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Effect of the administration of dextrose and phosphorous on reproductive performance of the repeat breeding crossbred cows

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Abstract
The present study analysed the effect of exogenous administration of phosphorous and dextrose on the reproductive performance of repeat breeding crossbred cows of Kerala. Fifty-two animals that were hard to settle and free from any genital infection but apparently deficient in nutrition were divided in to two groups (GI and GII). Animals in GI are inseminated without any treatment and those in GII were administered 15 ml of *Tonophosphan* (each ml contained sodium salt of 4-dimethyl amino-2-methyl phenyl-phosphatic acid – 0.2 g) by intravenous injection or 540 ml of 25 percent dextrose by intravenous infusion or both, based on the deficient blood constituents, and then inseminated and followed up. Overall conception rate of animals in GII after treatment was observed as 77.77 percent, where as that in the non-treatment group (GI) was only 11.11 percent. Conception rate in the animals treated with phosphorous alone was 71.42%, against 25.00% of non-treated group. It was observed high conception rate of 75.00% among the animals treated with dextrose infusion against 12.5% in not treated group. In those animals given combined treatment of phosphorous and dextrose, 87.5% increase in conception rate was observed, where no animals in non-treatment group conceived. The results of the present study showed that intravenous administration of phosphorous and dextrose considerably improves the conception rate among repeat breeding cows, which are deficient in those parameters.

Keywords: Blood glucose, serum phosphorous, conception rate, repeat breeding cows

Introduction
Productivity of the dairy cattle largely depends upon reproduction, and one of the major reasons for the reduced life-time milk production by an individual dairy animal is the transient loss of fertility or infertility. The reproductive efficiency is influenced by several physiological, pathological, nutritional and environmental factors. Thus, the reasons for infertility in dairy animals are many, and may be complex in nature. The normal reproductive cycle involves many stages spreading from the follicle development and maturation, ovulation, fertilization, implantation, the development and delivery of the normal fetus and its membranes, proper uterine involution and cleansing, resumption of the ovarian cyclicity and oestrus expression etc. The cycle may be disrupted at any of the stages leading to reproductive failure. On an average, 8-10 such cycles are expected to take place in the lifetime of dairy animals. Any disturbance to the routines of this cycle, caused by diseases, malnutrition, environmental, management or hereditary factors, issues with physiological functions of hormones may lead to infertility in the animal, mostly of transient nature.

To enhance the reproductive performance, optimizing the genotypes to the production environment coupled with suitable management practices is necessary, so that the inter-calving periods are shortened and the conception rates are high. The infertility will in turn force the farmers to distress sale of their crossbred high producing animals for meat purpose, which lead to the loss of superior germplasm and reduction in the number of high yielding crossbred animals. So, treating infertility and bringing more animals in to milking is of the paramount importance [1].

Anoestrus and repeat breeding are two of the major reproductive problems affecting 30 to 40 percent of total cattle and buffalo population of India [2]. In Kerala, the incidence was reported to be even higher (61%) and this is mostly attributed to the negative energy balance in high producing cows during the postpartum period [3]. During the production period, farmers often could not satisfy the increased demand of the nutrients in crossbred animals, and the reproductive performance is adversely affected [4, 5].

It is a well-established fact that the deficiency of phosphorous in blood leads to impaired reproductive performance in dairy cattle [6]. Deficiency of the phosphorous cause subnormal fertility, depressed or irregular oestrus and prolonged calving to conception interval in dairy cattle [7]. Similarly, glucose was also associated with the improved reproductive efficiency of dairy cows. It is reported that during the oestrus stage, an elevated level of serum glucose was observed in the dairy cows, as during this period, there is hyper activity and excitation, thereby increasing the metabolic activities [8]. Similarly, the blood glucose concentration was observed to elevated during the most fertile stage was observed to be greater in animals having regular and normal cycles than anestrus or sub-oestrus cows [9, 10].

But, reports are scanty on the effect of exogenous administration of the phosphorous and dextrose on the reproductive performance of deficient repeat breeding crossbred cows. Hence, the present study was carried out to examine the efficiency of intravenous administration of phosphorous and dextrose on improving the conception rate in repeat breeding crossbred cows of Kerala.

Materials and Methods

Crossbred cows brought for insemination at the Artificial Insemination Centre, College of Veterinary and Animal Sciences, Mannuthy, Kerala were used for the study. The breeding history and feeding practices of all these animals were collected in details and were subjected to detailed Gynaeco-clinical examination.

Fifty-two animals that were hard to settle, but free from any genital infection and apparently deficient in nutrition were selected for the study. Ten ml of blood was collected from the jugular vein of all the cows in test tubes, and allowed to clot. The serum was separated and using this, Glucose was estimated by O-Toludine method using Stangen Glucose kit. Five ml of reagent was mixed with 0.05 ml of the standard (S) and the serum (T), and heated for 10 minutes in boiling water bath. Then it was cooled and absorbance (A) was read at 630 nm against deionized water (Blank) in a spectrophotometer. Then glucose was estimated as the ratio of absorbance of Test to that of sample expressed in percentage.

Serum phosphorous was estimated by modified Metol method using *Stangen* Phosphorous Kit. 0.1 ml of serum (T), Standard (S) and deionized water (Blank) were pipetted into clean dry test tubes, and 1 ml of Metol reagent were added to all the test tubes. Mixed well and kept in room temperature for 5 minutes. Absorbance (A) was measured on a spectrophotometer at 680 nm within 30 minutes. Then phosphorous concentration was estimated as the ratio of absorbance of Test to that of sample multiplied by five.

Then the animals were divided in to two groups. The animals in the Group I (GI) were inseminated without any treatment and the results were followed up. Animals in the Group II (GII) were administered 15 ml of Tonophosphan (Each ml contains Sodium salt of 4-dimethyl amino-2-methyl phenyl-phosphenic acid 0.2 g, marketed by *Hoechst India Ltd*, Mumbai) by intravenous injection or 540 ml of 25 percent dextrose by intravenous infusion or both based on the deficient blood constituents and these animals were also inseminated and followed up. The data were collected and subjected to statistical analysis [11].

Results and Discussion

It was observed that the level of phosphorous ranged from 2.57 to 8.85 mg percent with a mean of 4.175 among the experimental animals. In case of blood glucose level, the values ranged from 22 to 81.81 mg percent with a mean of 47.27 mg percent among the experimental animals (Table 1).

Table 1: Blood glucose and phosphorous levels in the animals selected for the study

Animal No.	Phosphorous (mg %)	Glucose (mg %)	Animal No.	Phosphorous (mg %)	Glucose (mg %)	Animal No.	Phosphorous (mg %)	Glucose (mg %)
1	3.28	81.81	19	3.50	59.0	37	3.42	31.8
2	3.85	31.8	20	5.86	33.4	38	2.79	39.4
3	3.85	8.51	21	8.26	27.5	39	3.00	40.9
4	3.71	45.44	22	5.65	27.3	40	3.42	69.0
5	3.14	31.8	23	5.86	30.2	41	3.71	64.0
6	4.00	22.0	24	4.56	26.0	42	3.57	40.9
7	3.14	88.1	25	4.78	27.1	43	3.80	35.0
8	4.57	40.90	26	8.47	49.9	44	3.40	63.0
9	3.85	29.00	27	5.00	29.2	45	3.18	59.0
10	8.85	34.0	28	4.34	41.7	46	3.10	40.0
11	7.42	34.0	29	6.08	32.6	47	3.42	39.9
12	3.00	34	30	2.57	36.33	48	3.62	36.86
13	3.90	30.90	31	3.86	40.90	49	3.42	56.0
14	3.70	45.00	32	2.86	36.33	50	2.71	36.36
15	3.70	30.0	33	2.59	63.63	51	4.76	36.36
16	8.50	39.9	34	3.57	54.50	52	4.10	34.2
17	3.40	73.0	35	4.77	36.36	Mean ± SE	3.65±0.068	31.13±0.726
18	3.42	41.2	36	4.70	36.30			

The overall conception rate in experimental animals under different treatment regime are given below (Table 2). Out of 23 animals of the treated group, 22 animals were inseminated of which 16 conceived recording a conception rate of 77.77 percent.

Table 2: Conception rate in experimental animals with and without treatment

S. No.	Group	Number observed	Number inseminated	Number conceived	Conception rate (%)
1	GI	29	18	2	11.11
5	GII	23	22	16	77.77

Although protein, vitamins and mineral deficiencies are capable of producing poor fertility, the mean effect is that of deficient energy intake [12]. Animals that are poor or of moderate conditions of nutritional status, improved in conception rates when dietary intake was increased. In the present study, animals with lower impaired fertility and apparently deficient in nutrition were administered glucose and phosphorous. It was observed that even when body weight was falling and blood glucose was rising, fertility was good [13]. The significant enhancement of conception rate observed in the animals under treatment could be considered as the beneficial effect of administration of deficient parameters.

The data regarding the conception rate of animals deficient in phosphorous and treated with *Tonophosphan* are presented in Table 3. It may be observed that 5 out of 7 cows treated with *Tonophosphan* became pregnant giving a conception rate of 71.42 percent while in the control group which did not receive any treatment only one cow conceived out of 4 recording a conception rate of 25 percent.

Table 3: Conception rate of animals treated with phosphorous alone (Group II)

S. No.	Group	Number observed	No. deficient in Phosphorous alone	Number inseminated	Number conceived	Conception rate (%)
1	GI	29	7	7	5	71.42
2	GII	23	4	4	1	25.00

$X^2 = 1.37$

Beneficial effects of administration of phosphorous have been reported by many authors [14, 17]. The deficiency can be corrected by special feed or by therapeutic measures. In Gir cows, it was found significant beneficial effects with administration of *Tonophosphan* [18]. It was reported that with the level of serum phosphorous increasing with the addition of superphosphate in the ration, a concomitant increase in pregnancy rate from 36.5 percent to 63.2 percent was also observed [19]. In the present study, the fertility increased from 25 to 71.42 percent with the treatment of phosphorous alone. This confirms the earlier beneficial observations cited and also many other authors [20, 23].

The data on the conception rate of animals treated with glucose are presented in Table 4. It was revealed that out of 4 animals treated with glucose, 3 cows conceived recording a conception rate of 75 percent. In the control group, deficient in glucose, not treated, only one out of 8 cows conceived giving a conception rate of 12.5 percent.

Table 4: Conception rate of animals treated with glucose alone (GII)

S. No.	Group	Number observed	No. deficient in Glucose alone	Number inseminated	Number conceived	Conception rate (%)
1	GI	29	4	4	3	75.0
2	GII	23	8	8	1	12.5

$X^2 = 1.75$

The difference in conception rate could be attributed to the beneficial effects of glucose administration before insemination. It was reported that hypoglycemia at oestrum or shortly after service may exert a harmful effect on conception by lowering the glucose and glycogen level in the mucosa of genital tract resulting in lack of energy to spermatozoa or fertilized ova [24]. It can be surmised that the therapy might have increased the level of glucose in the luminal fluids so that nourishment and life of fertilized ova in the uterus before implantation is improved increasing the conception rate.

Beneficial effects of glucose therapy have been recorded earlier. In repeater cows, previously obtained 100 percent conception rate with irrigation of uterus and cervix with sugar solution [25]. Some other scientists have also concurred with the above [26, 27]. It was stated that with higher glucose level, conception rate increased significantly. The higher conception rate currently observed in the treated group could, therefore, be attributed to the possible beneficial effects of glucose confirming the earlier reports [27].

The data regarding conception rate of animals treated with both glucose and phosphorous are presented in Table 5. Perusal of the data revealed that out of 8 cows treated and inseminated 7 conceived recording a conception rate of 87.5 percent, while in the control group, deficient in both, but not treated, none of the animals conceived. Statistical analysis revealed highly significant difference in conception rate between the groups ($P<0.01$).

Table 5: Conception rate of animals treated with both glucose and phosphorous (GII)

S. No.	Group	Number observed	No. deficient in Phosphorous and Glucose	Number inseminated	Number conceived	Conception rate (%)
1	GI	29	8	8	7	87.5
2	GII	23	8	8	0	0.0

$X^2 = 9.14$; significant at 1% level

The difference in conception rate could possibly be attributed to the beneficial effects on the administration of glucose and phosphorous, since these animals were apparently deficient in both these parameters based on assessment by hematological and biochemical studies. It was reported that undernutrition could reduce secretion of gonadotropins from pituitary glands in most species [27]. Besides, inadequate diet could depress ovarian function also [28]. Deficiency of protein, carbohydrate and phosphorous as causes of impaired fertility have been reported earlier [17, 24, 29]. Previously also, it was observed that when the blood glucose level was rising, fertility was good [13]. Similarly, previously it was reported that when the plane of nutrition of dairy cows was enhance, pregnancy rate also improved [12, 30]. In the present experiment, the administration of glucose and phosphorous could have improved the serum status of these animals there by conferring the benefits of better nutrition for higher fertility.

Conclusion

The results of the present study point to an influence of glucose and phosphorous on reproductive status of dairy cows. It could therefore be summarized that assessment of certain blood parameters would serve as an ideal tool in predicting the fertility status of the animals. However, a wider investigation involving more animals under varied managemental and nutritional status is warranted before reaching a final conclusion.

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