Original Research Article

Effect of Different Hormonal Protocols and Nutrient Supplementation on Reproductive Performance of Cattle under Different Field Conditions

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A B S T R A C T

Bovine infertility is a major issue in dairy industry and it is primarily addressed by hormonal therapy. In present study we compared ovarian structure palpation based minimum hormonal utilization approach (KVK-RDDC protocol) with other estrus synchronization protocols. This study was conducted on 315 infertile cows kept in different managemental conditions i.e. Commercial dairy farms, villages and Gaushala’s in different areas of Udaipur district of Rajasthan. These 315 infertile cows were divided in three feed groups mainly balanced feed without mineral and vitamin mixture, balanced feed with vitaminised chelated mineral mixture and balanced feed with vitaminised chelated oxicareovn solution. These feed groups were treated with five therapy protocols viz. No hormone, Ovosynch(GPG48), Cosynch(GPG56), Cosynch+ progesterone (GPG56+ CIDR) and KVK-RDDC. The study revealed that the group 3 which fed balanced feed with vitaminised chelated oxicareovn solution have highest conception rate i.e. 61.0 % and followed by group 2 (Balanced feed with vitaminised chelated mineral mixture) and group 1 (Balanced feed i.e without mineral and vitamin mixture) viz. 44.8% and 29.5 %, respectively. On the basis hormone protocol, the animals which were treated with KVK-RDDC protocol have highest conception rate of 61.9 % and followed by GPG+CIDR (46.0%), GPG-56(46.0%), GPG-48(42.9%) and no hormone protocol (28.6%). On the basis of different managemental conditions, highest conception rate were of at commercial dairies i.e. 55.2% and followed by village animals (43.8%) and Gaushala’s (36.9%).

Keywords
Balanced feed, Conception rate, Hormonal protocols, Infertile cattle, Vitaminised chelated oxicareovn solution

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Introduction

India’s livestock sector is one of the largest in the world, distributed over 100 million households in approximately 600000 villages. It has 56.7% of world buffaloes and 12.5% world cattle comprising 109.85 million buffaloes and 192.49 million cattle (20th Indian livestock census, 2019). Rajasthan ranks second with 11% of the total livestock population in the country after Uttar Pradesh. The state has 13.32 million of cattle and 12.98 million of buffalo (19th Indian livestock census, 2012), possessing high yielding breeds of cattle (Rathi, Gir, Sahiwal) and buffalo (Murrah and Surti). In Rajasthan, Animal husbandry is not merely a subsidiary to agriculture but it is a major activity which plays a vital role in livelihood, employment, economy, food security and nutrition. This contributes to balanced growth, gender equality and in reducing rural poverty. Livestock sector accounts for 30-50% of economy of rural Rajasthan and contributes approximately 13% to the state GDP (World Bank, 2018).

Livestock productivity or production efficiency is to a large extent dependent on reproductive performance. Proper nutrition could encourage mediocre biological types to reach their genetic potential and also alleviate the negative effects of a harsh physical environment. Deficiencies of various trace minerals, inadequate vitamin intake, energy, protein imbalance and excessive protein intakes are mentioned as contributive to infertility and poor reproductive performance (Amin, 2014).

In Udaipur district, livelihood security despite erratic monsoon is largely contributed by livestock. However, the major problem faced by the farmers is infertility in most of breedable population. This infertile population is a serious burden on resource poor farmer. Solution to this serious problem can usher in prosperity for the tribal and other livestock rearing farmers.

Hormones play an important role in cattle reproduction. Number of infertility treatment protocols are available in cattle based on the use of various hormones like GnRH, PGF$_{2α}$ (Pursley et al., 1995, Geary et al., 1998, Cartmill et al., 2001, DeJarnette et al., 2001, Kantharaj et al., 2015, Barolia et al., 2016), Progesterone (Melendez et al., 2006, Chebel et al., 2010), estrogen (Cavestany et al., 2003) and their various combination (Geary et al., 1998, Lemaster et al., 2001, Cavestany et al., 2003). However, Gonadotropin-releasing hormone (GnRH) and Prostaglandin used to increase pregnancy rate by inducing ovulation and improving the sperm transport in the female reproductive tract in dairy cattle and has been proven to be very successful (Odde, 1990).

Bovine infertility, silent estrus and repeat breeding are the major problems which reduce conception rate, increases inter-calving interval and dry period are major causes of loss and worry for livestock owners. Due to limited availability for feed, fodder, water, pasture and other resources, rearing of non-productive and low productive animals are very costly, challenging and become a burden for livestock owners. (Howlader et al., 2019)

Scientist are now working on developing new estrus synchronization protocols which can reduce the ovulation time window post synchronization so as to practice insemination at a fixed time thereby obviating the need for heat detection which is a serious problem especially in buffaloes (Prakash et al., 2012). A new ovarian structure palpation based estrus synchronization protocol for cows and buffaloes have been developed recently by Vidya Bhawan KVK, Badgaon Udaipur and Regional disease diagnostic center,
Department of AH, Udaipur. This protocol is an ovarian structure palpation based combination of GnRH – PGF$_{2\alpha}$ – GnRH injection which has been reported to considerably narrow down the ovulation time to a range of 24 hours to achieve the minimum rate with fixed time artificial insemination.

Present study we have evaluated the KVK-RDDC$^3$ protocol with other established hormonal protocol of estrus synchronization in various feeding supplement groups of infertile animals.

**Materials and Methods**

**Animals selection**

A total of 315 Infertile cows were kept under different managerial conditions *i.e.* in commercial dairies, in different village conditions (unorganized manner) and *Gaushala* were included in this study (Animal and Area details-Table 1)

**Feed groups**

In the present study on the basis of feed (composition-Table 2) provided to the cattle, the cattle were divided into three feed groups.

i) Group 1 - Control.-Balanced Feed without mineral and vitamin mixture

ii) Group 2- Balanced Feed + vitaminised chelated mineral mixture- Added 3.35% of vitaminised chelated mineral mixture with above balance feed.

iii) Group 3- Balanced Feed + vitaminised chelated oxicareovn solution provided by DSM Pvt. Limited– Added 3.35% of vitaminised chelated oxicareovn solution with above balance feed.

The feed was offered to each cattle for 60 days *i.e.* 2 kg feed/day/animal. The hormonal treatment was started after 30 days of feeding.

**Protocol groups**

Different hormonal protocols were used in these animals are as under.

i. No hormone: only balance feed with or without minerals and vitamins no other hormone

ii. GPG 48 (Ovosynch protocol)- First injection on day zero, seven days after GnRH injection PGF$_{2\alpha}$, 48 hours after PGF$_{2\alpha}$, II injection of GnRH repeated followed by Two AI at 12 hours apart.

iii. GPG 56 (Cosynch protocol) - First injection of GnRH on day zero, seven days after GnRH injection PGF$_{2\alpha}$, 56-60 hours after PGF$_{2\alpha}$, II injection of GnRH repeated followed by two$^4$ AI at 12 hours apart.

iv. GPG 56 + CIDR (Cosynch+progesterone therapy) - First injection of GnRH on day zero, with CIDR(intravaginal progesterone releasing device) seven days after GnRH injection PGF$_{2\alpha}$ and removal of CIDR 56-60 hours after PGF$_{2\alpha}$, II injection of GnRH repeated followed by Two AI at 12 hours apart.

v. Ovarian structure based on KVK- RDDC, Udaipur protocol.

The treatment plan is based on modifying the estrus cycle of the particular animal using hormonal treatment on the basis of presence and absence of specific structure on the ovaries.

This treatment is not synchronization of estrus in true sense because all animals selected will not be coming in estrus at the same time. Thorough rectal palpation will be done and ensure there is no abnormality and animal is not pregnant and based on ovarian structures, the selected animals are divided into two groups.
Group 1 - Animals having prominent luteal structure
Group 2 - Animals not having prominent luteal structure
These Animals of group 2 were examined after 7 days and subdivided into two groups depending upon the response of the treatment given.

| S. N. | Days          | Observation                          | Intervention                     |
|-------|---------------|--------------------------------------|----------------------------------|
| 1     | Day 01        | Prominent luteal structure palpated  | Inj. PGF$_{2a}$ IVSM * or I/M**  |
| 2     | Day 02 / 03   | Some animals showed good signs of heat. | Inj. GnRH (Deep I/M) and perform A.I. and repeat A.I. after 12 hrs. |
| 3     | Day 03        | Animals not showed good signs of heat. | Inj. GnRH (Deep I/M) Perform A.I. (Fixed time A.I.) after 12 hrs and repeat A.I. after 8-12 hrs. |
| 4     | Day 05 to 10  | Some of animals (5–10%) come in heat | Perform A.I. (if no functional CL is present) |

Treatment details for Group 2: Animal not having prominent luteal structure (these animals may have prominent follicular structure or no palpable structures on ovaries)

| S. N. | Days          | Observation                          | Intervention                     |
|-------|---------------|--------------------------------------|----------------------------------|
| 1     | Day 01        | Prominent follicular structure OR No palpable structure | Inj. GnRH 2.5 ml I/M |
|       |               | Follicular cyst                       | Inj. GnRH 5 ml I/M               |
| 2     | Day 02 – 07   | Some animal may come in heat         | Perform A.I. and repeat AI after 8-12 hrs. |

Day 07 Perform rectal palpation to observe ovarian structures

Treatment details for Group 2A: (If prominent Luteal structure is found)

| S. N. | Days          | Observation                          | Intervention                     |
|-------|---------------|--------------------------------------|----------------------------------|
| 1     | Day 07        | Prominent luteal structure palpated  | Inj. PGF$_{2a}$ IVSM or I/M      |
| 2     | Day 08 / 09   | Some animals may show good signs of heat. | Inj. GnRH (Deep I/M) and perform A.I. and repeat AI after 12 hrs. |
| 3     | Day 09 / 10   | Animals may or may not show good signs of heat. | Inj. GnRH (Deep I/M) Perform A.I. (Fixed time A.I.) after 12 hrs and repeat AI after 8-12 hrs. |
| 4     | Day 11 to 15  | Some of animals (5–10%) may come in heat | Perform A.I. |
Treatment details for Group 2 B: (If prominent follicular structure or no palpable structure is found)

| S. N. | Days  | Observation                                                                 | Intervention          | Interventions |
|-------|-------|------------------------------------------------------------------------------|-----------------------|---------------|
| 1.    | Day 07| Prominent Follicular Structure or No Palpable Structure is found             | Inj. GnRH             | 2.5 ml I/M    |

Repeat same procedure as mention above using PGF$_{2\alpha}$ (Day-14), GnRH (Day-16) and followed by A.I. (Day 16 / 17).

*IVSM (Intra vulvo submucosal route) **IM (Intra muscular)

Breeding: All cows were artificially inseminated with frozen semen of high fertility. AI was performed as per the plan after hormonal treatment.

Pregnancy diagnosis: All the inseminated cows which did not return to estrus were examined manually through rectum at day 35 - 45 and scanned ultra sonographically for the confirmation of pregnancy.

Parameters recorded: Conception rate (%) (\%)

**Results and Discussion**

Bovine infertility is a major concern to improve the economic status of Indian semi-organized dairy farmers. This is a single most factor responsible for abandon of the animals. So addressing this problem in a systematic and scientific manner is of prime importance. If we evaluate the cause of bovine infertility the major factor comes out is nutritional causes due to imbalance feed and feed with lack of micronutrient leads to disturbance of estrus cycle of cattle and buffalo results in repeat breeding. Further role of better management cannot be ruled out. Methods of address the infertility through hormonal therapy are documented very well (Roberts, 1986). With better nutrition this therapy gives higher conception rate. These all protocol Ovosynch, Cosynch and Cosynch+ progesterone therapy are blind protocols and require minimal animal investigation and moderate conception rate (Galvao and Santos, 2012).

But if we adopt the ovarian structure palpation based protocol with minimal hormonal intervention as required will definitely reduce the cost of therapy and improve the results in term of conception rate (Robert’s 1986 2nd edition). Though it requires extensive animal examination but conception rate will be high so it will prove ultimately beneficial. Another benefit of ovarian structure based hormonal therapy is utilization of the intravulvo-submucosal route (to reduce the dose of PGF$_{2\alpha}$ up to one- fourth of the IM route) was considered. PGF$_{2\alpha}$ is fatty acid in nature. In nature, the secretion of PGF$_{2\alpha}$ is caused by the uterine horn epsilateral to the ovary having CL. This hormone when drained by the uterine vein diffuses into the ovarian artery forms a coiling mesh around this vein and thus the hormone directly reaches to ovary having CL to cause its luteolysis. This mechanism forms the basis for using lower doses of PGF$_{2\alpha}$ injection by epsilateral VSM route (Parmar et al., 2016) which not only reduce the cost of PGF$_{2\alpha}$ but also improve its efficiency. One such protocol has been developed and tried on thousands of animals by Krishi Vigyan Kendra (KVK) and Regional Disease Diagnostic Centre (RDDC) Department of Animal Husbandry Udaipur Rajasthan (commonly termed as KVK-RDDC protocol).

Here in this study we incorporate the Ovosynch, Cosynch, Cosynch+CIDR and KVK-RDDC protocols for treatment of bovine infertility under different nutritional and management conditions.
As described in materials and methods, we selected animals from different habitat i.e. organized commercial farms, semi-organized farms and at unorganized villages and gaushala’s®. Further animal feed group were developed three as group-1 only balance feed, group -2 having balance feed+ vitaminised chelated mineral mixture from well reputed company and group-3 balance feed + chelated oxycareovn solution provided by DSM Pvt. Limited.

Minerals and vitamins play an important role with balanced feed and support to infertility by improving reproductive performance and health with little additional cost. Their imbalance causes various problems leading to lowered reproductive efficiency and resultant monetary loss to the dairy industry (Kumar et al., 2011).

The cost of balance feed calculated on the basis of raw material cost in the open market (in pellet form and packaging) provided to feed group 1 was Rs. 20.79/kg whereas for feed group 2 and feed group 3, it was Rs. 27.09/kg and Rs. 30.77/kg, respectively. The additional cost incurred for mineral and vitamin mixtures in group 2 and group 3 animals would certainly be reimbursed with high production potentiality after calving and also higher reproductive efficiency. The effect of nutrient supplementation on conception rate (Table-4) showed that balanced feed with vitaminised chelated oxycareovn solution (feed group 3) has highest conception rate of 61.0% followed by 44.8% in balanced feed with vitaminised chelated mineral mixture (feed group 2) and 29.5% in balance feed with no minerals and vitamins (feed group 1) whereas Puvarajan and Vijayrajan (2013) and Mohapatra et al., (2012) found 97.38% and 60% conception rate, respectively.

The higher conception rates in balanced feed with chelated oxycareovn solution observed may be due to supplementation of minerals as per NRC 2001 recommendation and also follow the optimum vitamin nutrition recommendations. In India, the main factors behind low production and suboptimal reproductive efficiency of our livestock is due to inadequate nutrition and that too particularly because of mineral deficiency because of their role in follicular dynamics, ovarian activity and fertility Minerals are the integral component of production in animal diet (Ansteguï et al., 1999, Boland, 2003, Coran and Ives, 1991).

The effect of different hormonal protocols under feed group 3 (Table-3) revealed that the conception rate is highest in the ovarian structure based KVK-RDDC protocol i.e. 76.2%. As this protocol is developed and followed by us in and around Udaipur Rajasthan, so there is no data available to compare it yet in present study the conception rate is higher than our previous studies (unpublished data not shown here). The higher conception rate may be due to better micronutrient supplement in oxycare group-3. As compared to Cosynch (GPG 48) (61.9%), Ovisynch (GPG 56) (61.9%), and Ovosynch+ progesterone therapy (GPG 56 + CIDR) (57.1%) and no hormone (47.6%), the conception rate was better in our KVK-RDDC® protocol.

The conception rate observed by different researchers with Ovosynch protocol viz. Barolia et al., (2016) 66.66%, Amle et al., (2015) 60%, Geary et al., (1998) 59.0%, Geary et al., (1998) 57.0%, Pursley et al., (1995) 50.0%, Pursley et al., (1997) 35.0% and Melendez et al., (2006) found conception rate of 22.7%. The variation in our finding regarding the conception rate might be due to selection of animals from different management condition i.e. from Gaushala's, villages, and organized dairy farms.
| Protocols Feed group | No Hormone | GPG-48 | GPG-56 | GPG-CIDR | KVK- RDDC | Total |
|----------------------|------------|--------|--------|----------|-----------|-------|
| Balanced feed (No Minerals and Vitamins) | Miraj (G) -7 | Bansda (G) -7 | Bansda (G) -7 | Bansda (G) -4 | Miraj (G) -7 | 21 |
| | Eklingpura (C) -1 | Eklingpura (C) -2 | Eklingpura (C) -1 | Miraj (G) -3 | Infert. clinic (C) -1 | 21 |
| | Imperial (C) -6 | KVK (C) -5 | KVK (C) -5 | Dabok (C) -7 | KVK (C) -6 | 21 |
| | Gadwa (V) -7 | Gadwa (V) -7 | Debok (C) -1 | Junawas (V) -7 | Junawas (V) -7 | 21 |
| | Total | 21 | 21 | 21 | 21 | 21 | 105 |
| Balanced feed + Vitaminised chelated mineral mixture | Bansda (G) -7 | Bansda (G) -7 | Bansda (G) -4 | Miraj (G) -7 | Miraj (G) -7 | 21 |
| | Eklingpura (C) -1 | Eklingpura (C) -1 | Miraj (G) -3 | Infert. clinic (C) -6 | Infert. clinic (C) -7 | 21 |
| | Imperial (C) -6 | KVK (C) -6 | Eklingpura (C) -2 | Eklingpura (C) -1 | Fatehpura (V) -7 | 21 |
| | Fatehpura (V) -2 | Gadwa (V) -7 | KVK (C) -5 | Fatehpura (V) -7 | Fatehpura (V) -7 | 21 |
| | Gadwa (V) -2 | | | Fatehpura (V) -4 | | |
| | Junawas (V) -3 | | | Gadwa (V) -3 | | |
| | Total | 21 | 21 | 21 | 21 | 21 | 105 |
| Balanced feed + Vitaminised chelated oxicareovn solution | Miraj (G) -7 | Miraj (G) -7 | Miraj (G) -7 | Miraj (G) -7 | Miraj (G) -7 | 21 |
| | Imperial (C) -7 | KVK (C) -7 | KVK (C) -7 | Infert. clinic (C) -7 | Debok (C) -1 | 21 |
| | Fatehpura (V) -7 | Fatehpura (V) -7 | Fatehpura (V) -7 | Fatehpura (V) -6 | KVK (C) -6 | 21 |
| | | | | | Gadwa (V) -1 | 21 |
| | Total | 21 | 21 | 21 | 21 | 21 | 105 |
| Grand Total | 63 | 63 | 63 | 63 | 63 | 315 |

C= Commercial dairy farm, V= Village, G= Gaushala,
Table 2 Balanced Feed Composition (Group1)

| Ingredients   | Qty (kg.) |
|---------------|-----------|
| Maize         | 20.0      |
| Barley        | 13.0      |
| Moong Churi   | 7.5       |
| Molasses      | 4.0       |
| Rice Polish   | 5.0       |
| GNC           | 20.0      |
| Guar Korma    | 10.0      |
| By Pass Fat   | 1.5       |
| DORB          | 10.0      |
| DCP           | 3.0       |
| Salt          | 1.6       |
| Calcite       | 3.7       |
| Na bi Carb    | 0.375     |
| MgO           | 0.125     |
| Toxin Binder  | 0.2       |
| Total         | 100.0     |

Table 3 Effect of hormonal protocols under different nutrient supplement on conception rates in cows

| Hormonal Protocols   | Balanced feed (No Minerals and Vitamins) | Balanced feed + Vitaminised chelated mineral mixture | Balanced feed + Vitaminised chelated oxicare ovn solution | Total |
|----------------------|------------------------------------------|-----------------------------------------------------|---------------------------------------------------------|-------|
|                      | Conceived/total animals (%)               |                                                     |                                                         |       |
| No Hormone           | 4/21 (19.0%)                             | 4/21 (19.0%)                                        | 10/21(47.6%)                                            | 18/63(28.6%) |
| GPG 48               | 5/21(23.8%)                             | 9/21 (42.9%)                                        | 13/21(61.9%)                                            | 27/63(42.9%) |
| GPG 56               | 6/21(28.6%)                             | 10/21 (47.6%)                                       | 13/21(61.9%)                                            | 29/63(46.0%) |
| GPG 56 + CIDR        | 6/21(28.6%)                             | 11/21 (55.0%)                                       | 12/21(57.1%)                                            | 29/63(46.0%) |
| KVK-RDDC             | 10/21(47.6%)                            | 13/21 (61.9%)                                       | 16/21(76.2%)                                            | 39/63(61.9%) |
| Total                | 31/105(29.5%)                           | 47/105 (47.8%)                                      | 64/105 (61.0%)                                          | 142/315(45.0%) |
Table 4 Effect of different nutrient supplementation on conception rates in cows

| Feed Group                                      | Number of animals | Number of animals conceived | Percent conception (%) |
|------------------------------------------------|------------------|----------------------------|------------------------|
| Balanced feed (No Minerals and Vitamins)       | 105              | 31                         | 29.5                   |
| Balanced feed + Vitaminised chelated mineral mixture | 105              | 47                         | 44.8                   |
| Balanced feed + Vitaminised chelated oxicare ovn solution | 105              | 64                         | 61.0                   |

Table 5 Effect of nutrient supplementation under different field conditions on conception rates in cows

| Field Condition   | Balanced feed (No Minerals and Vitamins) | Balanced feed + Vitaminised chelated mineral mixture | Balanced feed + Vitaminised chelated oxicare ovn solution | Total |
|-------------------|------------------------------------------|-----------------------------------------------------|----------------------------------------------------------|------|
|                   | Conceived/total animals (%)              |                                                     |                                                          |      |
| Commercial dairies| 13/35 (37.1%)                            | 20/35 (57.1%)                                       | 25/35 (71.4%)                                            | 58/105 (55.2%) |
| Village animals   | 10/35 (28.6%)                            | 16/35 (45.7%)                                       | 20/35 (57.1%)<sup>18</sup>                               | 46/105 (43.8%) |
| Gaushala          | 8/35 (22.9%)                             | 11/35 (31.4%)                                       | 19/35 (54.2%)                                            | 38/105 (36.2%) |

Table 6 Effect of hormonal protocols under different field conditions on conception rates in cows

| Field Condition   | No Hormone | GPG 48 | GPG 56 | GPG 56 + CIDR | KVK-RDDC | Total |
|-------------------|------------|--------|--------|---------------|----------|-------|
|                   | Conceived/total animals (%)              |         |        |               |          |       |
| Commercial Dairies| 7/21 (33.3%) | 12/21 (57.1%) | 12/21 (57.1%) | 12/21 (57.1%) | 15/21 (71.4%) | 58/105 (55.2%) |
| Village animals   | 6/21 (28.6%) | 9/21 (42.9%) | 10/21 (47.6%) | 9/21 (42.9%) | 12/21 (57.1%) | 46/105 (43.8%) |
| Gaushala          | 5/21 (23.8%) | 6/21 (28.6%) | 7/21 (33.3%) | 8/21 (38.1%) | 12/21 (57.1%) | 38/105 (36.9%) |

The effect of different hormonal protocols under feed group 2 (Table-3) showed the highest conception rate of 61.9% in ovarian structure based KVK-RDDC protocol followed by GPG 56 + CIDR (55.0%), GPG 56 (47.6%), GPG 48 (42.9%) and no hormone (19.0%).
The effect of different hormonal protocols under feed group 1 (Table-3) showed the highest conception rate of 47.6% in ovarian structure based KVK-RDDC protocol followed by GPG 56 + CIDR (28.6%), GPG 56 (28.6%), GPG 48 (23.8%) and no hormone (19.0%).

In present study, in ovsynch and cosynch protocol the conception rate is somewhat lower than reported by earlier by Barolia et al., 2016 (66.66%) and similarly reported by Neglia et al., (2003) & Baruselli et al., (2001). It may be due to various feeding and managemental conditions of selected animal group because all above said workers reported that percentage of conception rate in same breed of cows and same feeding and managemental conditions. But our KVK-RDDC protocol we received higher percentage of conception rate which was excepted as we monitored the development of ovarian structure and treated the animals accordingly.

During our study it has been observed that commercial farms have balanced availability of feed and green fodder, minerals and vitamins supplementation, scientific management conditions, better preventive health care etc. The effect of various treatments of nutrient supplementation under different field conditions revealed that in vitaminised chelated oxicareovn solution in commercial dairies have higher conception rate (71.4%) followed by 57.1% for village animals, whereas it was minimum (54.2%) under Gaushala condition(Table 5).

The availability of balanced feed and fodder and good management conditions favour’s to increase production potentiality and reproductive efficiency of the bovine (NDDB, 2012). The effect of different hormonal protocol under different field conditions showed that KVK-RDDC Udaipur have highest conception rate in all field conditions followed by GPG 56, GPG 56 + CIDR, GPG 48 and no hormone(Table 6).

Hence concluded in our study, we found that ovarian structure palpation based KVK-RDDC protocol to treat bovine infertility gave better conception rate followed by ovsynch (GPG48), cosynch(GPG56) and cosynch + progesterone(GPG56+CIDR) protocols. Further animal fed on balance diet+ oxycareovn solution have better conception rate among all four treatment protocols. Better management also proved helpful in increasing the conception rate among selected animals.

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References

19th Indian livestock census, 2012. The department of animal husbandry and dairying under ministry of fisheries.
20th Indian livestock census, 2019. The department of animal husbandry and dairying under ministry of fisheries.
Amin, R.U. 2014. Nutrition It’s role in reproductive functioning of cattle-a review. Veterinary Clinical Science. 2(1): 1-10.
Amle, M.B., Navkar, S.G., Birade, H.S., Gaikwad, S.M., Ulemale, A.H. and Patil, K.N. 2015. Reproductive performance in cross brred cows using in Ovsynch protocol. National symposium on “Current challenge and opportunities in animal reproduction. 27.
Ansotegui, R. P., Bailey, J. D., Paterson, J.
A., Hatfield, P. G. and Swenson, C. K. 1999. Effects of supplemental trace mineral form on copper status, estrus, ovulation rate, and fertility in beef heifers. Am Soc Anim Sci. 50: 189-192.

Barolia, Y., Shende, K., Vaishnava, C.S. and Nagda, R.K. 2016. Comparative study of Cosynch and Ovsynch Protocol on fertility in repeat breeder Gir cow. Int. J. Of science, Envr. Tech. 5(4): 1874-1878.

Baruselli, P.S. (2001). Control of follicular development applied to reproduction biotechnologies in buffalo. Proceedings of the I congress Nazionale sull allevamento del Buffalo., Book of the congress. p. 128-146.

Boland, M. P., Lonergan, P. and Callaghan, O. 2001. Effect of nutrition on endocrine parameters, ovarian physiology and oocyte and embryo development. Theriogenology. 55: 1323-1340.

Cartmill, J.A., El-Zarkouny, S.Z., Hensley, B.A., Lamb, G.C. and Stevenson, J.S. 2001. Stage of cycle, incidence, timing of ovulation and pregnancy rates in dairy cattle after three time breeding protocol. J dairy Sci. 84(5):1051-1059.

Cavestany, D., Cibils, J., Freire, A., Sastre, A. and Stevenson, J.S. 2003. Evolution of two different oestrous-synchronization methods timed artificial insemination and resyncronization of return to oestrus in lactating Holstein cows. Anim. Reporod Sci.77:141-155.

Corah, L. R. and Ives, S. 1991. The effects of essential trace minerals on reproduction in beef cattle. Vet Clin North Am Food Anim Pract. 7: 41-57.

Chebel, R.C., Al-Hassan, M.J., Fricke, P.M., Santosh, J.E.P., Lima, J.R., Marte, I.C.A., Stevenson, J.S., Garcia, R. and Ax, R.L. 2010. Supplementation of progesterone via CIDR insert during ovulation synconization protocol in lactating dairy cows. J Dairy Sci.93:922-931.

DeJarnette, J.M., Salverson, R.R. and Marshal, I.C.E. 2001. Incidence of premature estrus in lactating dairy cows and conception rate to standing estrous or fixed time insemination after synconization using GnRH and PGF2α. Ani. Reprod. Sci.67:27-35.

Galvao, K.N. And Santos, J.S.P. 2008. Factors Affecting Synchronization and Conception Rate after the Ovsynch Protocol in Lactating Holstein Cows. Reproduction in Domestic Animals. 45(3):439-46.

Geary, T.W. and Whittier, J.C. 1998. Effect of a timed insemination following synconization of ovulation using the ovsynch or Cosynch protocol in beef cows. Prof. Anim. Sci.14:217-220.

Howlader, M.M.R., Rahman, M.M., Hossain, M.G. and Hai. M.A. 2019. Factors Affecting Conception Rate of Dairy Cows Following Artificial Insemination in Selected Area at Sirajgonj District of Bangladesh. Biomed J Sci & Tech Res. 13(2)

Kantharaj, S., Murthy, V.C., Lakshmikanth, R.R., Honnappagol, S.S. and Krishnaswamy. a. 2015. A new progesterone (TRIU-B) based Ovsynch protocol for improving conception rate in repeat breeder cows. National symposium on "current challenges and opportunities in animal reproduction. 27.

Kumar, S, Pandey, A. K., Razzaque, W.A.A. and Diwvedi, D.K. 2011. Importance of micro minerals in reproductive performance of livestock.Veterinary World4(5):230-233.

Lemaster, J.W., Yelich J.V.,Kempfer, J.R., Fullenwider, J.K., Barnett, C.L., Fanning, M.D. and Selph, J.F. 2001. Effectiveness of GnRH plus PGF2 for estrus synchronization in cattle of Bos
indicus breeding. *J. Anim Sci.*79:309-16.

Melendez, P., Gonzale, G., Aguila, R.E., Lorea O., Risco, C. and Archbald, L.F. 2006. Comparison of two estrous synconization protocols and timed A.I. in dairy cattle. *J Dairy Sci.*89: 4567-4572.

Mohapatra, P., Swain, R.K., Mishra, S.K., School, and Rout, K.K. 2012. Effect of supplementation of area specific mineral mixture on reproductive performance of the cows. *Indian Journal of animal science.*82 (12): 1558-1563.

Neglia, G., Gasparrini, B., Di Palo, R., De Rosa C., Zicarelli, L. and Campanile, G. (2003). Comparison of pregnancy rates with two estrus synchronization protocols in Italian Mediterranean Buffalocow. *Theriogenology,* 60: 125-133.

NDDB, 2012. Nutritive value of commonly available feeds and fodders in India.

NRC, 2001. Nutrient requirements of Dairy cattle: 7th edn . *National Academipress.*: 105-1146.

Odde, K.G. 1990. A review of synchronization of estrus in postpartum cattle. *J.Anim. Sci.*68:817-830.

Parmar, S.C., Parmar, C.P. and Patel, J.A. 2016. Use of PGF$_2$α in ovarian and uterine pathological conditions of Bovine: A therapeutic approach. *Explor. Anim. Med. Res.* 6(2): 132-146.

Prakash, B.S., Kishore, B., Satyapal, Mohanty, T.K., Gosain, D.K. and Markandey, J.C. 2012. Application of Ovsynch Protocol for Fertility Improvement in buffaloes. *NDRI Publication.* 72:1-4.

Pursley, J.R., Mee, M.O. and Witbank, M.C. 1995. Synchronization of ovulation in dairy cows using PGF$_2$α and GnRH. *Theriogenol.* 44:915-923.

Pursley, J.R., Witbank, M.C., Stevenson, J.S., Ottobre, J.S.,Garverick, H.A. and Anderson, L.L. 1997. Pregnancy rates per artificial insemination for cows and heifers inseminated at a synchronized ovulation or synchronized estrus. *J. Dairy Sci.* 80(2): 295-300.

Puvarajan B. and Vijayarajan A. 2013. Effect of area specific mineral supplementation in anoestrous cross bred heifers, *Indian Journal Field Veterinarians.* 8(4): 43-44.

Roberts, S.J. 1986 Veterinary obstetrics and genital disease 2nd edition.

World Bank, 2018. Rajasthan Playing to its Strengths a Strategy for Sustained and Inclusive Growth. : 1-51.

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