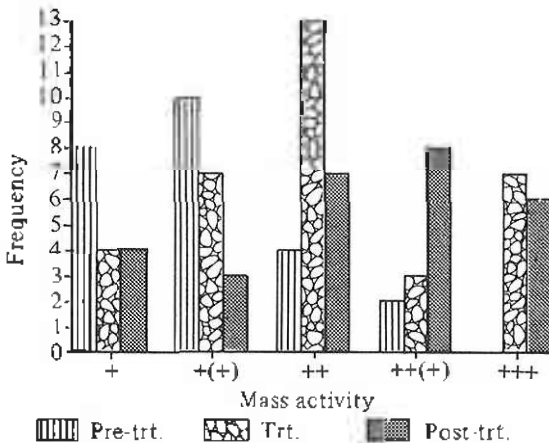


Figure 3. Pre-treatment, treatment and post-treatment frequency distribution of mass activity.

- + = with slight movement. Individual sperms do not move out of the field
- +() = increasing progressive movement
- ++ = no swirls formed but have excellent progressive movement
- ++(+) = have swirls and exhibit good movement
- +++ = have vigorous movement, vigorous swirls are present

values for reaction time and various seminal characteristics. Pre-collection injection of PGF₂ alpha has no significant effect on reaction time, semen volume, sperm concentration and total number of sperms per ejaculate of buffalo bulls. There was a rise in the number of sperms during the treatment and post-treatment periods but the difference is not significant. However, there was a significant ($p < 0.05$) increase in the mean percentage of normal sperms from the pre-treatment (51.64%) to the treatment (76.60%) and post-treatment (70.25%) periods. Likewise, there was a significant ($p < 0.05$) rise in the average percentage of live sperms from the pre-treatment (77.77%) to treatment period (92.98%). The effect however, did not persist as evidenced by the significant decrease in percentage livability during the post-treatment period (76.73%).

Exogenous prostaglandin possibly promotes the longevity of the sperms as evidenced by the significant increase in the percentage of live sperms after pre-collection injection of PGF₂ alpha.

Mean percentage motility was estimated to be 43.19% at pre-treatment, 45.46% at treatment and 49.06% at post-treatment periods. The ANOVA revealed significant differences among treatment periods and among bulls ($p < 0.05$). Treatment and bull interaction was however not significant. Least squares estimates showed significant variation between the pre-treatment and post-treatment periods. The results of the present work suggest that the significant improvement in sperm motility is probably a delayed response to exogenous prostaglandin since it was manifested only during the post-treatment period.

The clinical use of PGF₂ alpha in male farm animals is relatively a recent development. The administration of PGF₂ alpha has been shown to raise the plasma levels of interstitial cell stimulating hormone (Kisser et al., 1976), testosterone (Haynes et al., 1975) and prolactin (Hafs, 1975) in bulls. Elevated concentrations of spermatozoa after pre-collection injection of PGF₂ alpha has been reported in the bull (Marshall and Hafs, 1976), in the stallion (Cornwell et al., 1974) and in ram (Singh and Pant, 1981). Shankar et al. (1982) found a reduction in reaction time, an increase in the volume of semen and in the percentage of live sperms in the semen samples of Murrah buffalo bulls following pre-collection administration of PGF₂ alpha.

TABLE 1. COMPARISON OF MEAN VALUES OF DIFFERENT PARAMETERS

Parameter	Pre-treatment	Treatment	Post-treatment
Reaction time (sec)	29.79 ^a	45.11 ^a	38.38 ^a
Semen volume (ml)	3.07 ^a	2.71 ^a	2.54 ^a
Sperm concentration (million/ml)	694 ^a	988 ^a	1,012 ^a
Total number of sperms per ejaculate (million)	2,130.58 ^a	2,677.48 ^a	2,570.48 ^a
Live sperms (%)	77.77 ^a	92.98 ^b	76.73 ^a
Normal sperms (%)	51.64 ^a	76.60 ^b	70.25 ^b
Motility (%)	43.19 ^a	45.46 ^{ab}	49.06 ^b

a,bMeans with the same superscripts are not significantly different.

Knowledge concerning the physiological role of PG on the bull reproduction is still wanting. Incriminating evidences though suggest varied actions of PG on the male reproductive tract which may be direct or indirect. The indirect effects could occur through the pituitary-hypothalamic axis, increasing or decreasing ICSH secretion and through the mediated action of neurotransmitters, e.g. norepinephrine. Direct effects would likely include alterations on steroidogenic mechanism and the local effects on the contractility of the luminal musculature of the male reproductive tract.

It may be worthwhile to conduct further studies to include the monitoring of alterations in the levels of different hormones aimed at further shedding light on the beneficial effects of prostaglandin in the male reproduction.

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