IJABR, VOL.8 (4) 2018: 441-444 ISSN 2250 – 3579

INTERNATIONAL JOURNAL OF ADVANCED BIOLOGICAL RESEARCH

FACTORS INFLUENCING ON ESTRUS SYNCHRONIZATION IN BOVINES – DISCRIMINANT FUNCTION ANALYSIS

*#Kundavai Nachiyar C., Selvam S., Thirunavukkarasu M. And Kulasekar K.
Madras Veterinary College, Chennai – 600 007.
*Corresponding author email: kunthavai.vet@gmail.com
#Part of M.V.Sc., Thesis of Corresponding author.

ABSTRACT
This study was conducted to find out the factors infuencing estrus synchronization, therefore hundred estrus synchronized and fifty non-estrus synchronized bovines were selected at random sampling method and considered for the study. A discriminant function analysis was used to find out characteristics that discriminated beneficiaries (synchronized animals) from non-beneficiaries (non synchronized animals). In total of fifteen variables were included for the analysis. The step wise procedure revealed that the breed of the animal, age of the animal, average calving interval, type of calving, dairy character of the animal, average milk yield of the animal, lactation length and number of insemination per conception were the important significant variables which discriminated beneficiaries from non beneficiaries. The result of the classification of cases had shown that, among the beneficiaries 97 per cent were predicted correctly by the model and while among the non-beneficiaries 78 per cent were identified correctly. In total 90.6 per cent of the original grouped cases were correctly classified.

KEY WORDS: Bovines, Oestrus Synchronization, Discriminant function analysis.

INTRODUCTION
Livestock sector is an important sub-sector of the agriculture of Indian economy. According to estimates of the central statistics office, the value of output livestock sector at current prices was about Rs. 8,11,847crs during 2015-16 which is about 28.6% of the value of output from agricultural and allied sector. The economic success of dairy farming lies in proper and optimal reproductive rhythm of each individual animal in the herd within normal physiological range. An excessively long postpartum estrus interval and silent heat in buffalo (Narinder singh *et al.*, 1979) results in huge economic losses. Estrus synchronization in bovines implies the manipulation of estrus cycle or induction of estrus to being a large percentage of a group of females into estrus at a predetermined time (Odde *et al.*, 1990) to facilitate use of artificial insemination (Xu and Burton *et al.*, 1999). Fertility in farm animals may be expected towards higher side, as timely breeding of the animals is possible with this technique (Islam, 2011). Thus, this present study was undertaken to find out the factors influencing oestrus synchronization in bovines.

MATERIALS & METHODS
Multistage sampling technique was chosen for the study. Salem and Trichirapalli districts of Tamil Nadu randomly selected for the study. Then, five villages from each of the chosen two districts were selected. From each of the five selected villages, ten beneficiaries and five non-beneficiaries were selected randomly, leading to a total of 100 beneficiaries and 50 non-beneficiaries which found the sample for the study. The data collected were through personal interview with the help of a pre-tested interview schedule from the sample respondents.

Discriminant function analysis
Discriminant analysis is a multivariate technique used for predicting group membership on the basis of two or more independent variables. The linear combination of independent variables developed by discriminant analysis would best discriminate between the categories of the dependent variable (Hair *et al.*, 2006). This linear combination is called as the discriminant function. It can be represented in the following way (Gupta, 2003):

$$\mathbf{Z_i = b_1 X_{1i} + b_2 X_{2i} \ldots\ldots + b_n X_{ni}}$$

Where, Z_i = ith individual's discriminant score,
b_n = Discriminant coefficient for the nth variable and
X_{ni} = Individual's value on the nth independent variable.
Discriminant weights (b_n) or discriminant function coefficients are estimates of the discriminatory power of a particular independent variable. The size of the coefficients associated with a particular independent variable is determined by the variance structure of the variables in the equation. Independent variables with large discriminatory power will have large weights and those with little discriminatory power will have small weights. For the present study Wilk's lambda was used as the test of statistical significance.
The linear discriminant function used for the study is of the following form

$$Z = \sum_{i=1}^{15} biXi$$

Where, X1 Species (0 = Cows; 1 = Buffaloes); X2 Breed of the animal (0 = Cross breeds; 1 = others); X3 Age of the animal; X4 Age at first calving (yrs); X5 Postpartum interval (days); X6 Lactation period while pregnant (months); X7 Average calving interval (months); X8 Length of estrus cycle (days); X9 Type of discharge (0 = Normal; 1 = Abnormal); X10 Type of calving (0 = Manual calving; 1 = Assisted calving); X11 Dairy character of the animal (0 = Poor; 1 = Good); X12 Average milk yield of the animal (litres); X13 Peak milkyield of the animal (litres); X14 Lactation length (days); X15 Number of insemination per conception.

RESULTS & DISCUSSION

A discriminant function analysis was attempted to find out characteristics that discriminated beneficiaries (synchronized animals) from non-beneficiaries (non synchronized animals). In total of fifteen variables *viz.* species, breed of the animal, age of the animal, age at first calving (yrs), postpartum interval (days), lactation period while pregnant (months), average calving interval (months), length of estrus cycle (days), type of discharge, type of calving, dairy character of the animal, average milk yield of the animal (litres per day), peak milk yield of the animal (litres per day), lactation length (days) and number of insemination per conception were included for the analysis.

TABLE 1: Test of equality of group means (WILKS' Lambda and Univariate F Ratio)

Variables	Wilks' Lambda	F	Sig.
Species	0.979	3.119	0.079
Breed of the animal	0.981	2.813	0.096
Age of the animal (yrs)	0.824**	31.257	0.000
Age at first calving (yrs)	0.967*	4.982	0.027
Postpartum interval (days)	0.980	2.975	0.087
Lactation period while pregnant (months)	0.982	2.660	0.105
Average calving Interval (months)	0.729**	54.171	0.000
Length of estrus cycle (days)	0.984	2.384	0.125
Type of discharge	0.970*	4.524	0.035
Type of calving	0.929**	11.098	0.001
Dairy character of the animal	1.000	0.019	0.892
Average milk yield of the animal (litres/day)	0.796**	37.436	0.000
Peak milk yield of the animal (litres/day)	0.803**	35.874	0.000
Lactation length (days)	0.958*	6.445	0.012
Number of insemination per conception	0.607**	94.549	0.000

*Note: *Significant at 5 per cent level of probability; **Significant at 1 per cent level of probabilitty*

TABLE 2: Group mean and mean difference of variables

Character	Mean value of Beneficiaries	Mean value of Non- Beneficiaries	Mean Difference
Species	0.061	0	-0.061
Breed of the animal	0.444	0.674	0.229
Age of the animal (yrs)	2.121	3.306	1.185
Age at first calving (yrs)	1.293	1.571	0.279
Postpartum interval (days)	0.283	0.102	-0.181
Lactation period while pregnant (months)	0.364	0.184	-0.18
Average calving interval (months)	0.849	1.694	0.845
Length of estrus cycle (days)	1.929	1.837	-0.093
Type of discharge	1.929	1.735	-0.195
Type of calving	0.01	0.122	0.112
Dairy character of the animal	1.748	1.735	-0.013
Average milk yield of the animal (litres/day)	7.929	10.735	2.805
Peak milk yield of the animal (litres/day)	9.909	12.878	2.969
Lactation length (days)	294.55	302.14	7.59
Number of insemination per conception	0.99	2.163	1.173

Table 1. reveals that the univariate equality of group means for each of the variables in the discriminant function. A wilk's lambda of 1 indicated that all observed group means are equal. Values close to zero occur when within group variability is small, when compared to the total variation. Thus, larger value of lambda indicates that group means do not appear to be difference, while smaller values indicate group means appear to be different. F values are nothing but those calculated from a one way analysis of variance for each variable. Since the observed significance level was less than 0.05 for age of the animal, age at first calving, average calving interval, type of discharge, average milk yield, lactation length, type of calving, and number of insemination per conception, indicated that the hypothesis that all group means of these variables are equal was rejected. Table 2 gives the group means and mean difference of the selected variables for beneficiaries and non-beneficiaries.

Step wise selection of variables

To eliminate the interdependence among the variables, which in turn can affect the discriminant power of the function, the step wise selection was done using forward selection and backward selection elimination procedure (Lekshmi *et al.* 1998). At each step, the variable chosen for inclusion was one with the largest F value. The result of step wise procedure revealed that the breed of the animal, age of the animal, average calving interval, type of calving, dairy character of the animal, average milk yield of the animal, lactation length and number of insemination per conception were the important significant variables which discriminanted beneficiaries from non beneficiaries. The selection procedure was repeated by Wilk's lambda method with minimization of Wilk's lambda as criteria. The results of this method also revealed the involvement of same variables. Table 5.17 reveals that the discriminant function coefficients values of selected variables. The resultant discriminant function with the significant variables was of the following form,

$Z=0.305X_2+0.243X_3+0.864X_7+1.261X_{10}-0.923X_1+ 0.189X_{12} + 0.021X_{14} + 0.769X_{15}$

The Mahalanobis D^2 was worked out as 2.834 for the function fitted. Hence it can be inferred that the variables considered in the present analysis together were able to classify efficiently the non-beneficiaries and beneficiaries.

TABLE 3: variables selected by step wise selection and their discriminant function coefficients

Grouping Variable	1 = Beneficiaries; 2 = Non-Beneficiaries
Variables	Discriminant Function Coefficients
Breed of the animal	0.305
Age of the animal (yrs)	0.243
Average calving interval (months)	0.864
Type of calving	1.261
Dairy character of the animal	-0.923
Average milk yield of the animal (litres/day)	0.189
Lactation length (days)	0.021
Number of insemination per conception	0.769
Constant	-9.161

TABLE 4: percent contribution of variables to the discriminant score

Variables	Discriminant Function Coefficients (i)	Standardized mean difference (d)	Discriminant Score (d*i)	Per cent contribution
Breed of the animal	0.305	0.229	0.070	2.466
Age of the animal (yrs)	0.243	1.185	0.288	10.161
Average calving interval (yrs)	0.864	0.845	0.730	25.777
Type of calving	1.261	0.112	0.142	4.998
Dairy character of the animal	-0.923	-0.013	0.012	0.417
Average milk yield of the animal (liters/day)	0.189	2.805	0.530	18.712
Lactation length (days)	0.021	7.590	0.159	5.625
Number of insemination per conception	0.769	1.173	0.902	31.844
Total			2.834	100.000

Classification of cases

The mean value of the discriminant score for the beneficiaries and non-beneficiaries was -0.934 and 1.887. The critical mean discriminant score for the two groups was 0.4765 i.e. the cut off value. If the discriminant scores estimated function for a bovine is more than 0.4765, animal can be allowed for estrus synchronization that can be considered as a beneficiary; otherwise it is likely to be a non-beneficiary.

Character	Predicted Group Membership		Total
	Beneficiaries	Non-Beneficiaries	
Beneficiaries	96 (97.00)	3 (3.00)	99 (100.00)
Non-Beneficiaries	11 (22.00)	39 (78.00)	50 (100.00)

Classification of results

From Table, among the beneficiaries 97 per cent were predicted correctly by the model, whereas 3 per cent were classified wrongly. While among the non-beneficiaries 78 per cent were identified correctly and 22 per cent were misclassified. In total 90.6 per cent of the original grouped cases were correctly classified. The model therefore is able to capture the possibility of beneficiaries better than non-beneficiaries.

ACKNOWLEDGEMENT

The authors are thankful to Veterinary University Training and Research Centres, Salem and Trichirapalli for providing the necessary facilities to conduct the research work.

REFERENCES

Basarab, J.A., Rutter, L.M. and Day, P.A. (1993) The efficacy of predicting dystocia in yearling beef heifers: II. Using discriminant analysis. *Journal of Animal Science* **71(6),** 1372-1380.

Gupta, S.L. (2003) Marketing Research, EXCEL Books, New Delhi.

Hair, J.F., Bush, R.P. and Ortinau, D.J. (2006) Marketing Research within a Changing Information Environment, 3rd Edition, Tata McGraw Hill, New Delhi.

Islam, R. (2011) Synchronization of Estrus in Cattle: Review. *Veterinary World* **4(3):** 136-141.

Lekshmi, S., Rugmini, P. and Thomas Jesy (1998) Characteristics of defaulters in agricultural credit use. A microlevel analysis with reference to Kerala. *Indian Journal of Agricultural Economics* **53(4):** 640-47.

Odde, K.G. (1990) A review of synchronization of estrus in postpartum cattle. *Journal of Animal Science* **68**: 817-830.

Pandian, A.S.S., Selvakumar, K.N. and Ganesh kumar, B. (2004) Factors influencing repayment performance of livestock farmers: an application of discriminant function analysis. *Indian Journal of Animal Sciences* **74(7):** 783-786.

Selvaraju, M., Veerapandian, C., Kathiresan, D. and Chandrahasan, C. (2005) Effect of estrus synchronizing agents on estrus pattern and fertility in repeat breeder cows. *Indian veterinary Journal,* **82**: 510-512.

Singh, N., Chauhan, F.S. and Singh, M. (1979) Postpartum ovarian activity and fertility in buffaloes. *Indian journal of dairy science* **32(2):** 134-139.

Xu, Z.Z. & Burton, L.J. (1999) Reproductive performance of dairy heifers after estrus synchronization and fixed-time artificial insemination. *Journal of Dairy Science* **82**: 910-917.