RESEARCH ARTICLE

Efficiency of Multiple Ovulation and Embryo Transfer (MOET) in a Cattle Farm over a Period of Ten Years in Gujarat

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Abstract

The present study was conducted at Sabarmati Ashram Gaushala, Bidaj, Gujarat. A total of 427 donor animals were investigated over a ten-year period to assess the efficiency of Standard protocol of Multiple Ovulation and Embryo Transfer (MOET). Simultaneously a season wise and breed wise study was also conducted. Breeds studied were Gir, HF, HFCB, Jersey, JYCB, Red Sindhi and Sahiwal. Overall average number of embryos, average number of viable embryos, number of pregnancies and conception rate (%) were found to be 7.8, 4.8, 281 and 39.4, respectively. The year-wise number of pregnancies and conception rates varied from 09 to 42, and 24.6% in 2009-10 to the highest 61.3% in 2014-15, respectively. Further, breed-wise results showed average viable embryo in different breeds as 2.8 in Gir, 4.1 in HF, 5.1 in HFCB, 6.3 in Jersey, 5.8 in JYCB, 3.7 in Red Sindhi and 6.6 in Sahiwal, with corresponding conception rates of 67.7. 34.6, 28.8, 53.1, 39.4, 47.1 and 36.4 %, respectively. A trend was observed that the efficiency of MOET programme was less during monsoon (31.2%) as compared to summer and winter (41.5 and 41.4%).

Keywords: Cattle, Efficiency of MOET, FSH, Gir, Prostaglandin, Sahiwal, Red Sindhi

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Introduction

Multiple ovulation and embryo transfer are two of the most essential reproductive procedures for increasing animal output (Faizah *et al.,* 2018). Various bio-technological techniques, such as AI, estrus synchronisation for timed AI, multiple ovulation and embryo transfer, rumen microbial manipulation, and current breeding techniques, may be of considerable help in animal husbandry in the near future for enhancing animal species (Mondal *et al.,* 2014). Embryo transfer has become the most powerful tool available to animal scientists and breeders for improving the genetic structure of their herds and rapidly increasing elite animal numbers, and it has recently acquired appeal among seed stock dairy and beef producers. In 1970s, the most current embryo transfer technology was developed, which is now widely regarded as the most important approach for attaining success in many assisted reproductive technologies, particularly in the cases of *in vitro* fertilisation and animal cloning (Kennady *et al.,* 2018).

Embryo transfer is a procedure that involves collecting an embryo from a donor female and then transferring it to a recipient female a surrogate mother. Artificial insemination sires from high-proven cows and bulls are now regularly produced through embryo transfer. Since the 1970s, embryo transfer (ET) has had a significant impact on cow breeding programmes in developed countries. The transfer of genetic material between countries has also been substantially facilitated by embryo transfer, both for individual animals of high genetic value and to introduce exotic breeds (Mahon and Rawle, 1987). With changing economic trends, India is the fastest expanding country, with more than 60% of the population earning directly or indirectly from agriculture and animal husbandry, and both contribute equally to India's national GDP (Patel, 2011).

The National Dairy Research Institute (NDRI) in Karnal, the Central Institute for Research on Buffalo (CIRB) in Hisar, the Indian Veterinary Research Institute (IVRI) in Bareilly, and state agricultural universities in India were among the first to try ET in dairy animals. Concurrently, a pilot project was launched in 1987 by the National Dairy Development Board (NDDB), Anand and by Department of Biotechnology (DBT), Ministry of Science and Technology, Government of India, New Delhi for buffalo and cattle herd improvement,

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respectively through ET to this station. The NDDB project "Open Nucleus Breeding System (ONBS) in Cattle using MOET" was also financed by DBT (Misra *et al.,* 2005). Because cow slaughter is prohibited in India, practically all embryos are created *in vivo* after superovulation and nonsurgical embryo collection or *in vitro* after ultrasound guided transvaginal aspiration of oocytes (ovum pick-up) and subsequent *in vitro* maturation (IVM), *in vitro* fertilisation (IVF) and *in vitro* culture (IVC). The majority of buffalo embryos, on the other hand, are created *in vitro* from abattoir derived oocytes (Patel *et al.,* 2018). This study was aimed to evaluate the efficacy of MOET programme in different breeds of cattle during different seasons for over a period of ten years under Gujarat Agro-climatic conditions.

Materials and Methods

The research was carried out at the Sabarmati Ashram Gaushala in Gujarat, India, which is operated by NDDB Dairy Services. A total of 427 donor animals were investigated over a ten-year period (2009-2020). Simultaneously a season wise and breed wise study was also conducted. Breeds under this study were Gir, HF (Holstein Friesian), HFCB (Holstein Friesian Crossbred), Jersey, JYCB (Jersey Crossbred), Red Sindhi and Sahiwal.

Donors and recipients were either synchronised using a single Prostaglandin or picked after natural heat based on their past history of estrous cycle. Animals in standing estrus had their uterine tone assessed rectally, and CL development was evaluated on the 9th to 11th day. Superovulation (SOV) was performed with 200/400 mg (equally split constant dosage) of Folltropin V (Porcine Follicle Stimulating Hormone), and estrus was induced 48 h after the initial FSH injection with a single dose of Prostaglandin F2α (50 mg dinoprost tromethamine, Lutalyse). During the estrus, AI was performed three times at 12-h interval, with the first AI beginning at the onset of standing estrus.

On day 7, flushing was performed according to protocol (Misra *et al.,* 1990) with an 18 G Rusch catheter (Minitub, Germany) and DPBS medium (IMV, France) containing 0.1 % Bovine Serum Albumin (BSA, Fraction V, Sigma). The International Embryo Transfer Society (IETS) Manual was used to examine all of the rescued embryos. Fresh embryo transfers were done in recipients based on recipient availability, and excess embryos were stored using 1.5M ethylene glycol in a cryologic CL 500 biofreezer or vitrified using a vitrification kit bought from Biodynamics in India. The data was analysed using standard statistical procedures (Snedecor and Cochran, 1994).

Results and Discussion

A total 427 donor cattle were involved in the study over a period of ten years. The overall year wise, breed wise and season wise results are provided in Table 1, 2 and 3, respectively.

The total animals flushed were 376. The numbers of animals flushed year-wise from 2009-10 to 2019-20 are furnished in Table 1. Out of these 39 were in Gir, 18 in HF, 89 in HFCB, 12 in Jersey, 75 in JYCB, 35 in Red Sindhi and 108 in Sahiwal (Table 2). The highest number of flushing was done in winter, *i.e.,* 147, followed by 131 in summer and 98 in monsoon (Table 3).

Table 1: Year wise performance of the ET programme over 10 years at SAG, Bidaj Gujarat

Year	Donor Program	No. Responded	No. Flushed	Total Embryo Produced	Average Total Embryo	Viable	Average Viable Embryo	Cryo-preserved	Fresh Emb. Tran.	Recipient Used	Pregnancy	CR (%)
2009-10	44	36	41	310	7.6	179	4.4	94	85	57	14	24.6
2010-11	58	53	52	377	7.3	211	4.1	51	160	108	30	27.8
2011-12	54	50	49	339	6.9	215	4.4	78	137	104	40	38.5
2012-13	50	46	46	431	9.4	269	5.8	115	154	108	38	35.2
2013-14	26	25	25	174	7.0	125	5.0	45	80	60	32	53.3
2014-15	11	11	11	92	8.4	61	5.5	25	36	31	19	61.3
2015-16	26	21	21	182	8.7	95	4.5	35	60	49	26	53.1
2016-17	53	46	44	360	8.2	237	5.4	196	41	32	09	28.1
2017-18	54	46	47	375	8.0	207	4.4	99	108	94	42	44.7
2018-19	39	33	32	236	7.4	168	5.3	113	55	50	19	38.0
2020-21	12	7	8	42	5.3	27	3.4	6	21	20	12	60.0
Overall	**427**	**374**	**376**	**2918**	**7.8**	**1794**	**4.8**	**857**	**937**	**713**	**281**	**39.4**

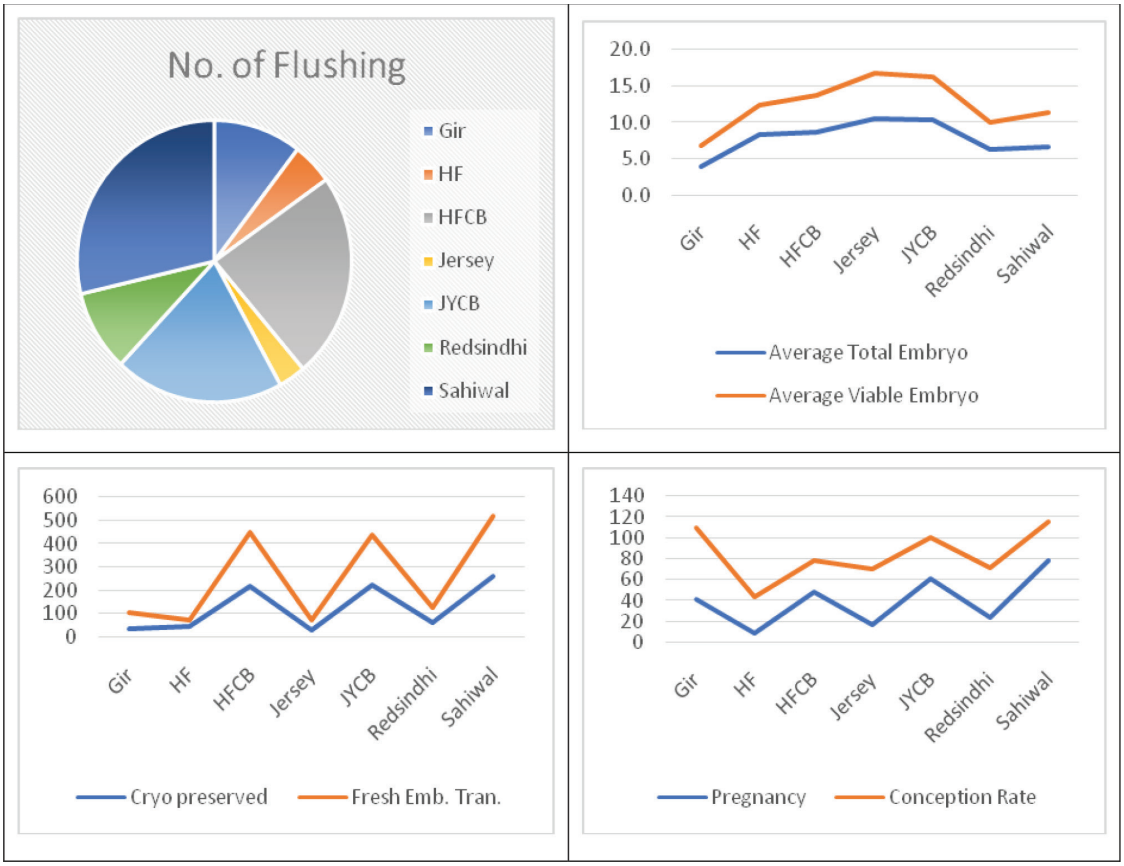

Fig. 1: Breed wise performance of the ET program

A total number of 2918 embryos were produced, and annually it varied from 42 to 431 from 8 and 46 flushings (Table 1). Among breeds 157 embryos were produced in Gir, 149 in HF, 769 in HFCB, 126 in Jersey, 780 in JYCB, 223 in Red Sindhi and 714 in Sahiwal (Table 2, Fig. 1). Following a similar trend, the highest numbers of embryos flushed were 1285 in winter, 1023 in summer and 610 in monsoon (Table 3). The total viable embryos out of these were 1794 with an average of the highest 5.8 in 2012-13, and the lowest 3.4 in 2019-20 (Table 1). According to breed the average viable embryos were 2.8 in Gir, 4.1 in HF, 5.1 in HFCB, 6.3 in Jersey, 5.8 in JYCB, 3.7 in Red Sindhi and 6.6 in Sahiwal (Table 2, Fig. 1). In monsoon the average viable embryos were 3.8, in summer 4.6 and in winter 5.6 (Table 3). From these embryos, a total number of 857 embryos were cryopreserved and 937 fresh embryos were transferred during 2009-2020 (Table 1).

Table 2: Breed wise performance of the ET programme over 10 years at SAG, Bidaj Gujarat

Breed	Donor Program	Re-spo-nded	Flush-ed	Total embryo	Average Embryo %	Viable	Average Viable Embryo %	Cryo-pre-served	Fresh ET	Recipient Used	Preg-nancy	Concep-tion Rate (%)
Gir	58	42	39	157	4.0	108	2.8	34	74	62	42	67.7
HF	19	18	18	149	8.3	74	4.1	42	32	26	9	34.6
HFCB	98	85	89	769	8.6	450	5.1	216	234	170	49	28.8
Jersey	14	13	12	126	10.5	76	6.3	27	49	32	17	53.1
JYCB	82	78	75	780	10.4	438	5.8	220	218	155	61	39.4
Red Sindhi	37	34	35	223	6.4	130	3.7	60	70	51	24	47.1
Sahiwal	119	104	108	714	6.6	518	4.8	258	260	217	79	36.4

Table 3: Season wise performance of the ET programme over 10 years at SAG, Bidaj Gujarat

Season	Donor Pro-gram	Respond-ed	Flush	Total emb	Average Total Embryo	Viable	Average Viable Embryo	Cryo- pre-served	Fresh Emb. Tran.	Recipi-entUsed	Preg-nancy	CR (%)
Summer	147	131	131	1023	7.81	601	4.6	255	346	275	114	41.5
Monsoon	118	98	98	610	6.22	376	3.8	195	181	141	44	31.2
Winter	162	145	147	1285	8.74	817	5.6	407	410	297	123	41.4

Overall 281 pregnancies were observed with an overall conception rate of 39.4 %. During different years of the study, the number of pregnancies and conception rates varied from 09 to 42, and 24.6% in 2009-10 to 61.3% in 2014-15, respectively (Table 1). These year-wise differences in CRs suggested climatic variation on the station during the period of study influencing the final outcome. Breed-wise number of pregnancies and conception rates were 42 and 67.7% in Gir, 9 and 34.6% in HF, 49 and 28.8% in HFCB, 17 and 53.1% in Jersey, 61 and 39.4% in JYCB, 24 and 47.1% in Red Sindhi and 79 and 36.4% in Sahiwal, respectively (Table 2, Fig. 1). With respect to seasons, the number of pregnancies and conception rates were 114 and 41.5% in summer, 44 and 31.2% in monsoon and 123 and 41.4% in winter, respectively (Table 3).

In this study, a trend was observed that the efficiency of MOET programme was less efficient during monsoon with high humidity as compared to summer and winter. This observation contradicted with the report of Viera *et al.* (2014), who demonstrated that multiple ovulation embryo production efficiency is compromised during the hot seasons. They obtained on an average 4.3±0.5 embryos in cooler times of the year against 2.4±0.4 embryos in warmer times.

The average of total embryos obtained in our study was 7.8, which is in close agreement with Vázquez-Mosquera *et al.* (2022). However they found average viable embryos to be 7.1, whereas in our study it was only 4.8. The overall conception rate stand at 39.4% in the present study, which is within the range of 22.0-45.0% reported by Shiferaw *et al.* (2003) and Bekana *et al*. (2007) in tropical areas; and 0.0-67.0% worldwide by Yang and Honaramooz (2010).

Conclusions

The present study on efficiency of multiple ovulation and embryo transfer (MOET) involving 427 donor animals over a ten-years period revealed overall average number of embryos, viable embryos, pregnancies and conception rate (%) to be 7.8, 4.8, 281 and 39.4, respectively. Breed-wise average number of viable embryos varied from lowest 2.8 in Gir to the highest 6.6 in Sahiwal with corresponding conception rates of 67.7 and 36.4%, respectively and the values of exotic and crossbreds were in-between. The efficiency of MOET programme was less during monsoon as compared to summer and winter in cattle.

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References

Bekana, M., Odensvik, K., & Kindahl, H. (2007). Prostaglandin $F_2\alpha$ metabolite and progesterone profile in postpartum cows with retained foetal membranes. *Acta Veterinaria Scandinavia, 37,* 171-185.

Faizah, H.M.S, Richard, F., Meena, P., Stanley, K.L., Amriana, H., Alhassany, A., Yadav, S.B., Marie, L., Crouch, B., & Saipul, B.A.R. (2018). Multiple ovulation embryo transfer (MOET) in dairy cattle in Gatton. *Malaysian Journal of Veterinary Research, 9*(2), 109-116.

Kennady, V., Manimegalai, J.,Verma, R., & Chaudhary, V. (2018). Embryo transfer technology in animals: An overview. *Journal of Entomology and Zoology Studies, 6*(5), 2215-2218.

Mahon, G.D., & Rawle, J.E. (1987). The export of deep-frozen bovine embryos. *Theriogenology, 27,* 21-35.

Misra, A.K., Joshi, B.V., Agarwal, P.L., Kasiraj, R., Siviah, S., Rangareddy, N.S., & Siddique, M.U. (1990). Multiple ovulation and embryo transfer in Indian buffaloes (*Bubalus Bubalis*). *Theriogenology, 33*, 1131-1142.

Misra, A.K., Prasad, S., & Taneja, V.K. (2005). Embryo transfer technology (ETT) in cattle and buffalo in India: *Indian Journal of Animal Sciences*, *75*(7), 842-857.

Mondal, M., Baruah, K.K., & Rajkhowa, C. (2014). Application of biotechnology for augmentation of productivity in mithun (*Bos frontalis*). *Global Journal of Animal Science Scientific Research, 2*(4), 357-364.

Patel, A.C. (2011). What is the role of Livestock sector in National Economy? http://www.indiastudychannel.com/resources/141694-LivestockNationaleconomy.aspx.

Patel. D.N., Haque, N., Patel, G.K., Chaudhari, A.K., Madhavatar, M., Bhalakiya, N., Jamnesha, N., & Patel, P. (2018). Implication of embryo transfer technology in livestock productivity. *International Journal of Current Microbiology and Applied Sciences, Special issue - 7,* 1498-1510.

Shiferaw, Y., Tenhagen, B.A., Bekana, M., & Kassa, T. (2003). Reproductive performance of crossbreed dairy cows in different production systems in the central Highlands of Ethiopia. *Tropical Animal Health and Production, 35,* 551-61.

Snedecor, G.W., & Cochran, W.G. (1994). *Statistical methods*. 8th edn. Iowa state University Press, Ames, Iowa, USA.

Vázquez-Mosquera, J.M., Fernández-Novo, A., Bonet-Bo, M., Pérez-Villalobos, N., Pesántez-Pacheco, J.L., Pérez-Solana, M.L., de Mercado, E., Gardón, J.C., Villagrá, A., Sebastián, F., Pérez-Garnelo, S.S., Martínez, D., & Astiz, S. (2022). MOET efficiency in a Spanish herd of Japanese black heifers and analysis of environmental and metabolic determinants. *Biology (Basel), 11*(2), 225.

Vieira, L.M., Rodriguesb, C.A., Mendanhaa, M.F., SáFilhoa, M.F., Salesc, J.N.S., Souzad, A.H., Santose, J.E.P. & Barusellia, P.S. (2014). Donor category and seasonal climate associated with embryo production and survival in multiple ovulation and embryo transfer programs in Holstein cattle. *Theriogenology, 82*(2), 204-212.

Yang, R.C., & Honaramooz, C. (2010). Effects of medium and hypothermic temperatures on preservation of isolated porcine testis cells. *Reproduction, Fertility and Development, 22*, 523-532.