

## EVALUATION OF AULPROFEM® TECHNOLOGY FOR CONTROL OF SEX RATIO IN DAIRY CATTLE – A PRELIMINARY STUDY

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**Abstract:** The present study was conducted to study and document the effect of oral administration of Aulprofem® on conception rate and calf sex ratio in dairy cattle. About 400 crossbred cows in the area of Chikkaballapura, Sidlaghatta and Bagepalli taluks of Karnataka during December, 2014 to February, 2015 were considered for the study. Control and Treatment group were comprised of 235 and 165 crossbred cows, respectively. The dose of the test compound Aulprofem® was 225 ml which was administered orally after diluting with equal quantity of water half an hour prior to artificial insemination. The overall conception rate observed was 45.96 and 64.24 per cent in control and treatment groups, respectively. The sex ratios of female to male calves born in control group and treatment group were 40:60 and 83.67: 16.33, respectively. The Lactation-wise conception rates were 37.25, 56.41, 45.09, 46.15, 38.09 and 62.50 per cent for 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup> and 6<sup>th</sup> lactation, respectively in control group, whereas the corresponding values in treatment group were 63.33, 50, 73.17, 69.23, 69.23 and 33.33 per cent, respectively. The lactation-wise calves female to male sex ratios were 47.36:52.63, 31.57:68.42, 55:45, 31.81:68.18, 25:75 and 55:45 for 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup> and 6<sup>th</sup> lactation, respectively in control group, where as in treatment group the corresponding ratios were 94.11:5.89, 78.94:21.05, 82.14:17.85, 79.17:20.83, 87.50:12.50 and 100:0, respectively. In the present study treatment with Aulprofem® before artificial insemination has considerably increased the female calf ratio, hence Aulprofem® may be used to increase the female calf ratio in dairy cattle.

**Keywords:** Aulprofem®, Conception rate, Sex ratio, Dairy cattle, Female calves.

### INTRODUCTION

In India, productivity in dairy cattle is being calculated by dividing the milk production over the population of animals which includes the male animals also, we have at least 50 per cent of the male animals, which is one of the main reasons for the disappointing figure. The misery is the productive animals sharing the crop residues feed/ fodder resources with the unproductive ones. Prohibitive cost on feeding of animals puts a huge burden on the poor farmer, especially when there is no increase in the aerable land and availability of *gomala* (Government owned free grass land) facilities. Further, the cow/ cattle slaughter ban act exercises tremendous pressure on the system. The animal welfare activities have been quiet

partisan towards safe guarding the interest of dog population, leaving the male cattle/ calves which are seldom required for breeding/ draft purpose as orphans.

To address this menace, utility of sexed semen for AI in case of dairy animals is being proposed/ practised. Till today, the proven technology for sex selection is through flow cytometry activated cell sorting, in which the selection of desired sex is reported to be more than 90 per cent. However, the major constraint with this method is more damage to spermatozoa leading to reduced fertility apart from high cost of the equipment. The success rate of that across the age groups and across the years of lactation of the animals is being debated. However, in the absence of availability of this technology domestically, the same has to be imported and the establishment of infrastructure for such a facility besides being exorbitantly expensive and would be time consuming as well.

Thus, any alternate technique that is cost effective, easily adoptable and efficient, which can skew the sex ratio by more than 50 per cent would be beneficial to the farm animal's productivity. Some studies demonstrated a significant variation from the expected 1:1 birth sex ratio in many mammalian species after altering pre-conceptual maternal environment (Trivers and Willard, 1973; Celik *et al.*, 2003; Rosenfeld and Roberts, 2004; Sheldon and West, 2004; Grant and Chamely, 2010 and Vahidi and Sheikha, 2007). Arangasamy *et al.* (2015) measured the changes in sex ratio skewing by estimation of mineral and steroid hormones level in rat model with the administration of calcium and magnesium.

Aulprofem<sup>(R)</sup> is a liquid dosage formula, contains certain active constituents that have the capability to fix the selective combination of desired chromatin containing spermatozoa with the ovum (Salisbury and Van De Mark, 1961). This is achieved by blocking the receptor sites for the undesired spermatozoa on the surface of body of the ovum (Zavos and Dawson, 1991). The technology involves the production of certain Y sperm binding ligand mimics (YSBLM) in the plasma of the female animal just before conception (Aulakh, 2009). The chemical composition of Aulprofem<sup>(R)</sup> includes certain chemicals which are known as sex fixers in scientific history (US patent no. 7351581), which yield predominantly female zygotes.

The differential binding of sperms bearing X and Y chromosome with different binding moieties is a well-known phenomenon in the scientific history (U.S. patents 4,448,767 and 4,999,283). These differential binding ligands on X and Y sperms may be in conformation to the selective receptor binding sites on the body of the ovum (Anon., 2008a and ISVPT, 2008). More of such evidence exists in research publications (Anon., 2008b and Pashudhan,

2008). The sex ratio manipulator action of these chemicals is also tabulated in Australian patent no. 2001235973, New Zealand patent no. 526489, South African patent no. 2003/4623 and Canadian patent no. 2432,172. This YSBLM acts as a precursor of selective sperm binding ligand mimic moieties (Aulakh, 2009). In addition, it forms a buffer system as well and thereby acts as a selective sex ratio manipulator towards the predominantly female zygote (US patent no. 7351581, Australian patent no. 2001235973, New Zealand patent no. 526489, South African patent no. 2003/4623 and Canadian patent no. 2432,172). With this background the present study was conducted to study and document the effect of oral administration of Aulprofem<sup>(R)</sup> on conception rate and calf sex ratio in dairy cattle.

## MATERIALS AND METHOD

The materials for the present study comprised of dairy cattle in the area of Sidlaghatta, Chikkaballapura and Bagepalli taluks of Kolar and Chikkaballapura districts of Karnataka. The total number of animals considered in the trial was 436 cows during the period from December, 2014 to February, 2015. The artificial inseminations were carried out by the staff of Karnataka Milk Federation (KMF) and the data was recorded along with the tag numbers as well as a photograph in each core. The same data is available on the NDDB website too. All the artificial inseminations done each day were taken into consideration and at random one cow among them was administered the test compound Aulprofem<sup>(R)</sup>. About 225 ml of the test compound Aulprofem<sup>(R)</sup> was administered orally after diluting with equal quantity of water half an hour immediately prior to artificial insemination. However, 23 cows from the control group of 258 and 13 cows from the treatment group of 178 cows were sold during the trial and hence were deleted from the data base. A total of 400 cows were, divided into two groups namely, control (235) and treatment (165) to document the conception rate and Female: Male ratio, and to study the effect of the test compound (Table 1).

**Table 1: Details of study area and distribution of animals**

Location	Control Group	Treatment Group	Over All
Chikkaballapura	150 (64 %)	69 (42 %)	219 (55 %)
Sidlaghatta	85 (36 %)	56 (34 %)	141 (35 %)
Bagepalli	0	40 (24 %)	40 (10 %)
<b>Total</b>	235 (100 %)	165 (100 %)	400 (100 %)

Note: figures in the parenthesis are the percentages

## RESULTS AND DISCUSSION

### Distribution of cows based on the number of lactation

The composition of the animals (400 cows) involved in the study is presented in table 2. It comprised of heifers as well as cows from first lactation to seventh lactation. The heifers constituted about 21.70 and 18.18 per cent in the control and treatment groups, respectively. The majority of the cows were found in the group of cows which were in first to third lactation, *i.e.* 60.45 and 71.52 per cent in control and treatment groups, respectively. The percentage of cows which represented from fourth to seventh lactation was 17.88 and 10.31 per cent in control and treatment groups, respectively.

**Table 2: Distribution of cows based on number of lactation**

No of Lactation	Control Group	Treatment Group	Over All
<b>Heifer</b>	51 (21.70 %)	30 (18.18 %)	81 (20.25 %)
<b>1</b>	39 (16.60 %)	38 (23.03 %)	77 (19.25 %)
<b>2</b>	51 (21.70 %)	41 (24.85 %)	92 (25.00 %)
<b>3</b>	52 (22.15 %)	39 (23.64 %)	91 (22.75 %)
<b>4</b>	21 (8.94 %)	13 (7.88 %)	34 (8.50 %)
<b>5</b>	16 (6.81 %)	3 (1.82 %)	19 (4.75 %)
<b>6</b>	5 (2.13 %)	0 (0.00 %)	5 (1.25 %)
<b>7</b>	0 (0.00 %)	1 (0.61 %)	1 (0.25 %)
<b>Total</b>	235 (100 %)	165 (100 %)	400 (100 %)

Note: figures in the parenthesis are the percentages

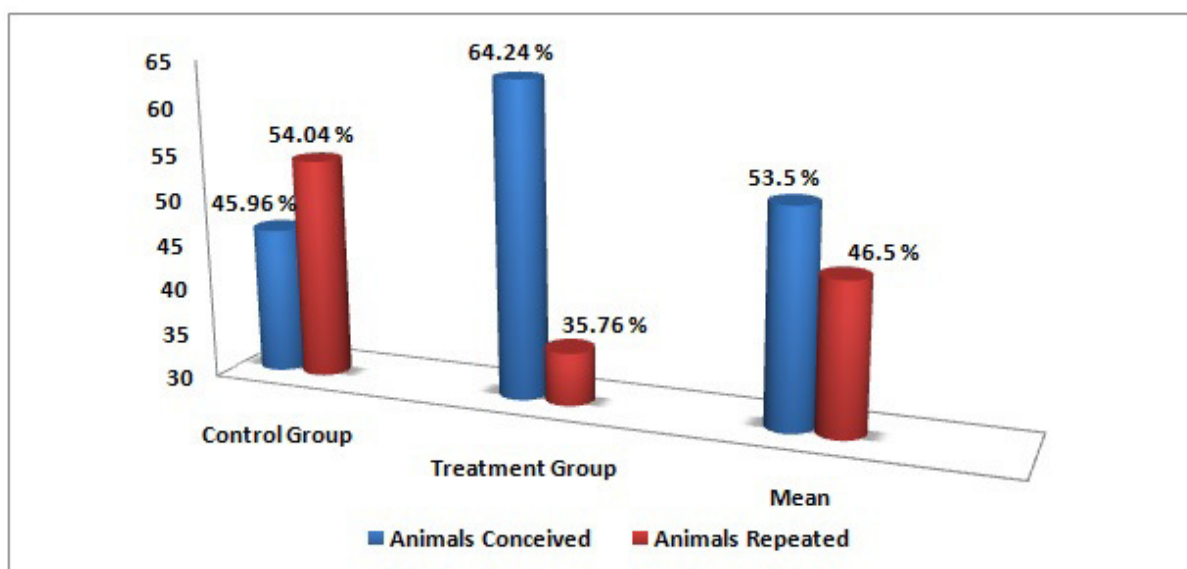
### Conception rate

The conception rate observed in studied population is presented in table 3 and figure 1. The overall rate of conception was 53.50 per cent. However, the conception rate was better in treatment group (64.24%) compared to the control (45.96%). Among the conceived animals, the overall percentage of calves born was 92.52 per cent. The abortion was recorded in 8 cows (7.41 %) from the control and 8 cows (7.55 %) in the treatment groups. The number of calves born was to the tune of 92.59 and 92.45 per cent in control and treatment groups, respectively (Table 4).

**Table 3: Conception rate observed in studied population**

Particulars	Control Group	Treatment Group	Over All
Animals Conceived	108 (45.96 %)	106 (64.24 %)	214 (53.50 %)
Animals Repeated	127 (54.04 %)	59 (35.76 %)	186 (46.50 %)
Total No of Inseminations	235	165	400

Note: figures in the parenthesis are the percentages

**Figure 1: Conception rate observed in studied population****Table 4: No. of calves born and abortions**

Particulars	Control Group	Treatment Group	Over All
Calves Born	100 (92.59 %)	98 (92.45 %)	198 (92.52 %)
Abortions	8 (7.41 %)	8 (7.55 %)	16 (7.48 %)
Total	108	106	214

Note: figures in the parenthesis are the percentages

#### Female: Male ratio of the calves born

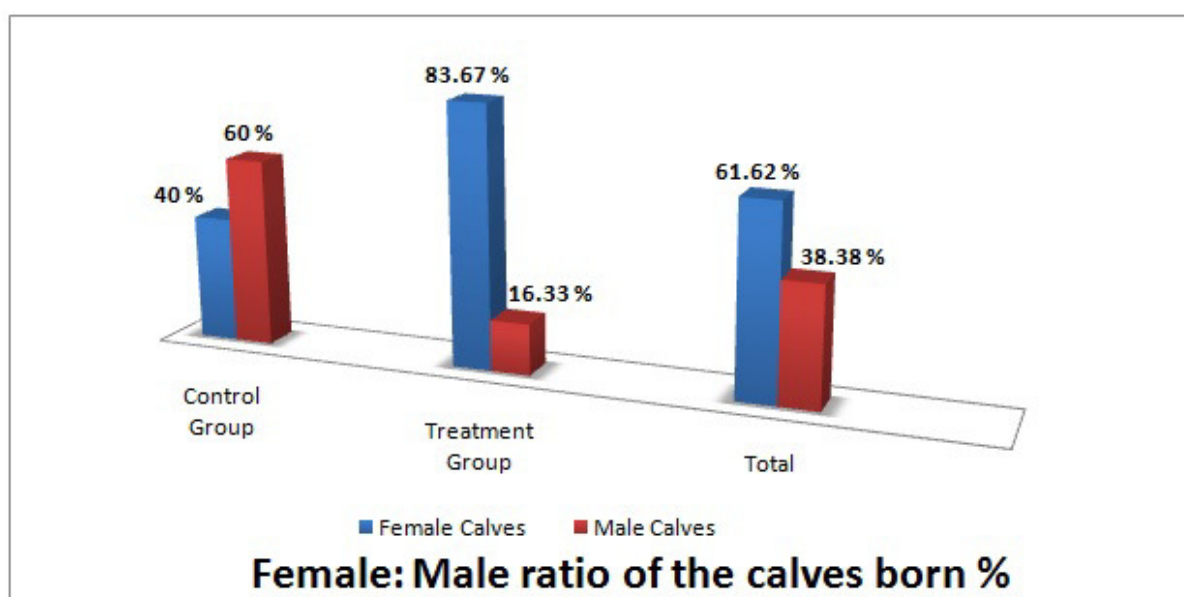
The total number of calves born were 198 comprising of 122 (61.62 %) and 76 (38.38 %) female and male calves, respectively. It is evident from the table 5 and figure 2 that out of 100 calves obtained from the control group 40 (40.00%) were females and 60 (60.00%) were male calves. Similarly, out of 98 calves born to the cows from the treatment group, 82 (83.67%) were females and 16 (16.33%) were male calves. The sex ratio of male to female

calves from control group was 60: 40; whereas, the same was recorded as 16.33 in case of the treatment group.

**Table 5: Female: Male ratio of the calves born**

Sex of the calves	Control Group	Treatment Group	Over All
Female	40 (40.00%)	82 ( <b>83.67%</b> )	122 (61.62%)
Male	60 (60.00%)	16 (16.33%)	76 (38.38%)
Total	100	98	198

Note: figures in the parenthesis are the percentages



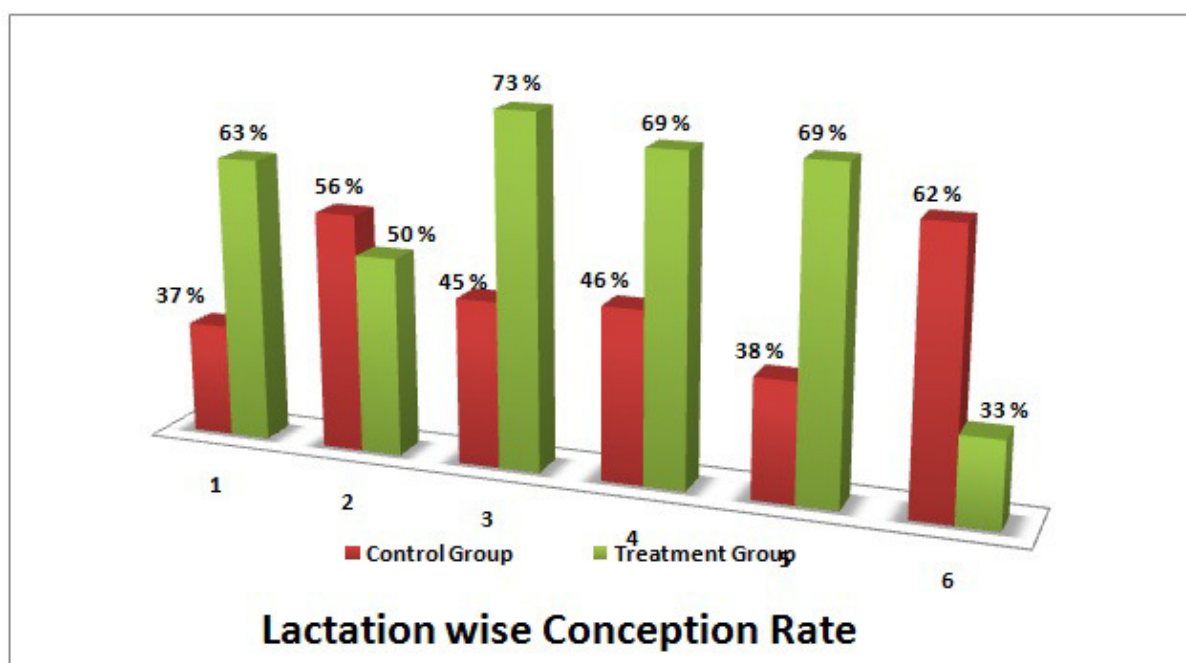
**Figure 2: Percentages of female and male calves born**

#### Lactation wise conception rate

The lactation wise conception rate recorded in studied population is presented in table 6 and figure 3. The conception rate in case of treatment group across the lactation numbers was better compared to control group. Consistently, during the 3<sup>rd</sup> (73.17%), 4<sup>th</sup> (69.23%), 5<sup>th</sup> (69.23%) and 1<sup>st</sup> (63.33%) lactations. The conception rate was phenomenal. Only in case of 6<sup>th</sup> lactation the conception rate in the control group was better (62.50%) compared to the treatment group (33.33%) probably due to minimum number of observations. Better conception rates during 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> lactations comparable to the first lactation of the treatment group are quiet promising.

**Table 6: Lactation wise Conception Rate**

No. of Lactation	Control Group				Treatment Group			
	No. of cows	Conceived	Aborted	Calves Born	No. of cows	Conceived	Aborted	Calves Born
1	51	19 (37.25%)	0	19	30	19 (63.33%)	2	17
2	39	22 (56.41%)	3	19	38	19 (50.00%)	0	19
3	51	23 (45.09%)	2	21	41	30 (73.17%)	2	28
4	52	24 (46.15%)	2	22	39	27 (69.23%)	3	24
5	21	8 (38.09%)	0	8	13	9 (69.23%)	1	8
6	16	10 (62.50%)	1	9	3	1 (33.33%)	0	1



**Figure 3: Percentages of lactation wise conception rate**

Lactation wise Female: Male calves ratio

Table 7 and figure 4 indicate the number of calves born to the cows from both the control and treatment group, and corresponding female: male ratio. It is obvious that the sex ratio in favour of female calves was far superior in the treatment group where the minimum figure was 78.94: 21.05 during the 2<sup>nd</sup> lactation.

In the control group only two categories; lactation numbers 3<sup>rd</sup> and 6<sup>th</sup> exhibited female calves at 55.00 per cent. Whereas, in the 1<sup>st</sup> lactation the female calves obtained were 47.36 per cent and in 2<sup>nd</sup>, 4<sup>th</sup> and 5<sup>th</sup> lactation the female calves born were 31.57, 31.81 and

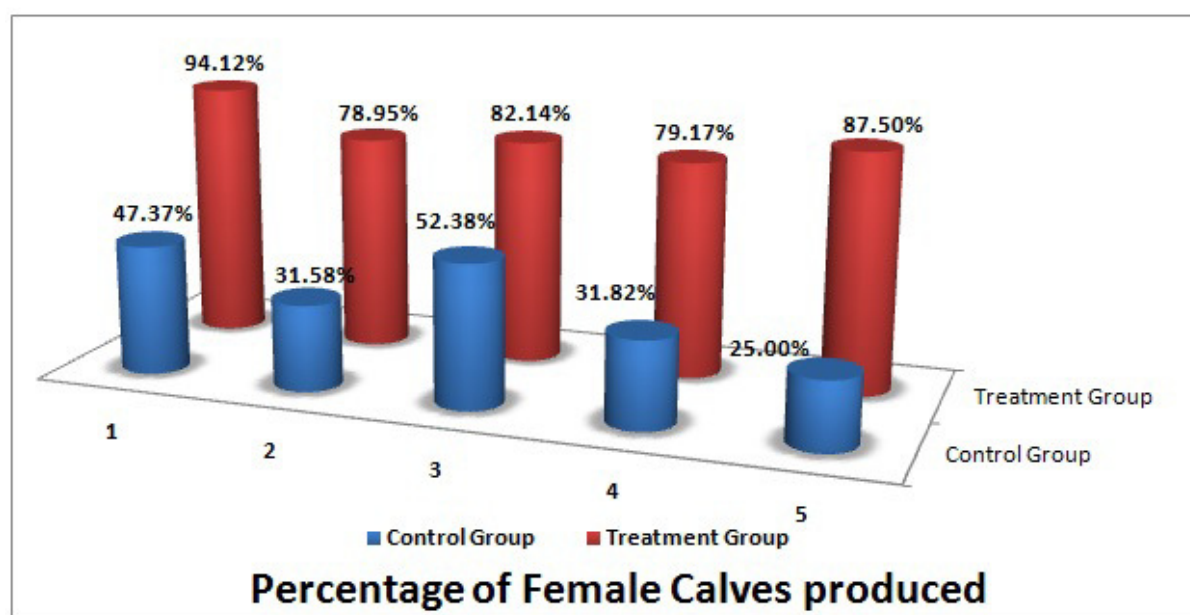
25.00 per cent, respectively. Rest of the lactation groups (control) revealed a predominant male sex ratio.

Unbelievable sex ratio of 94.11:05.89 was recorded in the first lactation in the treatment group. The numbers of female calves obtained were to the tune of 94.11, 78.94, 82.14, 79.17 and 87.50 per cent from the 1<sup>st</sup> lactation to 5<sup>th</sup> lactation groups under treatment group.

Hence, it may be concluded from the present study that oral administration of Aulprofem<sup>(R)</sup> improves the conception rate and female calf ratio in cows.

**Table 7: Lactation wise Female: Male Ratio**

No. of Lactation	Control Group				Treatment Group			
	Calves Born	Female Calves	Male Calves	Female: Male Ratio	Calves Born	Female Calves	Male Calves	Female: Male Ratio
1	19	9	10	47.36: 52.63	17	16	1	94.11: 05.89
2	19	6	13	31.57: 68.42	19	15	4	78.94: 21.05
3	21	11	10	55.00: 45.00	28	23	5	82.14: 17.85
4	22	7	15	31.81: 68.18	24	19	5	79.17: 20.83
5	8	2	6	25.00: 75.00	8	7	1	87.50: 12.50
6	9	5	4	55.00: 45.00	1	1	0	100.00: 00.00



**Figure 4: Percentages of lactation wise female and male calves born**

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