# EFFECT OF DIFFERENT COLOURS AND DURATION ON SPERM VIABILITY OF WEST AFRICAN DWARF RAM SEMEN

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**ABSTRACT**
*This study was conducted to evaluate the effect of different light colours and duration on sperm viability of West African dwarf ram. A total of six West African dwarf rams were used for the experiment. The animals were reared under a semi-intensive management and fed with concentrates and Panicum maximum, with water given ad libitum. Semen was collected using an artificial vagina using a doe as a teaser. The collected semen were pooled together and divided into 5 graduated Eppendorf tube (2mL), placed in a box of 36.5cm x 31cm x 26cm (L × B × H). The light source was a 10w bulb of different colours which were positioned 20cm above the semen sample. With 0 hours as the control, the semen sample was exposed to light for 0, 1, 2, 3, and 4 hours. The motility, livability, acrosome integrity, membrane integrity and abnormalities were evaluated. The results showed that different light colours have significant ($p<0.05$) effect on sperm livability and abnormality but not significant ($p>0.05$) in motility, acrosome and membrane integrity. Duration was observed to be significantly higher ($p<0.05$) in motility, livability, acrosome and membrane integrity but decreased after 2 hours. In conclusion, different light colours have no detrimental effect on sperm quality and semen collected and intended to be used for artificial insemination should be used at most within 2 hours of collection.*
**Keywords: Semen, ram, light colours, light duration and sperm viability**

## INTRODUCTION

Over time, methods and techniques for processing semen have helped to improve artificial insemination The use of this technology in animals has raised interest in improving semen processing techniques to improve the chances of survival and reproduction for the animals (Catalán *et al.,* 2020). However, cryo-damage to cells (Pegg, 2009) is a major constraint of cryopreservation because of consequent decline in sperm viability. In this regard, research conducted on different species has demonstrated that stimulating semen with red light prior to artificial insemination can somewhat improve reproductive effectiveness (Yeste *et al.,* 2016). However, sperm response to light depends on factors, such as species, nature of semen (i.e., fresh, frozen), wavelength range, extender used and colour of light (Catalán *et al.,* 2021).

Research has additionally demonstrated that exposure to red light enhance sperm motility, livability and functional integrity which may directly affect reproductive success in animals like; birds, fishes and mammals ( Yeste *et al.,* 2018).

In spite of all the aforementioned, the effects of different light colours have not being extensively studied on animal semen. Thus, the goal of the current study was to assess how various light colors would influence or increase the quality of the semen produced by West African dwarf rams.

## MATERIALS AND METHODS

### Experimental site

The experiment was conducted at the Ruminant Unit, College of Animal Science and Livestock Production (COLANIM) Farm, Federal University of Agriculture, Abeokuta, Nigeria. The University is situated on latitude 7°10′ N, longitude 3°2′ E and altitude of 76m above sea level (Google Earth, 2019).

### Experimental animals and management

For the experiment, six fully grown West African dwarf rams, weighing an average of 65 kg, between two and three years of age, were used. The animals were raised in a semi-intensive setting using

concentrates and *Panicum maxima* as their feed sources, and unlimited access to water. Daily routine management, biosecurity measures and medication were strictly observed in the course of the research.

**Composition and Preparation of Extender**

Tri based extender consisting of Tris-hydroxymethyl-aminomethane (2.42g), citric acid (1.35g), penicillin (0.028g), glucose (1g), 20mL egg yolk and distilled water (80mL) were mixed to make it up to 100mL used for the experiment

**Semen collection and dilution**

Semen was collected using an artificial vagina. The lubrication of the inner sleeve was done using a white Vaseline. The semen was mixed with an already prepared extender and the sample kept in a thermo flask at 37°C and transportation to the laboratory for evaluation for evaluation.

**Incubation Process**

The collected semen were pooled together and divided into 5 graduated Eppendorf tube (2mL), placed in a box of 36.5cm x 31cm x 26cm (L × B × H). The light source was a 10w bulb of different colours. This colours includes red, green, yellow, blue, white and dark which is the control. Which were placed 20cm above the semen sample. The semen sample was exposed to light except the control for 0, 1, 2, 3 and 4hr. All extraneous light were omitted.

**Semen evaluation**

The semen sample from each hour was withdrawn from the box and evaluated. Sperm motility and livability were evaluated as described by Bearden and Fuquay (1997), sperm membrane integrity by Correa *et al.* (1997) and acrosome integrity by Ahmad *et al.* (2014) at 0, 1, 2, 3 and 4hr.

**Statistical Analysis and model**

Data collected was analyzed using two-way analysis of variance (ANOVA) for a completely randomized design using a statistical package SPSS 2010. Treatments means were separated using Duncan multiple Range Test (Duncan, 1955).

**RESULTS**

Table 1, showed that the effect of different lights colors on sperm viability of ram semen. The result showed no significant ($p>0.05$) percentage on sperm viability, acrosome integrity and membrane integrity in ram semen exposed to different light colors. However, higher ($p<0.05$) percentage livability were observed in ram semen exposed to red and white colors compared to other colours and the dark which is the control. Lower ($p<0.05$) percentage abnormality was observed in ram semen exposed to green color compared to other colors.

Table 2, show the effect of duration on sperm viability of ram semen. The result showed, motility, livability, Acrosome and membrane integrity were highly significant ($p<0.05$) at durations and no significant difference ($p>0.05$) in abnormality.

**Table 1. Effect of different light colours on sperm viability if ram semen**

| LIGHT | MOT (%) | ACRO (%) | MEM (%) | LIV (%) | ABN (%) |
|---|---|---|---|---|---|
| DARK | $65.80 \pm 2.36^{b}$ | $71.60 \pm 2.82^{a}$ | $47.60 \pm 3.02^{c}$ | $67.29 \pm 3.70^{b}$ | $0.67 \pm 0.07^{d}$ |
| WHITE | $66.00 \pm 2.93^{b}$ | $65.00 \pm 2.54^{b}$ | $44.20 \pm 3.50^{c}$ | $72.90 \pm 3.09^{a}$ | $0.76 \pm 0.08^{d}$ |
| RED | $65.00 \pm 2.10^{b}$ | $63.60 \pm 3.37^{b}$ | $39.20 \pm 4.01^{c}$ | $76.22 \pm 2.71^{a}$ | $0.69 \pm 0.09^{d}$ |
| GREEN | $64.20 \pm 3.60^{ab}$ | $68.40 \pm 3.15^{a}$ | $46.80 \pm 2.09^{b}$ | $66.92 \pm 2.96^{a}$ | $0.41 \pm 0.05^{c}$ |
| BLUE | $63.80 \pm 2.77^{ab}$ | $64.60 \pm 3.18^{ab}$ | $46.20 \pm 2.83^{b}$ | $67.88 \pm 2.80^{a}$ | $0.68 \pm 0.08^{c}$ |
| YELLOW | $58.60 \pm 3.64^{b}$ | $66.20 \pm 3.76^{a}$ | $49.40 \pm 3.25^{c}$ | $69.78 \pm 3.33^{a}$ | $0.59 \pm 0.09^{d}$ |
| P Value | 0.511 | 0.494 | 0.282 | 0.033 | 0.041 |

$^{a, b, bc, c, d}$ values within row with different superscripts differ significantly ($p<0.05$)

**Table 2. Effect of light duration on sperm viability of ram semen**

| DURATION | MOT (%) | ACRO (%) | MEM (%) | LIV (%) | ABN (%) |
|---|---|---|---|---|---|
| 0 | $80.17 \pm 1.72^{a}$ | $84.67 \pm 1.38$ | $72.67 \pm 1.70^{ab}$ | $85.05 \pm 3.40^{a}$ | $0.67 \pm 0.07^{c}$ |
| 1 | $61.67 \pm 1.35^{b}$ | $63.83 \pm 2.10^{b}$ | $49.67 \pm 1.90^{c}$ | $72.95 \pm 2.93^{a}$ | $0.51 \pm 0.05^{d}$ |
| 2 | $66.50 \pm 1.32^{b}$ | $79.83 \pm 2.27^{a}$ | $48.67 \pm 2.45^{c}$ | $68.18 \pm 2.96^{b}$ | $0.58 \pm 0.07^{d}$ |
| 3 | $45.67 \pm 2.65^{c}$ | $60.67 \pm 2.53^{b}$ | $24.33 \pm 1.82^{d}$ | $73.20 \pm 2.03^{a}$ | $0.71 \pm 0.08^{e}$ |
| 4 | $58.17 \pm 2.42^{b}$ | $39.17 \pm 1.94^{c}$ | $34.00 \pm 1.77^{c}$ | $72.47 \pm 2.79^{a}$ | $0.63 \pm 0.09^{d}$ |
| P value | 0.000 | 0.000 | 0.000 | 0.000 | 0.261 |

$^{a, ab, b, c, d, e}$ values within row with different superscripts differ significantly ($p<0.05$)

## DISCUSSION

The ability to transport the male nuclear material to the oocytes during fertilization makes motility the most crucial characteristic of mammalian sperm. The sperm tail is the primary organelle associated with sperm motility, as spermatozoa need to be motile to swim up to the egg (Corral *et al.,* 2005). Studies reveals that different light color was found to modify some sperm motion variables and increase mitochondrial membrane potential of ram sperm without affecting the motility and the integrity of the plasma membrane and acrosome. However, these effects varied with the color of the light intensity on livability and abnormality of the sperm. The percentage viability and motility of ram semen was shown to be unaffected by the light color. Which is consistent with evidence from Corral *et al.* (2005) showing no discernible impact of a 655-nm diode laser on dog sperm motility. On the other hand, recent research discovered that exposing sperm to red light improves both total and progressive motility in sheep (Mosca *et al.,* 2016) and humans (Ban *et al.,* 2015). Various light colors on the sperm membrane and acrosome integrity; none of the colors used on the semen sample in the present study differed significantly from the others. These outcomes were comparable to those published in studies on pigs by Pezo *et al*., 2019 and Blanco-Prieto *et al*., 2020, in horses and donkeys by Catalán *et al.,* 2020, and in rabbits by Laffaldano *at al.,* 2010. The selection of viable spermatozoa can be facilitated by the integrity of the acrosome and membrane.

In this study, acrosome integrity had a similar effect with the control at two hours, demonstrating the spermatozoa's capacity for fertilization and capacitation at this time. This finding suggests that semen's functional integrity declines with processing time, which is consistent with findings from studies by Kasimanickam *et al.* (2007) and Gundogan, (2009).

## CONCLUSION

Prior studies have indicated that semen shouldn't be exposed to light after collection; however, this investigation revealed that the quality of semen exposed to various light colours was preserved and that light had no negative effects on the quality of sperm. Furthermore, semen should be used no later than two hours after collecting if it is to be used in artificial insemination.

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