*J. Vet. Malaysia (1995) 7(2):29-31*

# SEMEN QUALITY AND SPERM CHARACTERISTICS OF MAFRIWAL CROSSBRED CATTLE OF DIFFERENT FRIESIAN BLOOD LEVEL

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## SUMMARY

Four different Friesian blood levels of Mafriwal bulls were used in this study, namely M25 (25% Friesian blood level), M50 (50% Friesian blood level), M62.5 (62.5% Friesian blood level) and M75 (75% Friesian blood level). The results showed that the semen quality and sperm characteristics were not significantly dependent upon the Friesian blood level. However, volume had a tendency to increase with the increased Friesian blood level whereas concentration was decreased in crossbreds with increased Friesian blood level.

Keywords: Semen quality, sperm characteristics, crossbred cattle, Mafriwal.

## INTRODUCTION

There are some crossbred/synthetic breeds that have become established today, namely (a) the Jamaica Hope which consists of Jersey (80%), Friesian (5%) and Sahiwal (15%) blood, (b) the Australian Milking Zebu (AMZ), which was derived mainly from crosses between Jersey and Sahiwal, and has between 50 to 62.5% Jersey blood and (c) the Australian Friesian Sahiwal, which is a taurindicus breed with 50% Friesian and 50% Sahiwal blood (Adrien Kumar, 1994).

In Malaysia, crossbreeding programme in cattle between *Bos taurus* and *Bos indicus* was practised by the Department of Veterinary Service (DVS), to produce dual-purpose cattle, for both milk and meat characteristics. In order to achieve maximum productivity and to exploit heterosis effect in dam/sire, the desired genes from two or more breeds were combined into hybrids. The Mafriwal crossbreeds are among these hybrids and are mainly of Friesian and Sahiwal background with 25 (M25), 50 (M50), 62.5 (M62.5) and 75 (M75) percent Friesian blood levels. They have been derived from *inter se* mating and crisscrossing in breed improvement schemes modified for the Malaysian situation (Hawari, 1994) The female cattle were selected for milk production (including machine adaptability) whereas the males were selected for meat. Both were subjected to selection for tropical adaptability (including tick resistance).

Semen cryopreservation is undertaken for use in artificial insemination and IVF programmes. The bulls undergo progeny testing to select proven bulls for the above purposes. Since Institut Bioteknologi Haiwan Kebangsaan is the main centre for semen cryopreservation, it is important that greater emphasis for selection of quality semen were based on prefreezing standard of >60% motility, 3 x 3 (amplitude, frequency), +++ speed, <10% primary abnormalities and a <25% total spermatozoa abnormalities. Zawawi *et al.* (1995) reported that *Bos indicus* had better semen quality and sperm characteristics than the *Bos taurus*, however the *Bos taurus* bulls produced larger semen volume while the crossbred bulls ranked intermediate between both breeds. The objective of this study was to investigate the pattern of semen quality and sperm characteristics with the increase in Friesian blood level in Mafriwal crossbred cattle.

## MATERIALS AND METHODS

Four groups of Mafriwal crossbred bulls, M25, M50, M62.5 and M75 were used in this study; each group represented by three bulls except M25 (two bulls). The selected bulls were used for semen collection and freezing from the age of 36 months and were culled at 60 months due to decreased semen quality and poor freezability. The bulls were kept in individual pens in shade and received identical feed , supplements and management. Semen collection was carried out in the morning once a week using an artificial vagina. A male was used as a teaser on all occasions. Immediately after collection, the volume of the semen was recorded from the graduated tube. This was followed by determination of the concentration of semen sample using spectrophotometer sperm counter (IMV, France) at wavelength of 355 nm. The semen was diluted 16 times with 3% (w/v) sodium citrate and kept on a warmer plate at 35°C for 30 second before

magnification for sperm characteristics. The motility was scored by percentage of motile sperm whereas density (the thickness of the fluid), mass activity (the pattern of wave movement on the slide without cover slip), amplitude (the width of head displacement), frequency (the beat of sperm tail per second) and speed (the linear progressive movement of spermatozoa forward) were categorised manually from 0 to 5. Data collected were statistically analysed using the computer software SGPLUS. Mean, Duncan's Multiple Range Test and regression analysis were employed.

The statistical model used for semen quality and sperm characteristics was:

$$Y_{ij} = \mu + \alpha_i + e_{ij}$$

where,

$Y_{ij}$ = the observation of j-th ejaculate of the i-th crossbred group
$\mu$ = the common mean
$\alpha_i$ = the effect of i-th Friesian blood level
$e_{ij}$ = random error

The effect was fixed.

## RESULTS AND DISCUSSION

The semen characteristics studied, especially volume and concentration showed large coefficient of variation. This phenomenon may be influenced by the wide age range over which the study was carried out and the small sample size used for each group. Table 1 shows the mean ± standard error of semen characteristics studied. The observation of the various semen characteristics were as follows:

### Volume

The M62.5 and M75 groups produced significantly ($P<0.05$) larger volume of semen than M50 and M25 animals but the increase of Friesian blood level from 25% to 50% and 62.5% to 75% had no effect on volume. The regression co-efficient analysis of variance (Table 3) shows that although there were positive co-efficient of regression (0.055 ± 0.029), the regression between Friesian blood level and semen volume was not significant.

### Concentration

M25 showed highly significant difference ($P<0.05$) to M50, M62.5 and M75. This is in agreement with other findings (Zawawi, 1995) which showed *Bos taurus* had significantly less concentration of sperm than *Bos indicus* and since M25 had 75% *Bos indicus* blood, the higher concentration of M25 was expected. This is supported by the negative coefficient of regression (-5.850 ± 0.311) in Table 2. However non significance of this value suggested sperm concentration did not show linear decrease with the increase of Friesian blood level.

**Table 1.** Mean ± SEM and coefficient of variation (c.v. in %) of semen and spermatozoa characteristics.

| | M25 | M50 | M62.5 | M75 |
|---|---|---|---|---|
| Volume (mL) | $6.00^{a}$ ± 0.44 (41.29) | $5.48^{a}$ ± 0.30 (35.70) | $7.74^{b}$ ± 0.47 (40.82) | $8.62^{b}$ ± 0.27 (30.57) |
| Concentration (x $10^6$) | $1576.43^{b}$ ± 6.54 (18.98) | $1330.40^{a}$ ± 57.63 (28.40) | $1250.4^{a}$ ± 50.34 (26.39) | $1315.60^{a}$ ± 36.25 (26.28) |
| Density | $2.68^{bc}$ ± 0.08 (17.75) | $2.88^{c}$ ± 0.11 (25.34) | $2.34^{a}$ ± 0.08 (22.19) | $2.47^{ab}$ ± 0.05 (20.25) |
| Mass activity | $3.06^{b}$ ± 0.08 (14.44) | $3.37^{b}$ ± 0.10 (19.44) | $2.76^{a}$ ± 0.13 (32.05) | $3.18^{b}$ ± 0.08 (24.43) |
| Motility (%) | $65.10^{a}$ ± 1.39 (11.89) | $72.56^{b}$ ± 1.36 (12.25) | $65.44^{a}$ ± 1.17 (11.95) | $65.28^{a}$ ± 1.13 (17.17) |
| Amplitude | $2.81^{a}$ ± 0.07 (14.31) | $3.19^{a}$ ± 0.08 (15.84) | $2.91^{a}$ ± 0.07 (16.08) | $3.08^{a}$ ± 0.31 (10.07) |
| Frequency | $2.74^{a}$ ± 0.08 (16.22) | $3.06^{b}$ ± 0.05 (7.71) | $2.98^{b}$ ± 0.07 (15.17) | $3.02^{b}$ ± 0.04 (11.63) |
| Speed | $2.55^{a}$ ± 0.09 (19.85) | $3.11^{b}$ ± 0.08 (10.39) | $2.98^{b}$ ± 0.08 (18.24) | $3.11^{b}$ ± 0.06 (18.96) |
| No. of ejaculation | 31 | 43 | 45 | 98 |

$^{a,b,c}$ Means with different superscripts within a row were significantly different at $P<0.05$.
( ) c.v.

**Table 2.** The regression coefficient ± SEM for semen quality and spermatozoa characteristics.

| Parameter | |
|---|---|
| Volume | 0.055 ± 0.029 |
| Concentration | -5.85 ± 0.311 |
| Density | -0.000 ± 0.006 |
| Mass activity | -0.000 ± 0.008 |
| Motility | -0.010 ± 0.120 |
| Amplitude | 0.004 ± 0.004 |
| Frequency | 0.005 ± 0.002 |
| Speed | 0.010 ± 0.004 |

**Table 3.** The mean squares analysis of the regression coefficient of semen quality and sperm characteristics.

| Source of variation | Regression | Remainder |
|---|---|---|
| Degree of freedom | 1 | 2 |
| Volume | $4.141^{ns}$ | 0.358 |
| Concentration | $46887.162^{ns}$ | 7304.204 |
| Density | $0.052^{ns}$ | 0.059 |
| Mass activity | $0.001^{ns}$ | 0.098 |
| Motility | $0.192^{ns}$ | 19.844 |
| Amplitude | $0.023^{ns}$ | 0.032 |
| Frequency | $0.040^{ns}$ | 0.011 |
| Speed | $0.154^{ns}$ | 0.029 |

$^{ns}$Not significantly greater than zero at $P<0.05$.

**Mass semen characteristics (density, mass activity and % motility)**

These three characteristics showed no particular trend in mean value. The coefficient of regression values were almost zero and non significant, which indicated that there was no tendency for these traits to increase or decrease with increased Friesian blood level.

**Individual spermatozoa characteristics (amplitude, frequency and speed)**

As with mass semen characteristics, the coefficient of regression was not significant for these characteristics. However, Friesian blood level at M50, M62.5 and M75 had a significantly higher mean than M25 for the parameters frequency and speed. This may be due to the higher semen concentration

In conclusion, semen quality and sperm characteristics studied showed no significantly linear relationship with the proportion of Friesian blood in the crossbreds.

## ACKNOWLEDGEMENTS

The authors wish to thank the Director General of Veterinary Services Malaysia for permission to present this paper and sincere appreciation to Mr. Amat Aswadi (IBHK) and Mr.Mansur (UPM) for technical assistance.

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## RINGKASAN

*KUALITI SEMEN DAN CIRI SPERMA DARIPADA LEMBU KACUKAN MAFRIWAL YANG BERBEZA DALAM ARAS DARAH FRIESIAN*

*Empat aras darah Friesian berbeza pada lembu jantan Mafriwal yang diguna dalam kajian ini ialah M25 (25% aras darah Friesian), M50 (50% aras darah Friesian), M62.5 (62.5% aras darah Friesian) dan M75 (75% aras darah Friesian). Hasil kajian menunjukkan kualiti semen dan ciri sperma yang diselidik tidak bergantung erti pada aras darah Friesian. Bagaimanapun, isipadu lebih cenderung untuk meningkat dengan peningkatan aras darah Friesian sambil kepekatan pula menurun pada lembu kacukan dengan meningkatnya aras darah Friesian.*