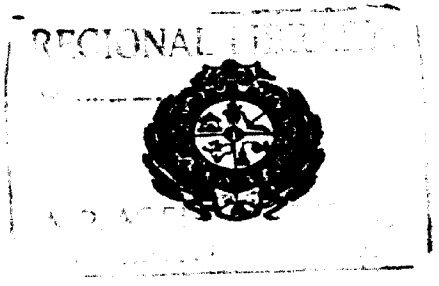
STUDIES ON RETENTION OF FOETAL MEMBRANES IN CROSSBRED COWS

By

T. SRINIVAS

THESIS SUBMITTED TO THE
ANDHRA PRADESH AGRICULTURAL UNIVERSITY
IN PARTIAL FULFILMENT OF THE REQUIREMENTS
FOR THE AWARD OF THE DEGREE OF
MASTER OF VETERINARY SCIENCE
IN THE FACULTY OF VETERINARY SCIENCE



DEPARTMENT OF ANIMAL REPRODUCTION AND GYNAECOLOGY
COLLEGE OF VETERINARY SCIENCE, TIRUPATI
ANDHRA PRADESH AGRICULTURAL UNIVERSITY
RAJENDRANAGAR, HYDERABAD - 500 030

NOVEMBER 1994

CERTIFICATE

Mr.T.SRINIVAS has satisfactorily prosecuted the course of research and that the thesis entitled **"STUDIES ON RETENTION OF FOETAL MEMBRANES IN CROSSBRED COWS"** submitted is the result of original research work and is of sufficiently high standard to warrant its presentation to the examination.

I also certify that the thesis or part thereof has not been previously submitted by him for a degree of any University.

Date: 11-1-96

(K.SUBRAMANYAM NAIDU)
Major Advisor
Assistant Professor
Department of Animal Reproduction
and Gynaecology
College of Veterinary Science
TIRUPATI.

CERTIFICATE

This is to certify that the thesis entitled **"STUDIES ON RETENTION OF FOETAL MEMBRANES IN CROSSBRED COWS"** submitted in partial fulfilment of the requirements for the degree of **"MASTER OF VETERINARY SCIENCE"** of the Andhra Pradesh Agricultural University, Rajendra Nagar, Hyderabad, is a record of the bonafide research work carried out by **Mr.T.SRINIVAS** under my guidance and supervision. The subject of the thesis has been approved by the Student's Advisory Committee.

No part of the thesis has been submitted for any other degree or diploma. The published part has been fully acknowledged. All the assistance and help received during the course of the investigation have been duly acknowledged by the author of the thesis.

11/11/96

CHAIRMAN OF THE ADVISORY COMMITTEE

Thesis approved by the Student Advisory Committee

CHAIRMAN: **(K.SUBRAMANYAM NAIDU)**
Assistant Professor
Dept. of Animal Reproduction & Gynaecology
College of Vety. Science,
Tirupati.

11/11/96

Associate Professor Dept. of
Animal Reproduction & Gynaecology
College of Veterinary Science,
TIRUPATI.

MEMBER : **(K.VEERABRAMHAIAH)**
Assistant Professor
Dept. of Animal Reproduction & Gynaecology
College of Vety. Science,
Tirupati.

11/11/96

MEMBER : **(T.S.CHANDRASEKHARA RAO)**
Assistant Professor
Dept. of Anatomy,
College of Vety. Science,
Tirupati.

T.S Chandra Sekhara Rao
11/11/96

MEMBER : **(Y.NARASIMHA REDDY)**
Assistant Professor
Dept. of Microbiology
College of Vety. Science,
Tirupati.

11/11

CONTENTS

CHAPTER			PAGE NO.
I	1	**INTRODUCTION**	1
II	2	**REVIEW OF LITERATURE**	3
	2.1	Haematological constituents	3
	2.1.1	Haemoglobin	3
	2.1.2	Packed cell volume	4
	2.1.3	Total white blood corpuscle count	5
	2.2	Biochemical constituents	6
	2.2.1	Blood glucose	6
	2.2.2	Serum calcium	8
	2.2.3	Serum inorganic phosphorus	10
	2.2.4	Total serum proteins	13
	2.2.5	Serum acid phosphatase	14
	2.2.6	Serum alkaline phosphatase	14
	2.3	Treatment regimen	16
	2.3.1	Efficacy of drugs	16
	2.3.1.1	Time of expulsion of foetal membranes	16
	2.3.1.2	Involution of uterus	16
	2.3.1.3	Occurrence of first postpartum heat	18
	2.3.2	Antibiotic sensitivity test	19
	2.4	Physical characters of foetal membranes	19
	2.4.1	Weight	19
	2.4.2	Cotyledon number	20
	2.5	Influence of reproductive traits on the incidence of RFM	20
	2.5.1	Sex of calf	20
	2.5.2	Number of calvings	21

III	3	**MATERIALS AND METHODS**	22
	3.1	Haematological constituents	23
	3.2	Biochemical constituents	23
	3.3	Treatment regimen	24
	3.3.1	Efficacy of drugs	24
	3.3.1.1	Time of expulsion of foetal membranes	24
	3.3.1.2	Involution of uterus	24
	3.3.1.3	Occurrence of first postpartum heat	26
	3.3.2	Antibiotic sensitivity test	26
	3.4	Physical characters of the foetal membranes	29
	3.5	Influence of reproductive traits on the incidence of RFM.	29
	3.5.1	Sex of calf.	29
	3.5.2	Number of calvings.	29
	3.6	Statistical methods	29
IV	4	**RESULTS**	30
	4.1	Haematological constituents	30
	4.1.1	Haemoglobin	33
	4.1.2	Packed cell volume	33
	4.1.3	Total white blood corpuscle count	33
	4.2	Biochemical constituents	33
	4.2.1	Blood glucose	37
	4.2.2	Serum calcium	37
	4.2.3	Serum inorganic phosphorus	37
	4.2.4	Total serum proteins	38

	4.2.5	Serum acid phosphatase	38
	4.2.6	Serum alkaline phosphatase	38
	4.3	Treatment regimen	39
	4.3.1	Efficacy of drugs	39
	4.3.1.1	Time of expulsion of foetal membranes	39
	4.3.1.2	Involution of uterus	41
	4.3.1.3	Occurrence of first postpartum heat	48
	4.3.2	Antibiotic sensitivity test	51
	4.4	Physical characters of foetal membranes	54
	4.4.1	Weight	54
	4.4.2	Cotyledon number	54
	4.5	Influence of reproductive traits on the incidence of RFM.	58
	4.5.1	Sex of calf	58
	4.5.2	Number of calvings	58
V	5	**DISCUSSION**	60
VI	6	**SUMMARY**	78
		LITERATURE CITED	81
		APPENDICES	92

LIST OF TABLES

TABLE No.	PARTICULARS	PAGE No.
1.	Treatment schedule of drugs used and dosages employed for the expulsion of foetal membranes.	25
2.	Zone size interpretative particulars of the antibacterials used.	27
3.	Dosage schedule for intrauterine antibacterial therapy.	28
4.	The values for haemoglobin, packed cell volume, total white blood corpuscle count in individual crossbred cows without RFM and with RFM.	31
5.	The values for blood glucose, serum calcium, serum inorganic phosphorus and serum calcium: phosphorus ratio in individual crossbred cows without RFM and with RFM.	34
6.	The values for total serum proteins, serum acid phosphatase activity and serum alkaline phosphatase activity in individual crossbred cows without RFM and with RFM.	35
7.	Particulars of time of expulsion of foetal membranes (in days) after treatment with Exapar and Replanta	40
8.	Mean (± SE) time of involution of gravid and nongravid uterine horns in crossbred cows without RFM and in cows having RFM treated with Exapar and Replanta.	42

9. Analysis of variance for the time of involution of gravid and nongravid uterine horns in normally calved crossbred cows without RFM and in cows having RFM treated with Exapar and Replanta. 46

10. Time of occurrence of first postpartum heat in individual crossbred cows without RFM and with RFM. 49

11. Analysis of variance for the occurrence of first postpartum heat in crossbred cows without RFM and in cows having RFM and treated with Exapar and Replanta. 52

12. Antibiotic sensitivity pattern of the uterine contents collected from cows with RFM. 53

13. Physical characters of foetal membranes in individual crossbred cows without RFM and with RFM. 55

14. Influence of sex of calf and number of calvings on the incidence of RFM. 59

LIST OF FIGURES

FIGURE NO.	PARTICULARS	PAGE NO.
1.	Haematological values in normally calved crossbred cows without RFM and with RFM.	32
2.	Biochemical levels in normally calved crossbred cows without RFM and with RFM.	36
3.	Involution of gravid uterine horn in normally calved crossbred cows without RFM and in cows having RFM, treated with Exapar and Replanta	43
4.	Involution of nongravid uterine horn in normally calved crossbred cows without RFM and in cows having RFM, treated with Exapar and Replanta	44
5.	Occurrence of first postpartum heat in normally calved crossbred cows without RFM and in cows having RFM treated with Exapar and Replanta	50
6.	Placental weight in normally calved crossbred cows without RFM and with RFM	56
7.	Cotyledon number in normally calved crossbred cows without RFM and with RFM	57

ACKNOWLEDGEMENTS

I am highly indebted to my Major Advisor Dr.K.Subramanyam Naidu, Assistant Professor, Department of Animal Reproduction and Gynaecology, College of Veterinary Science, Tirupati, for all the guidance, encouragement and interest in suggesting the problem and advice during the investigation.

It is with profound sincerity, I acknowledge the help and guidance extended to me by the members of the Advisory committee, Dr. K. Veerabramhaiah, Assistant Professor, Department of Animal Reproduction and Gynaecology, Dr.T.S.Chandrasekhara Rao, Assistant Professor, Department of Anatomy and Dr.Y.Narasimha Reddy, Assistant Professor, Department of Microbiology, College of Veterinary Science, Tirupati.

I avail this opportunity with profound sense of gratitude and pleasure as a privilege to express my sincere thanks to Dr.P.K.Sreeraman, Ph.D., Associate Professor, Department of Pathology and Dr.A.Venkatamuni Chetty, Ph.D., Professor and Head (Retd), Department of Animal Reproduction and Gynaecology, College of Veterinary Science, Tirupati, for their valuable suggestions and services rendered in the successful completion of this investigation and the thesis.

I would like to convey my heartful thanks to Dr.D.Haridas, Deputy Director, Veterinary Poly Clinic, Dr.Haragopal Singh, Assistant Director, Dr.R.Sudhakaran, Assistant Director, Dr.T.Venkata Subbaiah, Assistant Director, Animal Health Center, Chittoor and Dr. B.Chandra Sekhar, Dr.R.Mohan Reddy, Dr.R.Sudhakar, Dr.Kalpana, Dr.Shakila and Dr.Ravikumar, Veterinary Assistant Surgeons and other

encouragement and moral support during ~~my~~ The course of my post-graduate studies.

I wish to place on record the help received from my friends, Dr.Satish, Dr.K.Venkateswarlu, Dr.K.Muni Raja, Dr.A.Prasad, Dr.T.Madhava Rao, Dr.B.Devaraju and Dr.K.Babu Rao.

I am very much thankful to my Master Sri.P.Rajagopalachari for his grace in successful completion of this investigation.

The financial assistance rendered by Government of Andhra Pradesh is sincerely acknowledged.

(T.SRINIVAS) 96

Name of the author	:	**T. SRINIVAS**
Title of the thesis	:	"STUDIES ON RETENTION OF FOETAL MEMBRANES IN CROSSBRED COWS"
Degree to which it is submitted	:	MASTER OF VETERINARY SCIENCE
Faculty	:	Faculty of Veterinary Science Department of Animal Reproduction & Gynaecology, College of Veterinary Science TIRUPATI
Guide	:	**K.SUBRAMANYAM NAIDU** Assistant Professor Department of Animal Reproduction and Gynaecology College of Veterinary Science TIRUPATI
University	:	Andhra Pradesh Agricultural University, Rajendranagar, HYDERABAD - 500 030.
Year of Submission	:	1995

ABSTRACT

An investigation was undertaken to study the various haematological and biochemical constituents in 20 cows each without retention of foetal membranes and those with retention of foetal membranes (RFM) available at Sri Venkateswara Dairy Farm, Tirupati and in cows brought to college clinic and various veterinary hospitals in and around Chittoor. The results were compared and ~~causes~~ etiology of for retention of foetal membranes ~~were~~ was identified and discussed.

The mean haemoglobin concentration, packed cell volume and total white blood corpuscle counts in the crossbred cows without RFM were 10.10 ± 0.25g percent; 31.60 ± 0.61 percent

and 8.30 ±0.26 thousands/µl respectively. In the cows with RFM, though the Hb concentration (9.43 ± 0.18g%) was significantly lower ($p<0.05$). The mean PCV values and TWBC counts were insignificant (32.15 ± 0.49% and 8.76 ± 0.33 thousands/µl respectively) when compared to those in crossbred cows without RFM.

In cows without RFM the mean blood glucose, serum calcium, serum inorganic phosphorus, Ca:P ratio and total serum proteins were 58.94 ± 0.89 mg percent 10.36 ± 0.31 mg percent; 5.20 ± 0.16 mg percent; 1.99 ± 0.03; 7.70 ± 0.22g percent, respectively. In cows with RFM the mean blood glucose, serum inorganic phosphorus and total serum proteins were significantly ($p<0.05$) lower (47.68±1.93 mg% and 4.30 ± 0.13 mg% and 6.78 ± 0.28 g% respectively) with a significantly higher ($p<0.01$) Ca:P ratio (2.22 ± 0.07:1). The mean serum calcium level was though lower (9.51 ± 0.32 mg%), the difference was insignificant when compared to that in cows without RFM.

The mean serum acid phosphatase and alkaline phosphatase activities in cows without RFM were 0.44 ± 0.03 and 4.28 ± 0.26 K.A. units, respectively and the same in cows with RFM were 1.52 ± 0.11 and 10.33 ± 0.41 K.A. units, respectively and the increase in the activity in the cows with RFM was significant ($p<0.01$).

With regard to efficacy of the two drugs viz. Exapar and Replanta, which was evaluated on the basis of expulsion of foetal membranes, time taken for uterine involution and occurrence of first postpartum heat, it was noticed that

Exapar was found to be more efficacious than Replanta based on the following observations.

1. That 50% of cows expelled the foetal membranes by 2nd day.
2. In the cows which did not expel the foetal membranes, there was no difficulty while removing manually.
3. The mean time of involution of uterus and
4. the mean time of occurrence of postpartum heat were shorter.

The antibiotic sensitivity test conducted on 20 samples of uterine discharge from cows with RFM revealed that the organisms in most of the cases were sensitive to Gentamycin, Kanamycin and Chloramphenicol in that order and the organisms in all the samples were resistant to Cloxacillin indicating that the cows with RFM can be treated successfully with the above antibiotics to prevent the postpartum uterine infections in these parts of the district.

The physical characteristics of the placenta revealed that the mean weight of the foetal membranes in cows without RFM and with RFM was 2.23 ± 0.09 and 1.77 ± 0.09 Kg respectively with a mean cotyledon number of 68.6 ± 2.73 and 68.3 ± 2.39 respectively.

With regard to influence of sex of calf and number of calvings on the incidence of RFM, it was seen that RFM was more frequent with the birth of male calves and in primipara.

LIST OF SYMBOLS AND ABBREVIATIONS

ABST	Antibiotic sensitivity test
ACP	Acid phosphatase
ALP	Alkaline phosphatase
B.U.	Bodonsky units
°C	Degree celcius
Ca:P ratio	Calcium phosphorus ratio
cm	Centimeter(s)
EDTA	Disodium Ethylene diamino tetra acetate
Fig	Figure
g	gram(s)
Hb	Haemoglobin
HF	Holstein Friesian
hr	hour(s)
K.A.Units	King Aungstrom uints
Kg	Kilogram(s)
L	Litre
mcg	microgram(s)
mg	milligram(s)
µl	microlitre
ml	millilitre(s)
mm	millimetre(s)
PCV	Packed cell volume
%	Percent
RFM	Retention of foetal membranes
TSP	Total serum proteins
TWBC count	Total white blood corpuscle count
U	International units

INTRODUCTION

CHAPTER - I

1. INTRODUCTION

Retention of foetal membranes (RFM) is one of the most common postpartum pathological conditions amongst all the reproductive disorders in cows.

The impact of RFM on the farmers is great, in that it causes great financial loss by way of increased intercalving periods due to delayed involution of uterus, reduced milk production and uterine complications such as endometritis and pyometra leading to infertility or sterility. In postpartum animals, the RFM has been reported as one of the important conditions affecting the future fertility. The incidence of endometritis in animals with RFM appeared to increase ten fold (Arthur, 1979, Olson and Mortimer, 1986).

The incidence of RFM was reported to be between 2-12 per-cent in cows, with a higher incidence (17.7%) in small scale dairy farms in a tropical environment (Balasubramanian 1993). The same appeared to be higher in crossbred cows after normal calving (Shukla **et al**., 1978).

There is lot of diverse opinion regarding the etiology, treatment and sequelae of RFM. The physiological mechanism involved in the expulsion of foetal membranes is not clearly understood and there is dearth of information about the basic mechanism that leads to RFM.

To formulate an effective preventive and treatment regimens, identification of haematological and biochemical markers may be of value (Payne and Leech, 1964).

Information is meagre on the haematological and biochemical alterations that occur due to RFM in crossbred cows, though literature pertaining to the same is available in exotic and native cattle. Similarly information on the comparative efficacy of available drugs used in the treatment to expel the foetal membranes is also lacking. Reports on the antibiotic sensitivity of the bacteriological agents recovered from the animals with RFM are scanty which has a bearing on selecting a correct treatment regime to prevent postpartum uterine infection .

In recent years there is a spurt in the dairy farming activity with crossbred cattle in **Chittoor** district of **Andhra Pradesh**. There is dearth of information on the haematological and biochemical alterations that occur due to RFM and on the drug of choice for the expulsion of retained foetal membranes as well as on the choice of antibiotics based on antibiotic sensitivity test in preventing the postpartum uterine infections in crossbred cattle. In view of thes the present work was undertaken to study the following.

1. Haematological and biochemical changes in cows without RFM and those with RFM and compare the findings.

2. To know the efficacy of two commonly used drugs for the expulsion of retained foetal membranes and

3. To select the antibiotic based on sensitivity test for the prevention of postpartum uterine infection .

REVIEW OF LITERATURE

CHAPTER - II

REVIEW OF LITERATURE

The available literature pertaining to various haematological and biochemical profiles in the normally calved cows but without RFM as well as cows with RFM is reviewed separately for exotic, native and crossbred cows. The reports regarding the treatment regimen followed for the expulsion of foetal membranes, involution of uterus, time of occurrence of postpartum heat and the control of postpartum uterine infections along with the literature on the influence of sex of calf and number of calvings on the incidence of RFM are also reviewed.

2.1 HAEMATOLOGICAL CONSTITUENTS

2.1.1 HAEMOGLOBIN (Hb)

Normally Calved Cows without RFM

Exotic and Native breeds

Agarwal et al., (1965) noticed a decreased Hb percentage (12.97 g%) from 14.24 g percent in Haryana cows after calving.

Benysek and Kudlac (1971) observed a sharp but temporary increase in Hb concentration immediately after parturition in cows.

Rowlands et al., (1975) found the Hb concentration in normally calved Friesian, Ayrshire or Friesian X Ayrshire cows during one to 30 days postpartum to be 12 g percent.

Crossbred Cows

Prakash and Tondon (1978) observed a steep rise in the Hb concentration of Holstein x Tarparkar heifers at the time of parturition.

Miltenburg et al., (1991) recorded the highest concentration of Hb in crossbred Friesian dairy cows at 3-5 hr after parturition.

Normally Calved Cows with RFM

Exotic and Native breeds

In cows with RFM Benysek and Kudlac (1972) observed a lower Hb concentration.

Crossbred Cows

Suryanarayana Murty (1992) noticed the mean Hb concentration to be 9.14 ± 0.25 g percent in crossbred Jersey cows with RFM.

2.1.2 PACKED CELL VOLUME (PCV)

Normally Calved Cows without RFM:

Exotic and Native breeds

In cows Benysek and Kudlac (1971) observed a sharp but temporary increase of PCV immediately after parturition.

Crossbred Cows

In Holstein X Tharparkar heifers Prakash and Tondon (1978) reported a steep rise in the PCV at the time of

parturition. The authors recorded 37.4 ± 1.86 percent PCV on day one,postpartum.

Normally Calved Cows with RFM

Exotic and Native breeds

Benysek and Kudlac (1972) observed a significant decrease in the haematocrit value in cows with RFM on day 4 postpartum.

Crossbred Cows

The mean PCV in Jersey crossbred cows with RFM was found to be 33.87 ± 0.86 percent (Suryanarayana Murty, 1992).

2.1.3 TOTAL WHITE BLOOD CORPUSCLE COUNT (TWBC COUNT)

Normally Calved Cows without RFM

Exotic and Native breeds

A fairly constant TWBC count was noticed by Agarwal **et al**., (1965) in Haryana cows before and after calving (12.30 thousands/μl).

Mohanty (1978) found the TWBC count in cows to be within the normal maximum limit till the end of 90th day postpartum.

Normally Calved Cows with RFM

Exotic and Native breeds

Roberts (1971) reported a slight increase in the TWBC count in cows with RFM. During the first 10 days after parturition in cows with RFM, Kudlac and Benysek (1972) reported a greatly reduced leucocyte numbers, with the lowest numbers on the second day.

The TWBC count was found to be lower in cows with RFM than in normal cows (Mulei **et al.**, 1993).

Crossbred Cows

In Jersey crossbred cows with RFM the TWBC count was found to be 8.74 ± 0.34 thousands/μl by Suryanarayana Murty (1992).

2.2 BIOCHEMICAL CONSTITUENTS

2.2.1 BLOOD GLUCOSE

Normally Calved Cows without RFM

Exotic and Native breeds

During Postpartum (1-30 days) period Rowlands **et al.**, (1975) reported the blood glucose value to be 73 mg percent.

In Ongole cows, the mean glucose levels during 7th and 30th day postpartum were found to be 38.07 ± 0.53 and 37.27 ± 1.44 mg percent, respectively (Chalapati Rao, 1979).

In cows, Mulling **et al.**, (1979) observed an increase in mean glucose value (73 mg %) immediately after parturition.

The blood glucose level in postpartum Ongole cows was found to be 37.11 ± 1.27 mg percent (Rao **et al.**, 1981).

In Rathi cows, Pareek and Deen (1985) observed a decline in blood glucose level (40 mg %) during the postpartum period.

Crossbred Cows

Prakash and Tondon (1978) reported a steep rise in the glucose values of Holstein x Tharparkar heifers at the time of parturition with a value of 52.37 ± 1.12 mg percent at day one postpartum.

In Holstein Friesian (HF) X Ongole cows Chalapati Rao (1979) recorded the glucose values to be 38.08 ± 1.32 and 37.91 ± 1.45 mg percent during 7^{th} and 30^{th} day of postpartum, respectively.

Blood glucose level in normally calved crossbred cows without RFM was found to be 76.57 ± 4.23 mg percent (Agarwal *et al.*, 1985).

Mohanty *et al.*, (1994) noticed a significantly higher glucose values (62.68 ± 3.06 mg%) on the day of parturition in crossbred Jersey cows without RFM.

Normally Calved Cows with RFM

Exotic and Native breeds

Many authors noticed hypoglycemia in cows with RFM (Boiter *et al.*, 1972 and 1973., Dutta, 1980 and Choudhury *et al.*, 1993).

Crossbred Cows

Agarwal *et al.*, (1985) found a significantly lower blood glucose level (66.75 ± 8.15 mg%) in crossbred cattle with RFM than normal calvers without RFM (76.57 ± 4.23 mg%).

Suryanarayana Murty (1992) and Mohanty et al., (1994) noticed a significantly lower levels of blood glucose (43.98 ± 2.29 mg% and 51.07 ± 1.89 mg% respectively) in crossbred Jersey cows with RFM.

2.2.2 SERUM CALCIUM

Normally Calved Cows without RFM

Exotic and Native breeds

In Ongole cows, during 7th and 30th day postpartum, Chalapati Rao (1979) recorded the mean serum calcium level to be 10.37 ± 0.35 and 10.09 ± 0.18 mg percent respectively.

The concentration of serum calcium in Ongole cows during postpartum period was found to be 10.42 ± 0.35 mg percent (Rao et al., 1981).

Tariq Ahmed et al., (1984) recorded the lowest serum calcium concentration in cows on the day of parturition (9.2 ± 0.50 mg%).

In Rathi cows, Pareek and Deen (1985) reported the serum calcium level on the day of parturition to be 11.30 mg percent.

Sharma et al., (1991) recorded 10.41 ± 0.12 mg percent serum calcium concentration in cows with normal parturition

Crossbred Cows

In HF X Ongole cows, the mean serum calcium levels to be 10.47 ± 0.14 and 10.14 ± 0.21 mg percent during 7^{th} and 30^{th} day of postpartum respectively (Chalapati Rao, 1979).

On the day of parturition Shukla *et al*., (1983) recorded the lowest serum calcium level (10.36 ± 0.17 mg%) in crossbred cows without RFM.

The serum calcium level on the day of parturition in Jersey crossbred cows was found to be 9.17 ± 0.20 mg percent (Mohanty *et al*., 1994).

Normally Calved Cows with RFM

Exotic and Native breeds

Kumpf (1984) noticed an increase in the serum calcium level in cows with RFM.

Mean serum calcium values in cows with and without RFM fluctuated between 8.28 ± 0.60 to 9.5 ± 0.90 mg percent and 9.2 ± 0.50 to 10.5 ± 0.73 mg percent respectively (Tariq Ahmed *et al*., 1984). These authors observed lowered serum calcium levels in both the groups on the day of parturition and on all occasions before, during and after the parturition in cows which subsequently retained the placenta.

The serum calcium level in RFM cows was found to be 9.23 ± 0.14 mg percent (Sharma *et al*., 1991).

Crossbred Cows

Shukla *et al*., (1983) recorded the lowest serum calcium level in crossbred cows with RFM on day one postpartum (9.84 ± 0.07 mg%) with a gradual increase in the concentration between 1 to 20 days postpartum and found the concentration to

be lower in cows with RFM than in cows without RFM throughout the period.

Suryanarayana Murty (1992) noticed the mean serum calcium concentration to be 8.77 ± 0.44 mg percent in the crossbred Jersey cows with RFM.

Mohanty *et al.*, (1994) noticed a lower serum calcium (8.32 ± 0.35 mg%) in crossbred Jersey cows with RFM than those in without RFM.

2.2.3 INORGANIC PHOSPHORUS

Normally Calved Cows without RFM

Exotic and Native breeds

The concentration of serum inorganic phosphorus was found to remain relatively constant (5.97 mg%) during 1 to 30 day postpartum (Rowlands *et al.*, 1975).

In normally calved cows Garbacik and Balon (1978) noticed the serum inorganic phosphorus to be 3.1 to 8.4 (mean 5.75) mg percent.

Chalapati Rao (1979) estimated the serum inorganic phosphorus levels in Ongole cows during 7th and 30th day of postpartum and found it to be 6.32 ± 0.85 and 5.81 ± 0.34 mg percent, respectively.

In Ongole cows Rao *et al.*, (1981) recorded the serum inorganic phosphorus values to be 5.16 ± 0.29 mg percent in cows during postpartum period.

The mean serum inorganic phosphorus levels around parturition in cows without RFM varied between 4.90 ± 0.70 and 6.0 ± 1.2 mg percent (Tariq Ahmed **et al.**, 1984).

In normally reproducing Rathi cows, Pareek and Deen (1985) recorded the serum inorganic phosphorus at parturition to be 5.03 mg percent.

Sharma **et al.**, (1991) found the serum inorganic phosphorus in normally parturient cows to be 5.855 ± 0.22 mg percent.

Crossbred Cows

In HF X Ongole cows Chalapati Rao (1979) recorded the serum inorganic phosphorus levels during 7th and 30th day of postpartum and found it to be 6.06 ± 0.23 and 5.76 ± 0.40 mg percent respectively.

The mean serum inorganic phosphorus concentration in crossbred cows was found to be the lowest (5.30 ± 0.10 mg%) on day one postpartum and the same was found to increase gradually to maximum (5.61 ± 0.10 mg%) on day 20 postpartum (Shukla **et al.**, 1983).

In normally calved crossbred cows, Agarwal **et al.**, (1985) estimated the mean serum inorganic phosphorus to be 8.64 ± 0.39 mg percent.

Normally Calved Cows with RFM

Exotic and Native breeds

Garbacik and Balon (1978) observed lower serum inorganic phosphorus levels (2.16 - 2.84 mg% with a mean of 2.5 mg%) in cows with RFM than in those without RFM.

Kumpf (1984) recorded subnormal levels of serum inorganic phosphorus in cows with RFM.

The mean serum inorganic phosphorus around parturition in cows with RFM was found to vary from 3.25 ± 1.00 to 5.38 ± 1.00 mg percent (Tariq Ahmed *et al.*, 1984).

Jaskowski and Lachowski (1985) observed a lower concentration of serum inorganic phosphorus in retained placenta cows.

The serum inorganic phosphorus level was found to be lower in Simmental cows and in dairy cows with RFM by Shin and Jo (1987) and Vukovic *et al.*, (1987), respectively.

The concentration of inorganic phosphorus in cows with retained after birth was found to be 4.03 ± 0.33 mg percent (Sharma *et al.*, 1991).

In cows with RFM, Choudhury *et al.*, (1993) noticed no appreciable change in the concentration of serum inorganic phosphorus.

Crossbred Cows

In crossbred cows with RFM, Shukla *et al.*, (1983) observed a significantly lower level of serum inorganic phosphorus (4.59 ± 0.10 mg%) at day one postpartum.

The serum inorganic phosphorus level in crossbred cows with RFM was found to be lower (7.36 ± 0.82 mg%) by Agarwal *et al.*, (1985).

In Jersey crossbred cows with RFM Suryanarayana Murty (1992) recorded the serum inorganic phosphorus level to be 4.25 ± 0.20 mg percent.

2.2.4 TOTAL SERUM PROTEINS (TSP)

Normally Calved Cows without RFM

Exotic and Native breeds

In Rathi cows, Pareek and Deen (1985) found the TSP concentration at the time of parturition to be 6.36 g percent.

In non descript cows Mehta *et al.*, (1989) observed a significant decrease in TSP just prior to parturition and a further decrease during postpartum stage. The serum protein concentration within 48 hr after parturition was found to be 6.88 ± 0.65 g percent.

Crossbred Cows

In normally calved crossbred cows without RFM the TSP concentration was reported to be 9.81 ± 0.51g percent (Agarwal *et al.*, 1985).

Normally Calved Cows with RFM

Exotic and Native breeds

Serum protein level in cows with RFM was found to remain within normal range during first 3 weeks after calving (Benysek and Kudlac 1972).

Choudhury *et al.*, (1993) observed no appreciable change in the TSP level in cows with RFM.

Crossbred Cows

Agarwal *et al*. (1985) noticed lowered serum protein concentration (8.53 ± 0.72 g%) in crossbred cows with RFM than in normal calvers.

In crossbred Jersey cows with RFM, Suryanarayana Murty (1992) noticed lower level of TSP (5.64 ± 0.23 g%).

2.2.5 SERUM ACID PHOSPHATASE (Serum ACP)

The only reference available on serum ACP activity was that of Kendall & Harshbarger, 1962 in exotic dairy cows who reported the activity to be 0.113 BU/100ml on the day one postpartum.

2.2.6 SERUM ALKALINE PHOSPHATASE (Serum ALP)

Normally Calved Cows without RFM

Exotic and Native breeds

The serum ALP activity in dairy cows at day one postpartum was found to be 2.89 U by Kendall and Harshbarger (1962).

Singh *et al*., (1972) estimated the serum ALP activity in Rathi and Sahiwal breeds of cattle and found it to be between 4.3 to 5.2 and 2.7 to 4.3 B.U./100 ml respectively.

In non descript cows the mean serum ALP activity was found to be lower on days one and two postpartum. The value at 48 hr after parturition was 1.17 ± 0.03 B.U./100ml (Mehta *et al*., 1989).

Sharma et al., (1991) estimated the ALP activity in normally calved cows and found it to be 2.80 ± 0.14 B.U./100 ml.

Crossbred Cows

In crossbred Jersey cows with normal placental expulsion Mohanty et al., (1994) found the serum ALP activity on the day of parturition to be 326.00 ± 22.92 unit/litre.

Normally Calved Cows with RFM

Exotic and Native breeds

A higher level of serum ALP activity was noted by Dutta and Dugwekar (1982) at 12, 24, 48 and 120 hr after parturition in cows with RFM.

Peter et al., (1987) found the mean serum ALP activity to vary from 15.93 to 32.6 U/litre in dairy cows with RFM after 24 hr of retention.

Sharma et al., (1991) recorded higher serum ALP activity (3.61 ± 0.20 B.U./100 ml) in cows with RFM than in those without RFM.

Crossbred Cows

In crossbred Jersey cows with RFM Mohanty et al., (1994) observed a higher activity of serum ALP (586.50 ± 65.46 units/litre) on the day of parturition than in those without RFM.

2.3 TREATMENT REGIMEN

2.3.1 EFFICACY OF DRUGS

2.3.1.1 Time of Expulsion of Foetal Membranes

Replanta* has been claimed to be effective in uterine disorders (Bhatia, 1980 and Gahlot, 1980)

Hamidul Islam and Nooruddin (1990) reported that Replanta was found to be effective and safe in the treatment of bovine uterine disorders like RFM and delayed involution of the uterus.

Chakrabarthi and Pal (1990) recommended Replanta for safe and effective treatment of RFM in cattle and found normal uterine involution in 18 out of 20 cases.

Details of the treatment followed by Hamidul Islam and Nooruddin (1990) and Chakrabarthi and Pal (1990) are presented in the Appendix I.

2.3.1.2 INVOLUTION OF UTERUS

GRAVID UTERINE HORN

Normally Calved Cows without RFM

Exotic and Native breeds

Buch *et al*., (1955) and Roberts (1956) observed 47 days to be the interval between parturition and complete involution of uterus in cattle, while Casida and Venzke (1936), Casida and Wisnicky (1952) and Rasbech (1950) reported it to be still less (26 days).

---

* Indian Herbs Research & Supply Co., Saharanpur

In dairy cows Gier and Marion (1968) found a reduction in the length of the postgravid horn to a half of the parturition size by 15 days, one third by 30 days and complete involution by 50 days.

The reduction in the size of uterus was found to be relatively slow during the first 10 days, but markedly faster during 10 to 40 days of postpartum (Morrow, 1969). Marion et al., (1968), Morrow (1969) and Garcia (1982) reported that the size of gravid uterus returned to pregravid state by 25 to 50 days.

Francis and Raja (1971) reported that the average time required for complete involution of uterus in Sindhi cows was 36.27 ± 0.69 days with a range of 32 to 44 days.

Crossbred Cows

In HF X Haryana cows the time taken for complete involution of uterus was found to range from 31.6 to 33.7 days (Goel and Singh, 1988).

Normally Calved Cows with RFM

Exotic and Native breeds

Roberts (1971) found frequent failure of normal uterine involution in cows with RFM. Kumpf (1984) reported that the time required for the involution of cervix and uterus in cows with RFM to be beyond 6 weeks and Dutta and Dugwekar (1988) found it to be slightly more than those without RFM.

NONGRAVID UTERINE HORN

Normally Calved Cows without RFM

Exotic and Native breeds

The involution of nongravid horn was found to be completed by 17.91 days in Sahiwal cows (Kadu and Kaikini, 1972).

Crossbred Cows

In crossbred cows, the involution of nongravid horn was completed within a period of 22.21 to 44.29 days (Choudury *et al.*, 1974, Agasti *et al.*, 1975 and Jana and Mishra, 1978).

2.3.1.3 OCCURRENCE OF FIRST POSTPARTUM HEAT

Normally Calved Cows without RFM

Exotic and Native breeds

In Indian breeds the onset of postpartum heat was noticed between 39 days to 100 days (Acharya *et al.*, 1971, Kadu and Kaikini, 1972 and Sharma *et al.*, 1975). The average time of onset of postpartum heat was found to be 43 days by Kumpf (1984) and 61.37 ± 9.58 days by Dutta and Dugwekar (1988).

Crossbred Cows

In crossbred cows the first postpartum heat was found to occur between 39 to 63 days (Choudury *et al.*, 1974, Jana and Mishra, 1978, Pandey *et al.*, 1979 and Jaiswal *et al.*, 1979).

Normally Calved Cows with RFM

Exotic and Native breeds

In cows with RFM Kumpf (1984) reported the occurrence of first postpartum heat by 54 days. While treating the cows having RFM with Furea bolus, Mastalone-U and Terramycin liquid

Dutta and Dugwekar (1988) reported that the occurrence of first postpartum heat by 63.75 ± 8.10, 78.42 ± 9.99 and 71.00 ± 10.74 days respectively.

2.3.2 ANTIBIOTIC SENSITIVITY TEST

The lone reference available on the antibiotic sensitivity test of uterine microflora in RFM cases was that of Bretzlaff *et al*., (1982). This author found the sensitivity of bacterial isolates, to Penicillin, Tetracycline, Triple sulpha, Chloramphenicol, Gentamycin, Ampicillin, Furacin and Neomycin to be 44%, 59.5%, 36.9%, 96.4%, 77.4%, 77.4%, 86.9% and 52.4%, respectively.

2.4 PHYSICAL CHARACTERS OF FOETAL MEMBRANES

2.4.1 Weight

Normally Calved Cows without RFM

Exotic and Native breeds

The weight of foetal membranes was found to be 3.33 kg in female calves and 3.36 kg in male calves of Ongole cows with a range of 1.2 to 4.9 kg (Rao *et al*., 1966).

The average weight of foetal membranes in exotic cattle was found to be 3.7 kg with a range of 2.7 to 8.2 kg (Roberts, 1971).

The average weight of foetal membranes in Sahiwal cows was found to be 2.51 kg with a range of 1.34 to 3.87 kg. It was also noticed that the weight of foetal membranes of male calves were much higher (2.65 kg) when compared to that of

female calves (2.25 kg) (kadu and Kaikini, 1972 and 1975). In Haryana cows Tomar et al., (1974) reported the weight of foetal membranes to be 2.54 kg.

Crossbred Cows

The weight of foetal membranes was reported to be 2.52 kg in Brown Swiss-Sahiwal crossbred cows by Bhosrekar and Sharma (1972).

The weight of foetal membranes in HF X Haryana cows was found to range from 3.25 to 3.58 kg (Goel and Singh, 1988).

2.4.2 COTYLEDON NUMBER

Normally Calved Cows without RFM

Exotic and Native breeds

In European cattle the total number of cotyledons in both gravid and nongravid horns was reported to vary from 75 to 120 (Roberts, 1971). In Indian cows, the same was reported to vary from 47 to 147 (Kadu and Kaikini, 1972 and 1975, Bhosrekar and Sharma, 1972 and Acharya and Kohli, 1968).

2.5 INFLUENCE OF REPRODUCTIVE TRAITS ON THE INCIDENCE OF RFM

2.5.1 SEX OF CALF

Exotic and Native breeds

Lubrini (1964) observed RFM in two cows following the birth of male calf and attributed that to hormonal disturbances associated with the sex of the calf. Similarly Roberts (1971) found RFM following the birth of single male

calf However, Katoch *et al*., (1987) and Wautlet *et al*., (1990) opined that the sex of calf do not significantly affect the incidence of RFM in Jersey and Holstein cows respectively.

Crossbred Cows

Saini *et al*., (1988) found no significant difference in the incidence of RFM due to sex of calf in crossbred (Temperat x zebu) dairy cows.

2.5.2 NUMBER OF CALVINGS

Exotic and Native breeds

Primipara tend to retain the foetal membranes more commonly than multipara (Brands, 1966).

Panichi (1964) observed the incidence of RFM to be highest at the fourth calving as well as in pleuriparous cows.

MATERIALS AND METHODS

CHAPTER - III

3. MATERIALS AND METHODS

The present work was carried out on crossbred cattle available at an organised Dairy Farm, Tirupati and on the clinical cases brought to college clinics, as well as to various veterinary hospitals in and around Chittoor.

SELECTION OF ANIMALS

Twenty crossbred cows which had normal parturition without RFM available at **Sri Venkateswara Dairy Farm**, Tirupati and twenty crossbred cows with RFM brought to the various veterinary hospitals were selected to study the haematological and biochemical profiles.

In this study a cow which had delivered but did not shed the foetal membranes even after 12 hours was taken as a cow with RFM.

For all the above mentioned animals information regarding number of calvings, sex of calf and the occurrence of first postpartum heat, was collected. Involution of both gravid and nongravid uterine horns and the efficacy of drugs (Exapar* and Replanta) used for the expulsion of foetal membranes was studied. The physical characters of foetal membranes like weight and the number of cotyledons were also recorded.

Venous blood was collected from the external jugular vein immediately after expulsion of foetal membranes in normally

---

* Dabur Ayurvet Limited, New Delhi.

calved crossbred cows as well as from the cows with RFM immediately after their admission into the hospital.

3.1 HAEMATOLOGICAL CONSTITUENTS

Two ml of blood was collected in a vial containing Disodium Ethylene Diamino Tetra Acetate (EDTA) from each of 40 cows for estimation of packed cell volume by micro haematocrit method, Haemoglobin concentration by Sahli's acid haematin method and total white blood corpuscle count. For these the procedures as described by Jain (1986) were followed.

3.2 BIOCHEMICAL PROFILES

About 15 ml of blood was collected directly into a test tube from each of 40 cows and was allowed to clot. The tubes were kept in a slanting position for an hour at room temperature and then stored in the refrigerator in an upright position over-night at 4°C. The following day, the serum was separated and stored at -20°C until used for estimation of calcium (O-cresolphthalein complexone method)* ,inorganic phosphorus (Modified Metol method)*, total serum proteins (Modified Biuret and Dumas method)*, acid phosphatase (Modified Kings Method)* and alkaline phosphatase activity (Kind and Kings Method)* using diagnostic kits.

About 2-3 ml of blood was also collected separately from each cow in a vial containing sodium fluoride and potassium oxalate for the estimation of blood glucose (Folin-Wu method)*.

---

* Stangen immuno diagnostics, Hyderabad.

3.3 TREATMENT REGIMEN

3.3.1 EFFICACY OF DRUGS

The efficacy of each drug (Exapar and Replanta) was evaluated on the basis of the expulsion of foetal membranes and involution of uterine horns both gravid and nongravid as well as on the occurrence of first postpartum heat.

Composition of Exapar and Replanta are presented in Appendix II.

3.3.1.1 TIME OF EXPULSION OF FOETAL MEMBRANES

Twenty cows with RFM selected earlier were divided into 2 groups of 10 cows each. To one group (Group I) Exapar was administered and to the other (Group II) Replanta was given. The treatment schedule for these drugs is presented in the Table. 1. The cows were observed daily for 3 days for the expulsion of foetal membranes. The drugs were administered for 3 days irrespective of expulsion of foetal membranes.

3.3.1.2 Involution of Uterus

The study was carried out in both Group I and Group II cows and in ten cows without RFM, as per the method suggested by Francis and Raja (1971). The size of the uterus was ascertained by rectal palpation once in a week for 8 weeks from Ist week postpartum. Involution was considered as complete when the uterus returned to its normal intrapelvic position with two equal uterine horns.

Table 1 : Treatment schedule of drugs used and dosages employed for the expulsion of foetal membranes.

Days		Group I (Exapar in ml)*	Group II (Replanta in g)**
I	Morning	100	100
	Evening	100	50
II	Morning	50	50
	Evening	50	50
III	Morning	50	50
	Evening	50	50

* Haust ** As electuary

3.3.1.3 Occurrence of First Postpartum Heat

The time of occurrence of first postpartum heat was noted in normal calvers without RFM and in cows having RFM but treated with Exapar and Replanta separately.

3.3.2 ANTIBIOTIC SENSITIVITY TEST

Uterine swabs were collected from all the selected crossbred cows with RFM asceptically and brought to the laboratory. The swabs were then transferred into the test tubes containing nutrient broth and incubated at 37°C. The next day, the broth cultures were swabbed uniformly on to the nutrient agar plates. Seven different antibiotic discs* (Table.2) were placed in each plate and incubated at 37°C for 24 hr. After 24 hr, the zones of inhibition of growth of organisms were recorded and the sensitivity was noted as per the literature supplied by the firm (Table 2). The antibiotic to which the organisms were sensitive was given locally into the uterus for 7 days after the expulsion/manual removal of foetal membranes. The dosage of each antibiotic used is shown in the Table 3.

No attempt was made to isolate and identify the bacterial agent (s) due to various constraints in the field.

---

* Span Diagnostics Pvt. Ltd., Udhna.

Table 2: Zone size interpretative particulars of the antibacterials used

S. No.	Antibiotic	Strength (mg)	Diameter of zone of inhibition		
			Resistant mm or Less	Intermediate mm	Sensitive mm or more
1.	Ampicillin	10	11	12-13	14
2.	Chloramphenicol	30	12	13-17	18
3.	Cloxacillin	5	11	12-13	14
4.	Furazolidone	100	14	15-16	17
5.	Gentamicin	10	12	13-14	15
6.	Kanamycin	30	13	14-17	18
7.	Oxytetracycline	30	14	15-18	19

Table 3: Dosage schedule for intrauterine antibacterial therapy

S.No.	Drug[a]	Dosage schedule[b]
1.	Ampicillin sodium (Eskaycillin Vet. Inj. Eskayed)	500 mg in 20ml distilled water
2.	Chloramphenicol (Enteromycetin Inj. Days Pharma)	1000 mg in 20ml distilled water
3.	Cloxacillin (Orbenin) (Beecham Vet. Products)	500 mg in 20 ml distilled water
4.	Nitrofurazone (Furacine Vet. 0.2% w/w sol. Eskayef)	20ml
5.	Gentamicin Sulphate (Gentamicin. Vet. Inj. Luka)	200ml in 20ml distilled water
6.	Kanamycin acid sulphate (Kancin Vet. Inj. Alembic)	500mg in 20ml distilled water
7.	Oxytetracycline hydrochloride (Terramycin liquid. Pfizer)	750mg in 20ml distilled water

a. Name of antibacterial agent along with its trade name and name of manufacturer in parenthesis.

b. Intrauterine infusion once a day for 7 consecutive days.

3.4 PHYSICAL CHARACTERISTICS OF THE FOETAL MEMBRANES

A total of 20 foetal membranes expelled/manually removed were collected from seperate group of 10 cows each with normal parturition without RFM as well as those with RFM. The foetal membranes were allowed to hang for 15 minutes to drain out the fluid and after removing the debris the weight was recorded with the help of a spring balance.

The foetal membranes were cut open from tip to tip along the greater curvature and spread flat on the table. The number of cotyledons were recorded.

3.5 INFLUENCE OF REPRODUCTIVE TRAITS ON THE INCIDENCE OF RFM

3.5.1 Sex of Calf

The sex of the new born was also noted in 20 crossbred cows having RFM as well as in 20 cows without RFM to find any influence of sex.

3.5.2 Number of Calvings

The influence of number of calvings on the incidence of RFM among 20 crossbred cows was studied.

3.6 STATISTICAL METHODS

The statistical analysis of the data was done as per the methods of Snedecor and Cochran (1967).

RESULTS

CHAPTER - IV

4. RESULTS

In the present investigation, the various haematological and biochemical constituents were estimated in the crossbred cows without and with RFM to know the changes if any between the two. The efficacy of the 2 drugs used for the expulsion of foetal membranes viz. Exapar and Replanta was evaluated basing on the time of expulsion of foetal membranes, time of involution of uterus and the occurrence of first postpartum heat. The antibiotic sensitivity test of the uterine microflora was done to find out the most suitable antibiotic in controlling the postpartum uterine infection in cows with RFM.

The weight of foetal membranes and the number of cotyledons in cows without RFM and with RFM were found out to know the difference if any.

The influence of sex of the calf and number of calvings on the incidence of RFM was also investigated. The results of these are given hereunder.

4.1 HAEMATOLOGICAL CONSTITUENTS -

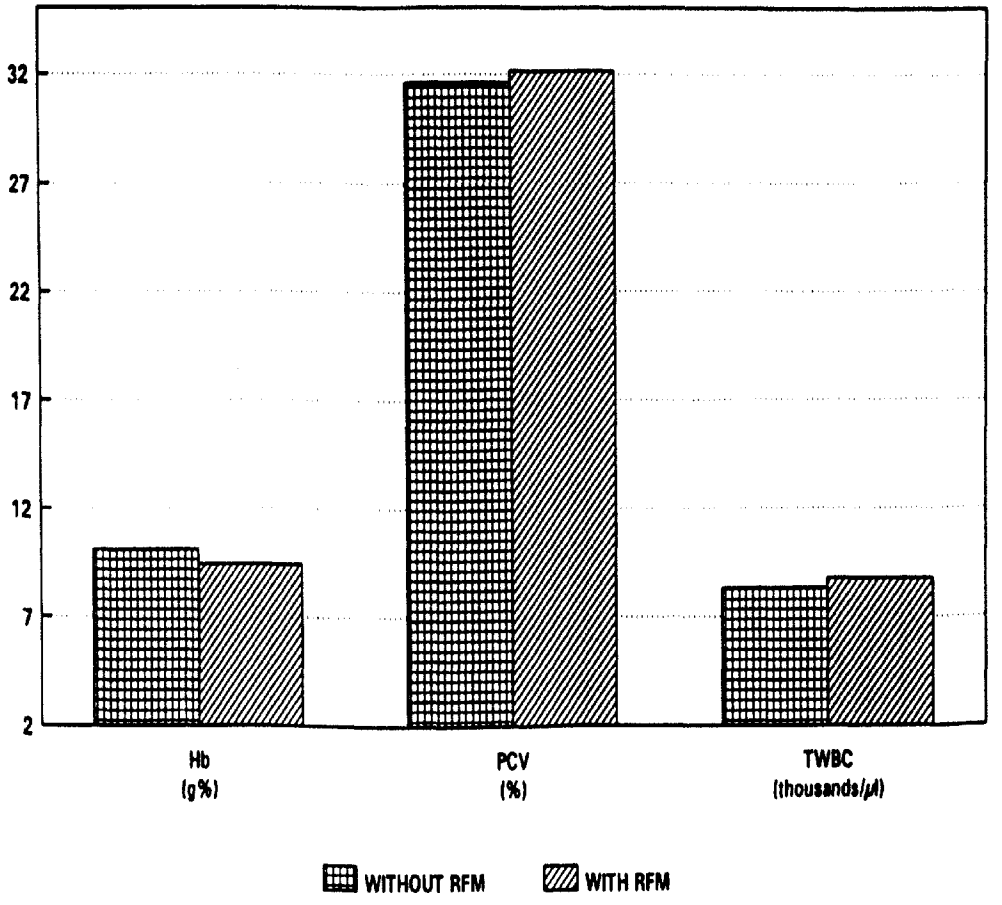
The values for haemoglobin concentration, packed cell volume and total white blood corpuscle count in individual crossbred cows without and with RFM along with 'T' values are presented in the Table 4 and Fig.1.

Table 4: The values for haemoglobin, packed cell volume, total white blood corpuscle count in individual crossbred cows without RFM and with RFM.

S.No.	Haemoglobin (g %)		Packed cell volume (%)		Total White blood corpuscle count Thousands / µl	
	without RFM	with RFM	without RFM	with RFM	without RFM	with RFM
1.	10.4	9.0	28	31	7.95	8.00
2.	9.8	10.4	29	32	9.05	10.40
3.	11.2	9.00	35	34	10.15	9.80
4.	10.6	10.2	28	33	7.80	8.25
5.	9.0	9.8	34	28	8.00	7.65
6.	10.2	9.2	28	32	11.25	13.15
7.	11.6	9.6	35	34	8.25	9.75
8.	10.6	9.4	28	30	9.75	7.05
9.	12.2	10.2	32	36	7.00	7.00
10.	12.0	8.6	34	32	8.15	8.15
11.	8.8	9.4	30	31	9.90	6.95
12.	9.9	11.2	33	30	7.95	9.90
13.	10.2	7.8	34	29	8.30	7.00
14.	11.2	8.6	36	31	7.20	8.30
15.	8.6	9.2	29	35	7.80	8.30
16.	9.2	8.8	28	32	8.25	8.90
17.	8.8	8.4	34	29	6.50	9.90
18.	9.4	10.2	32	34	7.50	10.10
19.	9.6	9.4	33	35	7.35	7.80
20.	8.6	10.2	32	35	7.95	8.80
Mean	10.10^{a}	9.43^{b}	31.60^{a}	32.15^{a}	8.30^{a}	8.76^{a}
Standard error	±0.25	±0.18	±0.61	±0.49	±0.26	±0.33
'T' Values	2.14*		0.68NS		1.06NS	

Mean values with different superscripts in a column differ significantly.
* Significant ($p < 0.05$)
NS-Nonsignificant

FIG.1: HAEMATOLOGICAL VALUES IN NORMALLY CALVED CROSSBRED COWS WITHOUT RFM AND WITH RFM



4.1.1 Haemoglobin

In cows without RFM the mean Hb concentration was found to be 10.10 ± 0.25 g percent with a range of 8.6 to 12.2 g percent. The same in the cows with RFM was 9.43 ± 0.18 g percent with a range of 8.4 to 11.2 g percent. The Hb concentration was significantly lower ($P<0.05$) in cows with RFM, when compared to those without RFM (Table.4)

4.1.2 Packed Cell Volume

In cows without RFM the mean PCV was 31.60 ± 0.61 percent. It ranged from 28.00 to 36.00 percent. In cows with RFM the average PCV was 32.15 ± 0.49 percent with a range of 28.00 to 36.00 percent (Table. 4). Though the PCV was slightly higher in cows with RFM, the difference was not significant ($P > 0.05$).

4.1.3 Total White Blood Corpuscle Count

The mean TWBC count (thousands/μl) in cows without RFM was 8.30 ± 0.26. It ranged from 6.5 to 11.25. In cows with RFM the same was 8.76 ± 0.33 with a range of 6.95 to 13.15 (Table.4). The mean TWBC count, though was higher in cows with RFM, the difference was insignificant ($P > 0.05$).

4.2 BIOCHEMICAL PROFILES

The values for blood glucose, serum calcium, serum phosphorus, total serum proteins, serum acid phosphatase activity and serum alkaline phosphatase activity in individual crossbred cows without and with RFM along with 'T' values are given in the Tables 5 and 6 and Fig.2.

Table 5: The values for blood glucose, serum calcium, serum inorganic phosphorus and serum calcium : phosphorus ratio in individual crossbred cows without RFM and with RFM.

S.No.	Blood glucose (mg%)		Serum calcium (mg %)		Serum phosphorus (mg%)		Calcium phosphorus ratio	
	without RFM	with RFM	without RFM	with RFM	without RFM	with RFM	without RFM	with RFM
1.	56.49	55.16	12.92	7.60	6.77	3.22	1.91	2.36
2.	58.68	46.13	9.15	9.66	4.84	4.84	1.89	2.00
3.	52.37	44.24	8.32	7.13	3.78	3.32	2.20	2.15
4.	60.83	49.55	8.54	11.39	4.36	4.67	1.96	2.44
5.	63.42	38.64	10.84	9.71	5.16	4.21	2.10	2.30
6.	53.16	40.40	10.32	9.36	4.49	4.09	2.30	2.29
7.	60.12	48.07	9.29	10.69	5.16	4.31	1.80	2.37
8.	62.15	51.32	11.69	10.00	5.28	3.74	2.10	2.67
9.	63.50	63.42	8.98	11.57	4.49	5.00	2.00	2.31
10.	55.48	45.72	11.77	7.18	6.13	4.51	1.92	1.59
11.	51.32	63.42	10.37	8.27	5.16	4.83	2.01	1.71
12.	56.78	55.16	9.09	8.51	5.12	4.20	1.78	2.03
13.	63.42	38.64	12.92	11.12	6.02	5.51	2.15	2.02
14.	61.52	40.40	9.49	11.22	4.84	4.83	1.96	2.32
15.	64.10	38.64	9.78	8.77	4.84	4.36	2.02	2.01
16.	62.50	40.41	11.14	9.38	5.28	4.83	2.11	1.94
17.	54.13	65.48	12.12	7.66	6.12	3.78	1.98	2.03
18.	62.10	46.13	10.96	11.39	5.89	4.52	1.86	2.52
19.	57.12	45.72	10.35	10.55	5.39	3.81	1.92	2.77
20.	59.63	36.87	9.08	9.12	4.83	3.49	1.88	2.61
Mean	58.94^{b}	47.68^{a}	10.36^{a}	9.51^{a}	5.20^{b}	4.30^{a}	1.99^{a}	2.22^{b}
Standard error	±0.89	±1.93	±0.31	±0.32	±0.16	±0.13	±0.03	±0.07
'T' values	5.17^{**}		1.85 NS		4.27^{**}		3.05^{**}	

Mean values with different superscripts in a column differ significantly.

** Significant ($p < 0.01$)

NS-Nonsignificant.

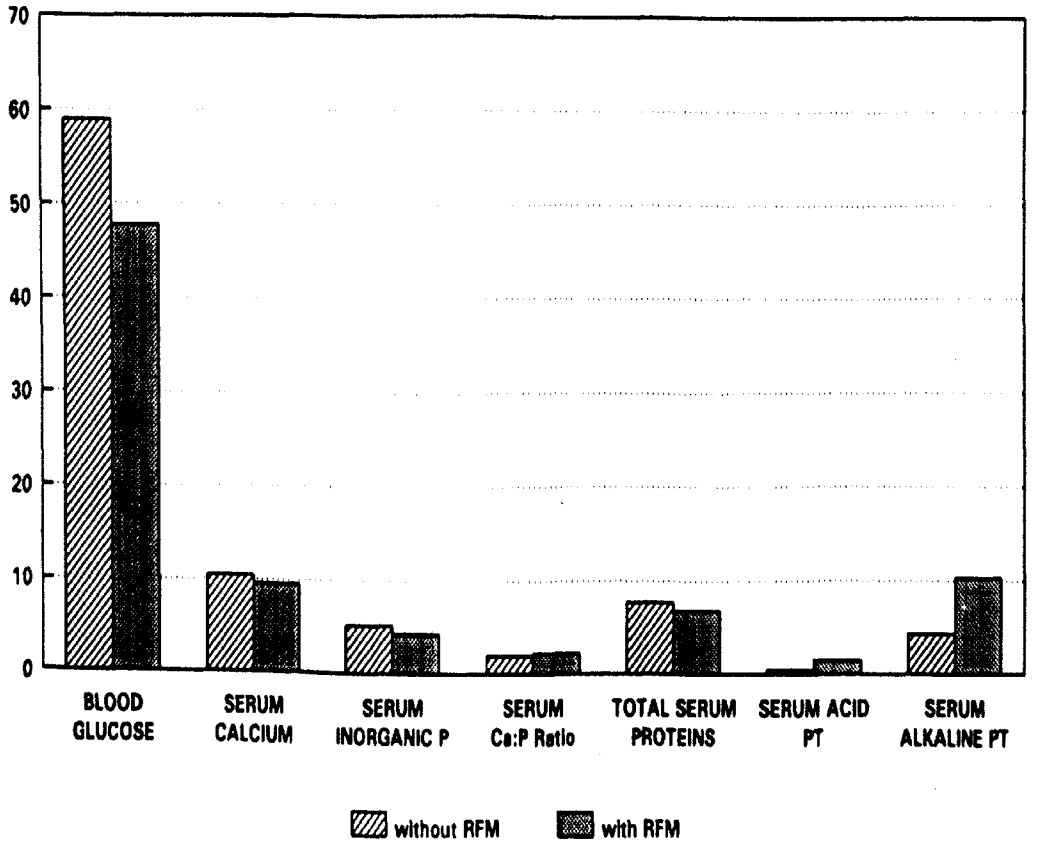
Table 6: The values for total serum proteins, serum acid phosphatase activity and serum alkaline phosphatase activity in individual crossbred cows without RFM and with RFM.

S.No.	Total serum proteins		Serum acid phosphatase		Serum alkaline phosphatase	
	without RFM	with RFM	without RFM	with RFM	without RFM	with RFM
1.	6.42	6.59	0.35	1.38	5.75	10.96
2.	9.22	6.27	0.43	2.27	2.72	7.57
3.	6.25	5.58	0.39	2.05	5.57	9.81
4.	8.85	5.11	0.60	1.37	4.72	13.75
5.	7.58	6.63	0.53	1.82	6.66	7.39
6.	6.92	8.94	0.23	0.89	4.84	9.69
7.	8.52	8.09	0.47	2.00	5.03	10.06
8.	9.19	8.69	0.51	1.58	3.94	9.09
9.	8.02	5.42	0.34	1.92	4.72	10.24
10.	7.86	5.93	0.63	0.89	2.93	8.94
11.	7.32	5.11	0.57	0.79	3.02	12.57
12.	6.69	8.10	0.41	1.05	4.58	9.96
13.	8.05	8.36	0.39	2.13	5.62	10.25
14.	8.42	8.69	0.58	1.19	3.02	13.27
15.	9.22	8.24	0.28	1.89	2.84	10.05
16.	7.02	7.80	0.25	0.89	3.36	12.76
17.	6.43	6.46	0.62	1.23	2.84	9.42
18.	6.24	5.93	0.42	0.98	5.25	9.87
19.	7.72	5.58	0.58	2.15	3.26	7.89
20.	8.01	6.09	0.28	1.98	4.83	13.01
Mean	7.70^{b}	6.78^{a}	0.44^{a}	1.52^{b}	4.28^{a}	10.33^{b}
Standard error	±0.22	±0.28	±0.03	±0.11	±0.26	±0.41
'T' Values	2.48^{*}		9.20^{**}		12.17^{**}	

Mean values with different superscripts in a column differ significantly.

* Significant ($p < 0.05$)
** Significant ($p < 0.01$)

FIG. 2: BIOCHEMICAL LEVELS IN NORMALY CALVED CROSSBRED COWS WITHOUT RFM AND WITH RFM



PT = PHOSPHOSPHATASE
P = PHOSPHORUS
Ca = Calcium

4.2.1 Blood Glucose

In cows without RFM the mean blood glucose was found to be 58.94 ± 0.89 mg percent with a range of 51.32 to 64.10 mg percent. The same in cows with RFM was 47.68 ± 1.93 mg percent. It ranged from 36.87 to 65.48 mg percent. The mean blood glucose level was significantly lower ($P < 0.01$) in cows with RFM when compared to that of cows without RFM (Table.5).

4.2.2 Serum Calcium

The cows without RFM had a mean serum calcium level of 10.36 ± 0.31 mg percent with a range of 8.32 to 12.92 mg percent. But in cows with RFM the mean serum calcium level was 9.51 ± 0.32 mg percent. It ranged from 7.13 to 11.57 mg percent. There was no significant difference ($P > 0.05$) in the serum calcium levels between the cows without RFM and those with RFM, though a lower serum calcium level was found in the cows with RFM (Table.5).

4.2.3 Serum Inorganic Phosphorus

The average serum inorganic phosphorus in cows without RFM was found to be 5.20 ± 0.16 mg percent with a range of 3.78 to 6.77 mg percent. In cows with RFM it ranged between 3.22 to 5.51 mg percent with an average of 4.30 ± 0.13 mg percent. The mean serum inorganic phosphorus in cows with RFM was significantly ($P < 0.01$) lower than that in cows without RFM. (Table.5).

Serum Calcium:Phosphorus Ratio (Ca : P ratio)

In cows without RFM the Ca : P ratio was 1.99 ± 0.03:1 and it ranged between 1.78 to 2.30:1. The mean serum Ca : P ratio in cows with RFM was found to be 2.22 ± 0.07:1 with a range of 1.59 to 2.77:1 (Table.5). A significantly ($P < 0.01$) higher serum Ca : P ratio was observed in cows with RFM when compared to those without RFM.

4.2.4 Total Serum Proteins

The mean TSP in cows without RFM was 7.70 ± 0.22 g percent with a range of 6.24 to 9.22 g percent. The mean value of the same in cows with RFM was 6.78 ±0.28 g percent with a range of 5.11 to 8.94 g percent (Table.6). The mean TSP was significantly lower ($P<0.05$) in cows with RFM than that in cows without RFM.

4.2.5 Serum Acid Phosphatase

The mean serum ACP activity in cows without RFM was 0.44 ± 0.03 K.A. units with a range of 0.23 to 0.63 K.A. units. In cows with RFM the value ranged from 0.79 to 2.27 K.A. units with an average of 1.52 ± 0.11 K.A. units. (Table.6). A significantly ($P < 0.01$) higher level of serum ACP activity was noticed in cows with RFM when compared to that of cows without RFM.

4.2.6 Serum Alkaline Phosphatase

The serum ALP activity in cows without RFM was 4.28 ± 0.26 K.A. units with a range of 2.72 to 6.66 K.A.units. The same in cows with RFM was 10.33 ± 0.41 KA units with a range

of 7.39 to 13.75 K.A. units. (Table.6). There was significantly ($p < 0.01$) increased serum ALP activity in cows with RFM when compared to that in cows without RFM.

4.3 Treatment Regimen

In this study Exapar and Replanta were used for the expulsion of foetal membranes. A total dose of 400ml of Exapar was administered as a haust at the rate of 200 ml on the 1st day in 2 divided doses (morning and evening) and the remaining 200ml was given at the rate of 100ml/day in 2 divided doses of 50ml each in the morning and evening on 2nd and 3rd day. Similarly a total of 350 g of Replanta was administered as an electuary at the rate of 150g on the 1st day (100g morning and 50g evening) and the remaining 200g was given at the rate of 100g/day in 2 divided doses of 50g each in the morning and evening on 2nd and 3rd day.

4.3.1 Efficacy of Drugs

The efficacy of drugs used for the expulsion of foetal membranes was based on 1. time of expulsion of foetal membranes 2. time of involution of uterus and 3. time of occurrence of first postpartum heat.

4.3.1.1 Time of Expulsion of Foetal Membranes

The particulars of time of expulsion of foetal membranes by individual cows treated with Exapar and Replanta are given in the Table 7.

Table 7: **Particulars of time of expulsion of foetal membranes (in days) after treatment with Exapar and Replanta.**

Animal Number	Day of expulsion of foetal membranes					
	1st day		2nd day		3rd day	
	Exapar	Replanta	Exapar	Replanta	Exapar	Replanta
1	-	-	✓	-	-	-
2	-	-	-	-	-	-
3	-	-	-	-	-	-
4	-	-	-	-	-	-
5	-	-	✓	-	-	-
6	-	-	✓	-	-	-
7	-	-	-	-	-	-
8	-	-	-	-	-	-
9	-	-	✓	-	-	-
10	-	-	✓	-	-	-

✓ indicates expulsion of foetal membranes

Out of 10 cows having RFM treated with Exapar, 5 cows expelled the foetal membranes completely on the 2nd day. Other 5 cows did not shed foetal membranes even after 3 days. In these cows the foetal membranes were removed manually without much difficulty.

All the 10 crossbred cows having RFM treated with Replanta did not shed foetal membranes even after 3 days. When the attempts were made to remove the foetal membranes manually, slight difficulty was felt.

4.3.1.2 Involution of Uterus

The particulars of mean time of involution for both gravid and nongravid uterine horns during postpartum period in cows without RFM and with RFM are presented in the Table.8 and Figs.3 and 4. The involution time in individual cows without RFM and in cows having RFM treated with Exapar and Replanta are presented in Appendix III to VIII.

GRAVID UTERINE HORN

The mean size of gravid uterine horn in cows without RFM by the end of 1st week was 11.20 ± 0.46 cm. By the end of 2nd week it has drastically reduced to 8.25 ± 0.28 cm. Later the reduction in the size was marginal. By the end of 5th week the size was 3.90 ± 0.15 cm when the involution was complete. At the end of 8th week the size was 2.40 ± 0.14 cm.

In cows having RFM and treated with Exapar and Replanta, the size of uterine horn by the end of 1st week was 11.70 ± 0.60 and 13.05 ± 0.66 cm. respectively. By the end of 2nd week

Table 8: Mean (± SE) time of involution of gravid and non-gravid uterine horns in normally calved crossbreed cows without RFM and in cows having RFM treated with Exapar and Replanta.

Weeks postpartum	Involution of gravid uterine horn				Involution of non-gravid uterine horn			
	Normally calved cows without RFM (cm)	Cows having RFM		Mean values for weeks (cm)	Normally calved cows without RFM	Cows having RFM		Mean values for weeks (cm)
		Treated with Exapar (cm)	Treated with Replanta (cm)			Treated with Exapar (cm)	Treated with Replanta (cm)	
1	$11.20^{a}\pm0.46$	$11.70^{a}\pm0.60$	$13.05^{a}\pm0.66$	11.98^{m}	$9.25^{a}\pm0.49$	$10.15^{a}\pm0.58$	$11.55^{a}\pm0.51$	10.32^{m}
2	$8.25^{b}\pm0.28$	$8.75^{b}\pm0.54$	$9.75^{b}\pm0.38$	8.92^{n}	$6.80^{b}\pm0.31$	$7.40^{b}\pm0.41$	$8.25^{b}\pm0.31$	7.48^{n}
3	$6.45^{c}\pm0.29$	$6.80^{c}\pm0.35$	$7.65^{c}\pm0.33$	6.97^{o}	$5.30^{c}\pm0.30$	$5.50^{c}\pm0.44$	$36.50^{c}\pm0.30$	5.77^{o}
4	$5.25^{d}\pm0.26$	$5.65^{d}\pm0.33$	$5.90^{d}\pm0.25$	5.60^{p}	$3.90^{d}\pm0.24$	$4.15^{d}\pm0.30$	$5.00^{d}\pm0.27$	4.35^{p}
5	$3.90^{e}\pm0.15$	$4.20^{e}\pm0.27$	$4.50^{e}\pm0.25$	4.20^{q}	$3.15^{de}\pm0.19$	$3.25^{e}\pm0.22$	$3.85^{e}\pm0.14$	3.42^{q}
6	$3.15^{ef}\pm0.14$	$3.25^{f}\pm0.28$	$3.50^{f}\pm0.21$	3.30^{r}	$2.50^{ef}\pm0.14$	$2.60^{ef}\pm0.12$	$3.00^{ef}\pm0.10$	2.70^{r}
7	$2.65^{fg}\pm0.14$	$2.75^{fg}\pm0.22$	$3.00^{fg}\pm0.20$	2.80^{rs}	$2.40^{fg}\pm0.09$	$2.50^{fg}\pm0.07$	$2.60^{fg}\pm0.09$	2.50^{rs}
8	$2.40^{g}\pm0.14$	$2.45^{g}\pm0.17$	$2.75^{g}\pm0.13$	2.53^{s}	$2.30^{g}\pm0.08$	$2.35^{g}\pm0.07$	$2.40^{g}\pm0.06$	2.35^{s}
	5.41^{u}	5.69^{u}	6.26^{v}	5.79^{x}	4.45^{u}	4.74^{u}	5.39^{v}	4.86^{v}

Values with different superscripts in a column differ significantly ($P<0.01$)

Fig.3: INVOLUTION OF GRAVID UTERINE HORNS IN NORMALLY CALVED CROSSBRED COWS WITHOUT RFM AND IN COWS HAVING RFM TREATED WITH EXAPAR AND REPLANTA

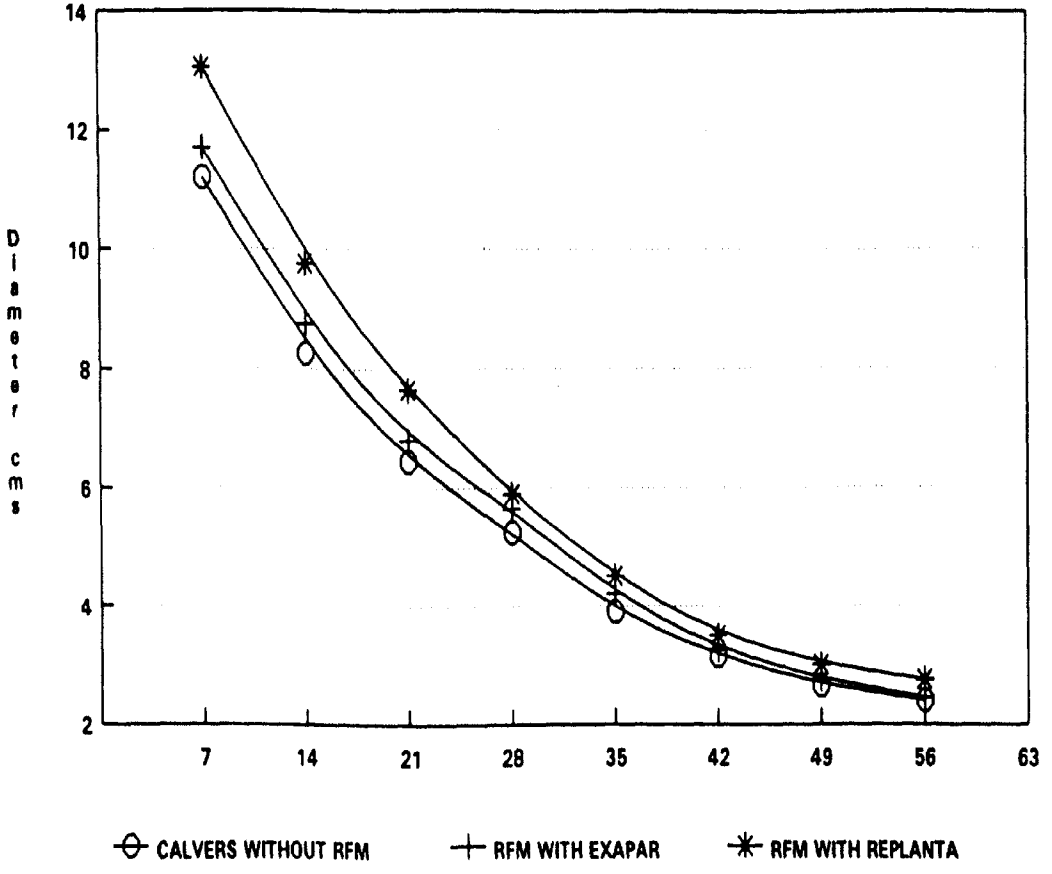
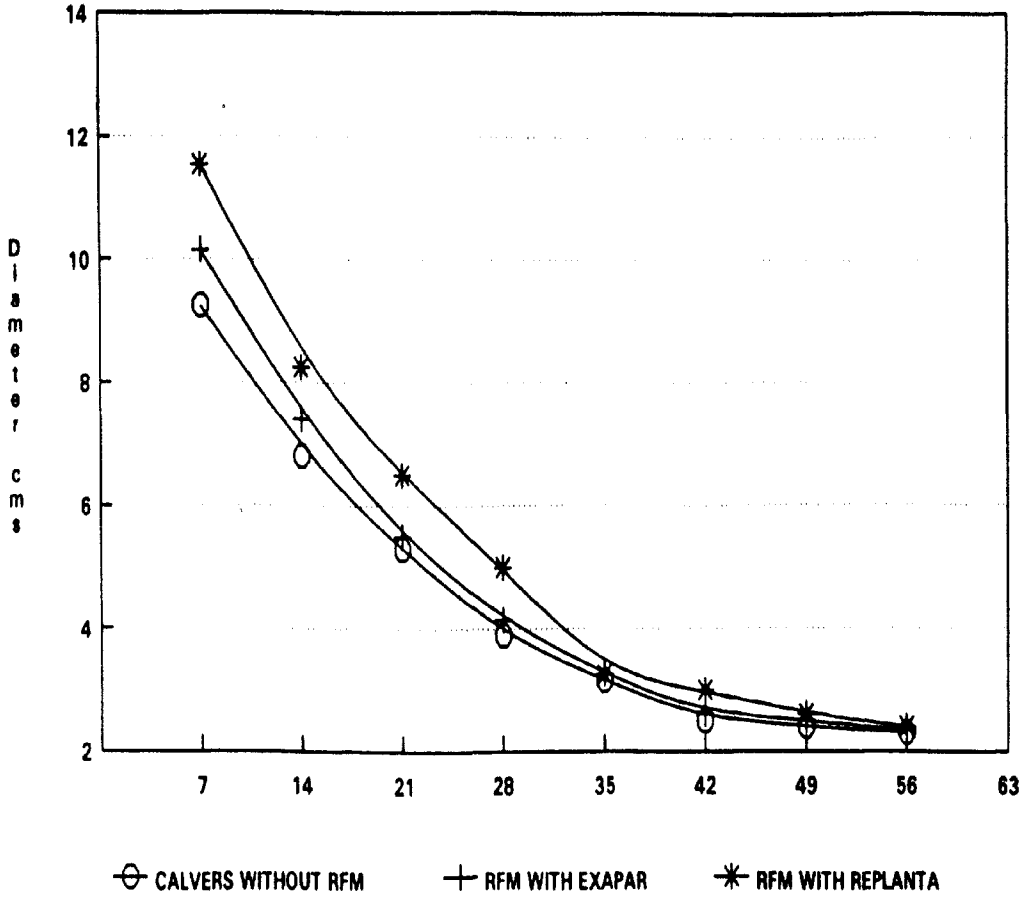


FIG.4: INVOLUTION OF NONGRAVID UTERINE HORNS IN NORMALLY CALVED CROSSBRED COWS WITHOUT RFM AND IN COWS HAVING RFM TREATED WITH EXAPAR AND REPLANTA



the size was reduced to 8.75 ± 0.54 and 9.75 ± 0.38 cm. respectively. The size of the uterine horn at the end of 6th week was 3.25 ± 0.28 and 3.50 ± 0.21 cm. in Exapar and Replanta treated cows respectively, when the involution was complete. The size of horn at the end of 8th week was 2.45 ± 0.17 and 2.75 ± 0.13 cm in Exapar and Replanta treated cows respectively (Table.8).

The regression of the gravid uterine horn in crossbred cows with and without RFM was observed to be rapid and linear from the day of parturition to 2nd week after calving and was slower from second to sixth week. The uterine regression was found to be negligible from 6th week onwards (Fig.3).

In cows (10) without RFM and in five cows having RFM but treated with Exapar which expelled the foetal membranes, the involution of gravid horn was completed by 5th week (35 days) after parturition. In the remaining 5 cows which were treated with Exapar but did not expel foetal membranes the same was completed by 6 weeks (42 days) after parturition (Appendix IX).

Analysis of the data revealed that there was a significant difference ($P < 0.01$) in the mean time of involution of gravid uterine horn between cows without RFM and RFM cows treated with Replanta as well as between Exapar and

Replanta treated cows. But there was no significant difference ($P > 0.05$) in the mean time of involution of uterine horns between cows without RFM and cows having RFM and treated with Exapar (Table.9).

NONGRAVID UTERINE HORN

The mean size of nongravid uterine horn in cows without RFM by the end of 1st week was 9.25 ± 0.49 cm. By the end of 2nd week it has drastically reduced to 6.80 ± 0.31 cm. Later the reduction in the size was marginal. By the end of 4th week the size was 3.90 ± 0.24 cm, when the involution was complete. At the end of 8th week the size was 2.30 ± 0.08 cm.

In cows having RFM and treated with Exapar and Replanta, the size of uterine horn by the end of 1st week was 10.15 ± 0.58 and 11.55 ± 0.51 cm respectively. By the end of 2nd week the size has reduced to 7.40 ± 0.41 and 8.25 ± 0.31 cm respectively. The size of the uterine horn at the end of 5th week was 3.25 ± 0.22 and 3.85 ± 0.14 cm respectively in Exapar and Replanta treated cows, when the involution was complete. The size of horn at the end of 8th week was 2.35 ± 0.07 and 2.40 ± 0.06 cm respectively in Exapar and Replanta treated cows. (Table.8).

The regression of the nongravid uterine horn in cows with and without RFM was observed to be rapid and linear from the day of parturition to 2nd week after calving and was slower from second to sixth week. The regression was found to be negligible from 6th week onwards (Fig.4).

Table 9 : Analysis of variance for the time of involution of gravid and nongravid uterine horns in normally calved crossbred cows without RFM and in cows having RFM treated with Exapar and Replanta

S. No.	Source of variation	Degrees of freedom	Sum of squares	Mean squares	F Ratio
1.	Animals	9	33.7139	3.7460	3.7821**
2.	Between normally calved animals without RFM and in animals having RFM treated with Exapar and Replanta (F1)	2	67.6172	33.8086	34.1344**
3.	Between gravid and non-gravid uterine horn (F2)	1	103.1387	103.1387	104.1328**
4.	Between Weeks (F3)	7	3994.7383	570.6769	576.1773**
5.	F1 x F2	2	0.2031	0.1016	0.1025NS
6.	F1 x F3	14	30.5566	2.1826	2.2037**
7.	F2 x F3	7	30.8398	4.4057	4.4482**
8.	F1 x F2 x F3	14	2.1055	0.1504	0.1518NS
9.	Error	423	418.9619	0.9905	
	Total	479	4681.8750		

** Significant (P<0.01) NS = Non Significant.

The nongravid uterine horn involuted completely by 4th week after parturition in cows without RFM. The time taken by the nongravid horn for complete involution was significantly ($P < 0.01$) shorter than that of gravid uterine horn.

Out of ten RFM cows treated with Exapar involution of nongravid horn was completed by the end of 4th week (28 days) in five cows and in the remaining 5 cows it was completed in 5 weeks (35 days) (Appendix IX). Where as in the cows (10) treated with Replanta the involution was completed by 5th week. Analysis of the data revealed that there was a significant difference ($P < 0.01$) in the mean time of involution of nongravid uterine horn between cows without RFM and RFM cows treated with Replanta as well as between cows having RFM treated with Exapar and Replanta. But there was no significant difference ($P > 0.05$) between cows without RFM and cows having RFM treated with Exapar (Table.9).

The uterine regression in cows with RFM was found to be similar in its trend to that of cows without RFM, but the rate of regression was observed to be significantly slower ($P<0.01$).

4.3.1.3 Occurrence of First Postpartum Heat

The particulars of occurrence of first postpartum heat in individual cows without and with RFM are given in the Table.10 and Fig.5.

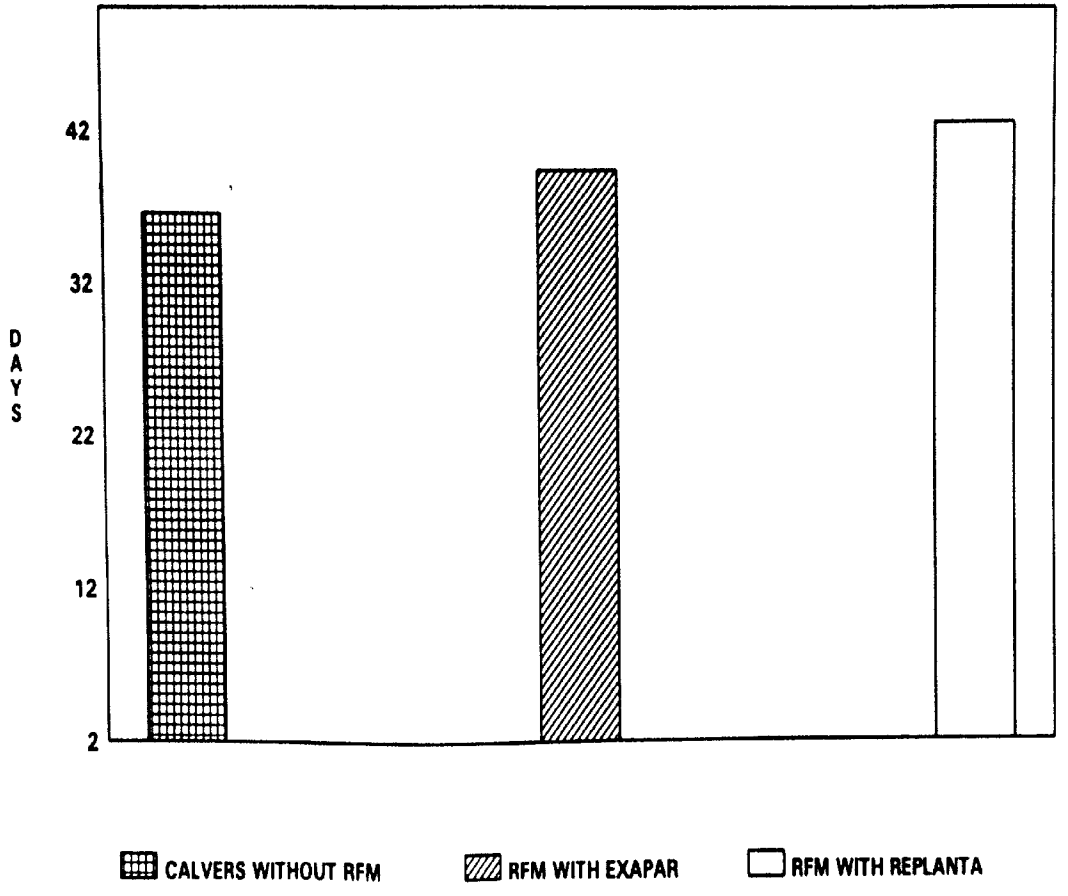
Cows without RFM exhibited first postpartum heat on an average by 36.50 ± 0.97 days after parturition with a range of 31 to 41 days.

Table 10: Time of occurrence of first postpartum heat in individual crossbred cows without RFM and with RFM

S. No.	Without RFM	RFM cows treated with	
		Exapar	Replanta
1	33	33	40
2	35	47	47
3	39	48	41
4	35	34	39
5	37	35	48
6	40	34	40
7	31	42	37
8	35	37	35
9	41	35	47
10	39	48	50
Mean	36.50^{a}	39.30^{ab}	42.40^{b}
Standard error	±0.97	±1.89	±1.55

Mean values with different superscripts in a column differ significantly.

FIG.5: OCCURRENCE OF FIRST POSTPARTUM HEAT IN NORMALLY CALVED CROSSBRED COWS WITHOUT RFM AND IN COWS HAVING RFM TREATED WITH EXAPAR AND REPLANTA



Cows having RFM and treated with Exapar exhibited first postpartum heat between 33 and 48 days after parturition with a mean of 39.30 ± 1.89 days. In Replanta treated cows it varied from 35 to 50 days with a mean of 42.40 ± 1.55 days (Table.10).

A significant difference ($P<0.05$) in the mean time of occurrence of first postpartum heat was observed between cows without RFM and RFM cows treated with Replanta. There was no siginificant difference ($P>0.05$) in the time of occurrence of first postpartum heat between cows without RFM and Exapar treated cows. Though there was a slight difference in the mean time of occurrence of 1st postpartum heat between Exapar and Replanta treated cows, the same was insignificant ($P>0.05$) (Table.11).

4.3.2 Antibiotic Sensitivity Test

In this study antibiotic sensitivity tests were conducted on 20 samples collected from the uterus of cows with RFM. The data on the sensitivity of the organisms is presented in the Table 12 and Appendix X.

It is seen from the Table 12 that most of the microflora were sensitive to Gentamycin, Kanamycin and Chloramphenicol. The microflora in all the 20 samples were found to be resistant to Cloxacillin and in most of the samples the microflora were found to be resistant to Ampicillin and Oxytetracycline.

Table 11: Analysis of variance for the occurrence of first postpartum heat in crossbred cows without RFM and in cows having RFM and treated with Exapar and Replanta

S.No.	Source of variation	Degrees of freedom	Sum of squares	Mean squares	F-value
1.	Animals	9	351.8672	39.0964	2.0751 NS
2.	Between normally calved crossbred cows without RFM and RFM in animals treated with Exapar and Replanta	2	174.1992	87.0996	4.6229*
3.	Error	18	339.1328	18.8407	
	Total	29	865.1992		

* Significant ($p<0.05$) NS = Non-significant

Table 12: Antibiotic sensitivity pattern of the uterine contents collected from cows with RFM

S. No.	Name of the Antibiotic	Number of samples		
		Resistant	Intermediate	Sensitive
1.	Ampicillin	18	-	2
2.	Chloramphenicol	6	2	12
3.	Cloxacillin	20	-	-
4.	Furazolidone	12	3	5
5.	Gentamicin	1	1	18
6.	Kanamycin	4	2	14
7.	Oxytetracycline	17	2	1

4.4 Physical Characters of Foetal Membranes

4.4.1 Weight

The weight of the placenta in individual cows without RFM and with RFM is presented in the Table 13 and Fig 6. In crossbred cows without RFM the weight of foetal membranes was found to be 2.23 ± 0.09 kg with a range of 1.80 to 2.50 kg and in RFM cows it was 1.77 ± 0.09 kg with a range of 1.30 to 2.25 kg.

The weight of foetal membranes was significantly ($P<0.01$) lower in cows with RFM when compared to that of cows without RFM (Table.13).

4.4.2 Cotyledon Number

The cotyledon number in individual cows without and with RFM was presented in the Table 13 and Fig 7. The number of cotyledons present in cows without RFM varied from 52 to 85 with a mean of 68.6 ± 2.73. The number in cows with RFM was 68.3 ± 2.39 with a range of 56 to 83.

No significant difference ($P > 0.05$) was observed in the cotyledon number between cows without RFM and with RFM (Table 13).

Table 13: Physical characters of foetal membranes in individual crossbred cows without RFM and with RFM.

S. No.	Placental weight		Cotyledon number	
	Without RFM	With RFM	Without RFM	With RFM
1	1.80	2.25	52	58
2	2.50	1.70	65	72
3	2.50	1.75	76	70
4	2.00	1.45	68	83
5	2.50	1.30	70	70
6	1.90	1.80	75	66
7	2.50	2.15	85	76
8	2.25	1.60	65	56
9	2.50	2.00	70	67
10	1.80	1.70	60	65
Mean	2.23^{b}	1.77^{a}	68.6^{a}	68.3^{a}
Standard error	±0.09	±0.09	±2.73	±2.39
T Values	3.32^{**}		0.08	

Mean values with different superscripts in the column differ significantly.

** Significant ($P < 0.01$)

FIG.6: PLACENTAL WEIGHT IN NORMALLY CALVED CROSSBRED COWS WITHOUT RFM AND WITH RFM

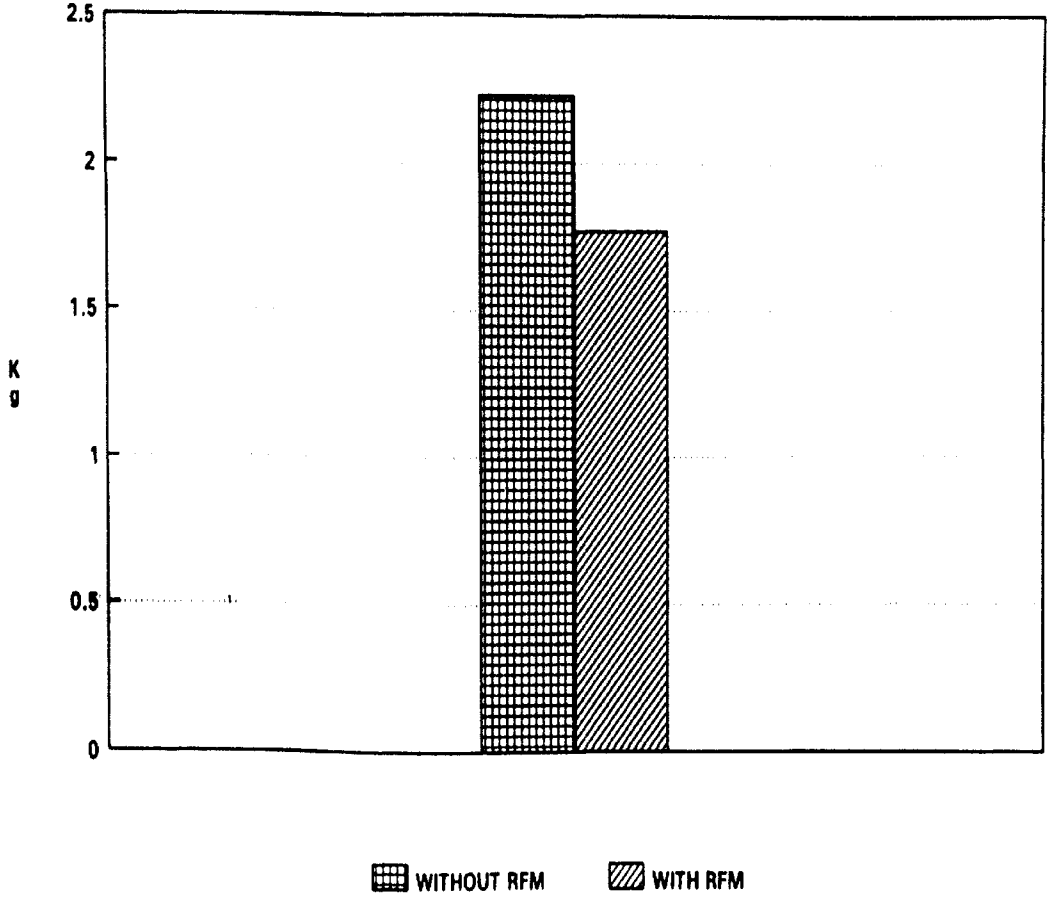
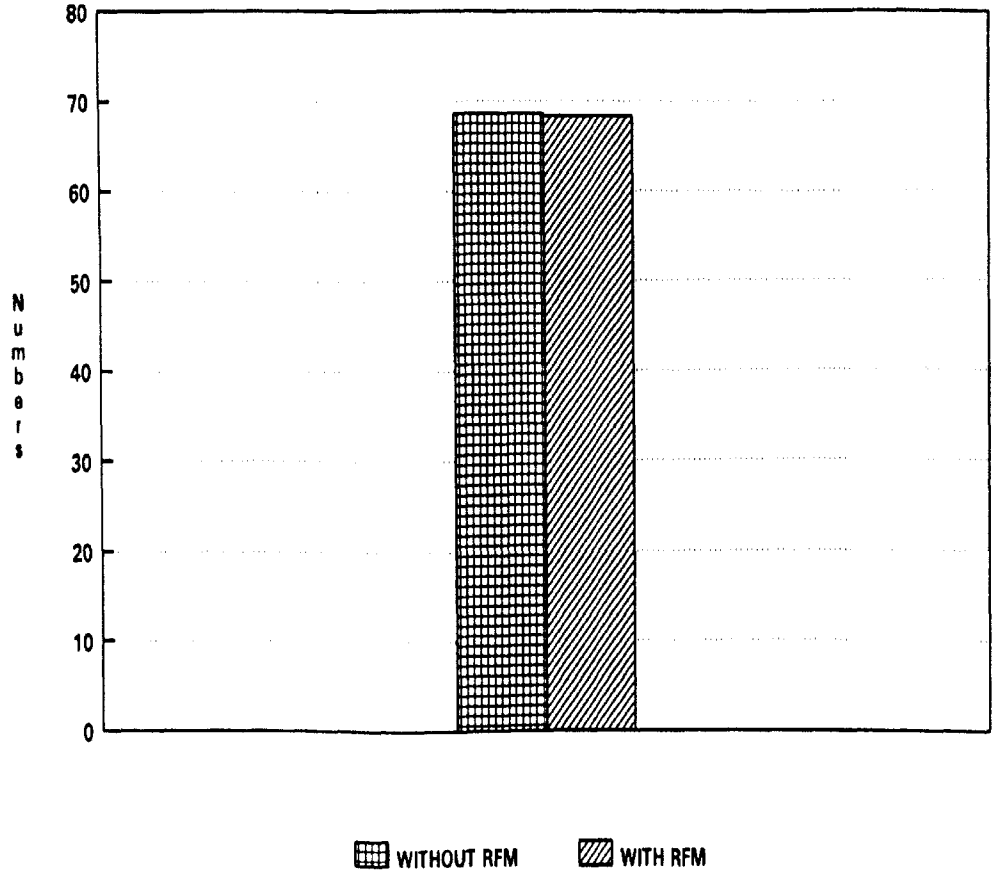


FIG. 7: COTYLEDON NUMBER IN NORMALLY CALVED CROSSBRED COWS WITHOUT RFM AND WITH RFM



4.5 Influence of Reproductive Traits on the Incidence of RFM

Particulars of number of calvings and sex of calf born to individual cows without RFM and with RFM are given in the Table 14.

4.5.1 Sex of Calf

In this study out of the 20 cows with RFM, 14 cows delivered male calf and the remaining gave birth to female calf. In cows without RFM 11 gave birth to female calf and 9 cows delivered male calf. From Table 14, it was found that the incidence of RFM was found to be more with the birth of a male calf (70%) rather than with that of female calf.

4.5.2 Number of Calvings

It is seen from the Table 14, that the retention of foetal membranes was noticed in 6 cows that were in the 1st calving, 6 in the 2nd, 4 in the 3rd and 3 in the 4th and 1 in the 5th calving.

A total of 6 out of 20 cows with RFM were in their 1st calving another 6 in their 2nd calving indicating a higherincidence of RFM during 1st and 2nd calvings.

Out of 20 cows without RFM, 2 cows were in the 1st calving, 2 in the 2nd, 5 in the 3rd, 4 in the 4th and 6 in the 5th calving. A total of 15 out of 20 cows without RFM were in their 3rd to 5th calvings.

Table 14 Influence of sex of calf and number of calvings on the incidence of RFM.

Without RFM				With RFM			
S.No/ Animal No.	Sex of calf		Number of Calvings	S.No./ Animal No.	Sex of calf		Number of Calvings
	Male	Female			Male	Female	
				Tirupati			
1	-	✓	3	1	✓	-	4
2	-	✓	3	2	✓	-	5
3	✓	-	2	3	✓	-	3
4	✓	-	4	4	✓	-	1
5	-	✓	1	5	-	✓	2
6	-	✓	2	6	✓	-	2
7	✓	-	1	Chittoor 7	✓	-	1
8	-	✓	3	8	-	✓	2
9	✓	-	3	9	✓	-	4
10	✓	-	3	10	✓	-	3
11	-	✓	4	11	✓	-	1
12	-	✓	6	12	-	✓	3
13	✓	-	5	13	-	✓	1
14	-	✓	5	14	✓	-	2
15	-	✓	5	15	✓	-	3
16	-	✓	5	16	✓	-	1
17	-	✓	4	17	✓	-	4
18	✓	-	4	18	✓	-	2
19	✓	-	5	19	-	✓	1
20	✓	-	5	20	-	✓	2

✓ Indicate birth of a calf

DISCUSSION

CHAPTER - V

5. DISCUSSION

In the present study the various haematological and biochemical constituents in crossbred cows without RFM (20) and in cows with RFM (20) were estimated and compared. The efficacy of drugs used for expulsion of foetal membranes viz. Exapar and Replanta was assesed. The antibiotic sensitivity of uterine microflora in cows having RFM was also determined. The influence of sex of calf and number of calvings on the RFM were also found out.

In the present study the mean level of haemoglobin in normally calved crossbred cows without RFM was found to be 10.10 ± 0.25 g percent. However Agarwal **et al**., (1965) in Haryana cows, Benysek and Kudlac (1971) in cows. Rowlands **et al**., (1975) in Friesian, Ayrshire or Friesian x Ayrshire, Prakash and Tondon (1978) in Holstein X Tharparkar heifers and Miltenburg **et al**., (1991) in crossbred Friesian dairy cows noticed a higher haemoglobin concentration than the present findings in normal calvers without RFM.

In the present study the mean haemoglobin concentration in cows with RFM was 9.43 ± 0.18g percent, which was significantly ($P < 0.01$) lower than that of cows without RFM. These findings were akin to the observations of Benysek and Kudlac (1972) in cows and Suryanarayana Murty (1992) in crossbred cows, who also reported lower level of Hb in cows with RFM.

The Hb level is an indication of nutritional status (Roberts, 1971) and is a measure of the protein status of the animal.

The lower level of Hb in cows with RFM as noticed in this study might be due to poor nutritional status of the animals which might have lead to retention of foetal membranes.

The mean packed cell volume of crossbred cows without RFM was 31.60 ± 0.61 percent. Contrary to the present findings, increased mean packed cell volume was recorded by Benysek and Kudlac (1971) in cows and Prakash and Tondon (1978) in Holstein X Tharparkar heifers after normal parturition without RFM.

The mean PCV in cows with RFM was 32.15 ± 0.49 percent. The present value was in close agreement with the findings of Suryanarayana Murty (1992). But Benysek and Kudlac (1972) reported a significantly lower PCV in cows with RFM. In the present study no significant difference ($P > 0.05$) in the PCV values between the cows without RFM and those with RFM was noticed. It may be possible that the PCV may not be a significant factor in reproduction.

In the present investigation the TWBC count in crossbred cows without RFM was 8.30 ± 0.26 thousands/μl which was similar to the observations of Agarwal *et al.*, (1965) who noticed a fairly constant TWBC count in Haryana cows and Mohanty (1978) who found the TWBC count to be within the normal maximum limit.

In the present study there was no marked change in the mean TWBC count in crossbred cows with RFM (8.76 ± 0.33 thousands/μl) when compared to that of cows without RFM. The difference was insignificant (P >0.05), though higher counts were noticed in cows with RFM. This gained support from the reports of Roberts (1971) in cows and Suryanarayana Murty (1992) in crossbred cows. On the contrary Kudlac and Benysek (1972), Mulei et al., (1993) noticed a decreased leucocyte count in cows with RFM.

The slightly higher TWBC counts noticed in cows with RFM might be due to presence of uterine infection. Cattle reacts to infection with a slight rise in the TWBC counts, since in the early phase of infection there is increased destruction of lymphocytes (Jain, 1986).

In the present study the mean blood glucose level in cows without RFM was recorded to be 58.94 ± 0.89 mg percent. Contrary to the present findings, in cows, Rowlands et al., (1975) and Mulling et al., (1979) and in crossbred cows Mohanty et al., (1994) and Agarwal et al., (1985) reported much higher values, while in Holstein x Tharparkar heifers Prakash and Tondon (1978), in Ongole and HF x Ongole cows Chalapati Rao (1979), in Ongole cows Rao et al., (1981) and in Rathi cows Pareek and Deen (1985), reported much lower values of glucose.

The mean blood glucose level in cows with RFM in the present study was 47.68 ± 1.93 mg percent which was

significantly lower to that of cows without RFM. Similar findings were observed by Boiter et al., (1972 and 1973), Dutta (1980) and Choudhury et al., (1993) in native cows, Agarwal et al., (1985), Suryanarayana Murty (1992) and Mohanty et al., (1994) in crossbred cows.

The decrease in the mean blood glucose as noticed in this study might be attributed to poor nutritional status of the animal (Roberts, 1971) or due to disturbance in the energy metabolism and utilisation (Sharma et al., 1983).

The lower levels of glucose might have caused atony of uterine tissues and less uterine contraction, which inturn might have lead to retention of foetal membranes.

In this study the mean serum calcium levels in cows without RFM was 10.36 ± 0.31 mg per cent. This observation gains support from the reports of Chalapati Rao (1979)in Ongole and HF X Ongole cows, Rao et al.,(1981) in Ongole cows, Shukla et al., (1983) in crossbred cows, sharma et al., (1991) in cows. But Tariq Ahmed et al., (1984) in native cows and Mohanty et al., (1994) in crossbred cows reported much lower levels. However Pareek and Deen (1985) reported much higher calcium levels in normally calved Rathi cows without RFM.

The mean serum calcium levels in cows with RFM was insignificantly ($P > 0.05$) lower in this study (9.51 ± 0.32 mg %). These findings were akin to the observations of Suryanarayana Murty (1992) in crossbred Jersey cows, though Shukla et al., (1983) in crossbred cows, Capaul and Luca

(1984), Tariq Ahmed *et al*., (1984), Sharma *et al*., (1991) in cows and Mohanty *et al*., (1994) in crossbred Jersey cows found significantly lower level of serum calcium in cows with RFM.

On contrary to the findings in this study, Kumpf (1984) reported an increase in the serum calcium level in cows with RFM.

The lower levels of calcium in cows with RFM might be due to disturbance in the mineral metabolism (Flegmatov and shipilov, 1961 and Martinov, 1964) or due to excessive mammary uptake and subsequent release in to colostrum (Shukla *et al*., 1983 and Tariq Ahmed *et al*., 1984) or due to execessive mobilisation of calcium to the foetus during later stages of pregnancy resulting in less availability to uterine tissue (Mohanty *et al*., 1994).

The decrease in the serum calcium might have caused atony of uterus resulting in RFM(Capaul and Luca, 1984 and Arthur *et al*., 1992).

In this investigation the mean serum inorganic phosphorus concentration in cows without RFM was 5.20 ± 0.16 mg percent. The present findings gain support from the observations of Rao *et al*., (1981) in Ongole cows, Shukla *et al*., (1983) in crossbred cows, Tariq Ahmed *et al*., (1984) in cows and Pareek and Deen (1985) in Rathi cows, who also reported similar values. But Rowlands *et al*., (1975) and Garbacik and Balon (1978) in cows, Chalapati Rao (1979) in Ongole and HF x Ongle cows, Agarwal *et al*., (1991) in cows recorded higher values.

In this study a significantly lower ($P < 0.01$) mean serum inorganic phosphorus level (4.30 ± 0.13 mg %) was noticed in cows with RFM and the findings were in close agreement with those of Garbacik and Balon (1978) in native cows, Shukla *et al.*, (1983) in crossbred cows, Kumpf (1984) and Tariq Ahmed *et al.*, (1984) in cows, Agarwal *et al.*, (1985) in crossbred cows, Vukovic *et al.*, (1987) in Simmental cows, Shin and Jo (1987) and Sharma *et al.*, (1991) in cows.

But Choudhury *et al.*, (1993) in native cows and Suryanarayana Murty (1992) in crossbred Jersey cows noticed no appreciable changes in the concentration of serum inorganic phosphorus in cows having RFM when compared to cows without RFM.

The lower level of serum inorganic phosphorus observed in this study might be due to disturbance in the mineral metabolism (Flegmatov and Shipilov, 1961 and Martinov 1964) or due to feeding of less phosphorus or due to increased utilisation of serum inorganic phosphorus along with glucose (Doxy, 1971).

In the present study the mean Ca : P ratio in crossbred cows without RFM was 1.99 ± 0.03 : 1 with a range of 1.78 to 2.3:1. Very close to the present findings, Morrow (1980) and Sharma *et al.*, (1991) recorded a ratio of 1.5 to 2.3:1 and 2:1 in cows without RFM respectively.

In the present investigation a significantly higher Ca:P ratio was observed in cows with RFM (2.22 ± 0.07 : 1) when

compared to that in cows without RFM and these findings were akin to those of Sharma *et al*., (1991) who recorded a ratio of 2.3:1.

A higher Ca:p ratio in cows with RFM noticed in this study might be due to changes in mean serum calcium and phosphorus levels. While the decrease in the mean serum calcium level was marginal, the decrease in the mean phosphorus level was considerable resulting a higher Ca:P ratio.

The mean concentration of serum total proteins in cows without RFM was 7.70 ± 0.22 g percent. Contrary to the present findings Pareek and Deen (1985) in Rathi cows, and Mehta *et al*., (1989) in non-descript cows reported lower total serum protein values while Agarwal *et al*., (1985) reported higher values in crossbred cows.

In this study the mean total serum proteins in cows with RFM was found to be 6.78 ± 0.28 g percent. While Agarwal *et al*., (1985) reported a higher value (8.53 ± 0.72 g%) Suryanarayna Murty (1992) noticed lower serum protein levels (5.64 ± 0.23 g%). But Benysek and Kudlac (1972) and Choudhury *et al*., (1993) did not observe any appreciable change in the total serum protein in cows.

A significantly ($P<0.05$) lower level of total serum proteins was observed in cows with RFM than that of cows without RFM, which might be due to poor nutritional status of the animal.

In this observation the mean serum ACP activity in crossbred cows without RFM was 0.44 ± 0.03 K.A. units. Unlike the present findings Kendall and Harshbarger (1962) reported lower serum acid phosphatase activity.

The mean serum ACP activity in cows with RFM was found to be 1.52 ± 0.11 K.A. units. A significantly ($P<0.01$) higher activity was observed in cows with RFM than that in cows wtihout RFM, which might be due to autolysis of uterine tissues by hydrolytic enzymes like ACP. Lobel and Deane (1962) also reported an increase in ACP by 3rd day postpartum and attributed this increase to the process of physiological autolysis by hydrolytic enzymes like ACP.

In the present study the mean serum ALP activity in cows without RFM was 4.28 ± 0.26 K.A. units. Contrary to the present findings Kendall and Harshbarger (1962)in dairy cows, Singh *et al*., (1972) in Rathi and Sahiwal cows, Sharma *et al*., (1991) in cows and Mohanty *et al*., (1994) in crossbred Jersey cows reported much higher values, while Mehta *et al*., (1989) recorded lower values in nondescript cows.

In the present investigation the mean serum ALP activity in cows with RFM was found to be 10.33 ± 0.41 K.A. units. Dutta and Dugwekar (1982) in native cows, Peter *et al*., (1987) in dairy cows, Sharma *et al*., (1991) in native cows and Mohanty *et al*., (1994) in crossbred cows also noticed similar serum ALP activity in cows with RFM. A significantly ($P<0.01$) higher level of serum ALP activity as observed in cows with

RFM in this study might be due to leakage of more amount of enzyme from the inflammed and necrotic tissue in the RFM cows (Mohanty *et al.*, 1994).

In this investigation in cows with RFM, the mean Hb, blood glucose, serum inorganic phosphorus concentration and total serum protein values were significantly ($P<0.05$) lower and the mean Ca:P ratio, serum ACP and ALP activity were significantly ($P<0.01$) higher, with no significant difference ($P>0.05$) in the mean PCV, TWBC count and serum calcium levels, when compared to cows without RFM.

Out of 10 cows having RFM and treated with Exapar 5 cows expelled the foetal membranes by 2 days. In all the 5 cows which did not expel the foetal membranes after Exapar treatment no difficulty was felt while removing the foetal membranes, unlike in those which were treated with Replanta. From this, it may be inferred that the drug, Exapar might have loosened the foetal membranes, but the same would not have been expelled due to poor uterine contractions or due to differences in the union between foetal villi and maternal crypts or due to differences in the endogenous collagenase levels amongst the cows with RFM (Hugo Eiler and Hopkins, 1993).

With regard to the efficacy of the two drugs used viz. Exapar and Replanta for the expulsion of foetal membranes, it was noticed that 5 out of 10 cows treated with Exapar expelled the foetal membranes, while none out of 10 cows did so with

Replanta. In those cows which were treated with Exapar but did not expel the foetal membranes by 2 days no difficulty experienced while removing them manually.

In the present observation a total dose of 400 ml of Exapar was administered as a haust at the rate of 200 ml on the 1st day in 2 divided doses (in the morning and evening) and the remaining 200 ml was given at the rate of 100 ml/day in 2 divided doses of 50 ml each in the morning and evening on 2nd and 3rd day. A total dose of 350 g of Replanta was administered as electuary at the rate of 150 g on the 1st day (100 g morning and 50 g evening) and the remaining 200g was given at the rate of 100 g per day in 2 divided doses of 50 g each in the morning and evening on 2nd and 3rd day without any antibiotic and uterine douch. Contrary to the present observation Hamidul Islam and Nooruddin (1990) found Replanta as a drug of choice for the expulsion of foetal membranes in cows. The authors found expulsion of foetal membranes in 16 out of 18 cows with RFM by giving Replanta orally and douching the uterus with antibiotics and antiseptics for 3 to 6 days. Likewise, Chakrabarthi and Pal (1990) also recommended Replanta as a drug for the expulsion of foetal membranes. The authors used Replanta and Pivipal together and Replanta, Pivipal and calcium borogluconate in combination and found expulsion of foetal membranes in all the 40 cows of 20 each with combination. The difference between the present findings and those of Hamidul Islam and Nooruddin (1990) and

Chakrabarthi and Pal (1990) might be due to the variation in the treatment regime (Appendix I).

In this study the involution of gravid uterine horn in cows without RFM was found to be completed on an average by 5th week (35 days) after parturition. The regression in the size of the gravid uterine horn in cows without RFM was observed to be rapid and linear from the day of parturition to 2nd week and less rapid and curvilinear from 2nd to 6th week after parturition. The uterine regression was found to be negligible from 6th week onwards. These observations were in close agreement with the findings of Francis and Raja (1971) in Sindhi cows (36.27 ± 0.69 days) and Goel and Singh (1988) in HF X Haryana cows, (31.6 to 33.7 days). However, Buch et al., (1955) Roberts (1956), Gier and Marion (1968) in cows, Marion et al., (1968) in exotic cows, Morrow (1969) and Garcia (1982) in dairy cows reported to have observed involution by 47 to 50 days. But Casida and Venzke (1936), Casida and Wisnicky (1952) and Rasbech (1950) reported to have noticed involution even earlier i.e., by 26 days.

In the present study, there was a significant ($P<0.01$) difference in the time of involution of gravid uterine horn between the cows treated with Exapar and Replanta as well as between cows without RFM and RFM cows treated with Replanta. But there was no significant difference in the time of involution between cows without RFM and cows having RFM treated with Exapar.

Only 5 out of 10 cows which were treated with Exapar expelled the foetal membranes. There was no difference in the mean time of involution of uterus (35 days or 5 weeks) between the cows which expelled the foetal membranes on treatment with Exapar and those without RFM. But there was a difference in the mean time of involution of uterus between cows without RFM (35 days or 5 weeks) and those treated with Exapar but did not expel the foetal membranes as well as those treated with Replanta (42 days or 6 weeks). The findings in the present study were akin to those of Kumpf (1984) and Morrow et al., (1969) in cows with RFM and those without RFM respectively.

Roberts (1971), Fonseca et al., (1983) and Dutta and Dugwekar (1988) opined that cows having RFM required slightly more time for complete involution of uterus than those without RFM.

In this study the mean time of involution of non-gravid uterine horn in cows without RFM was found to be completed by 4th week (28 days) after parturition. The present finding was in agreement with the findings of Choudury et al., (1974), Agasti et al., (1975) and Jana and Mishra (1978) who reported the involution time to be 22.21 to 44.29 days. But Kadu and Kaikini (1972) in Sahiwal cows reported it to be much earlier i.e., 17.91 days.

In the present investigation there was a significant difference ($p<0.01$) in the involution of non-gravid uterine horn between cows without RFM and RFM cows treated with

Replanta as well as between Exapar and Replanta treated cows. But there was no significant difference ($P > 0.05$) in the time of involution of nongravid uterine horn between cows without RFM and cows having RFM and treated with Exapar.

The time of involution of uterus was influenced by many factors viz. age, season of the year, suckling, climate, periparturient abnormalities like dystocia, hypocalcemia, ketosis, twin calves, RFM, metritis and delayed return to cyclical ovarian activity (Arthur **et al**., (1992).

Among the cows having RFM which were trated with Exapar in which the foetal membrane expelled, complete involution of non-gravid horn occurred on par with those without RFM (28 days or 4 weeks) where as in those cows which failed to expel the foetal membranes after the tratement with Exapar and Replanta the same has occurred at the end of 5th week.

Contrary to the findings in the present investigation Chakrabarthi and Pal (1990) observed no difference in the time of involution of uterus in crossbred cows without RFM and cows with RFM that were treated with Replanta. The difference in the findings might be due to differences in the breed or age of the cows treated.

In the present study, there was a difference in the mean time of involution of uterus between cows which expelled the foetal membranes and treated with Exapar and those which did not expel the same after Exapar and Replanta treatment. This might be due to the introduction of microorganisms while

removing the foetal membranes as opined by Banerjee (1966). Roberts (1971) opined that severe uterine infection might retard the rate of involution of uterus.

In this investigation the mean time of occurrence of first postpartum heat in cows without RFM was found to be 36.50 ± 0.97 days with a range of 31 to 41 days.

However the mean time of occurrence of first postpartum heat varied amongst different workers. Acharya **et al**., (1971), Kadu and Kaikini (1972) and Sharma **et al**., (1975) (39 to 100 days); Dutta and Dugwekar (1982) (61.37 ± 9.58 days) in Indian breeds and Choudury **et al**., (1974), Jana and Mishra (1978), Pandey **et al**., (1979) Jaiswal **et al**., (1979) (39 to 63 days) in crossbred cows and Kumpf (1984) in cows.

The variation in the time of occurrence of first postpartum heat between the present observation and those of earlier workers might be due to the variation in the breed, endocrine status as well as productivity and parity of the cows studied (Dutta and Dugwekar, 1988).

The mean time of occurrence of first postpartum heat in cows having RFM and treated with Exapar and Replanta was found to be 39.30 ± 1.89 and 42.40 ± 1.55 days respectively. But Kumpf (1984) reported the same to be 54 days.

In this study there was no significant difference ($P>0.05$) in the time of occurrence of first postpartum heat between the cows without RFM and those having RFM and treated

with Exapar. But a significant difference ($P<0.05$) was observed between cows without RFM and those having RFM and treated with Replanta. The mean time of occurrence of first postpartum heat was shorter i.e., 39.30 ± 1.89 days, in cows treated with Exapar, when compared to those treated with Replanta (42.40 ± 1.55 days). The difference might be due to difference in the mean time taken for uterine involution. In the cows treated with Exapar, the mean time of involution was less when compared to those treated with Replanta. The time of occurrence of first postpartum heat might be influenced by the time taken for the complete involution of uterus as opined by Paisldy *et al*., (1986) who reported delayed resumption of first postpartum heat due to delayed involution of uterus.

From the above findings it may be concluded that the drug Exapar was more efficacious in treating the RFM when compared to Replanta due to following reasons.

1. That 50% of cows expelled the foetal membranes by 2nd day.
2. In the cows which did not expel the foetal membranes, there was no difficulty while removing manually.
3. The mean time of involution of uterus and
4. the mean time of occurrence of postpartum heat were shorter.

An overview of the antibiotic sensitivity pattern of the 20 uterine samples obtained in this study revealed that most of the microflora were sensitive to Gentamycin followed by

Kanamycin and Chloramphenicol and the microflora in all the 20 samples were resistant to Cloxacillin. Bretzlaff **et al.**, (1982) found microflora in the RFM cases to be highly sensitive to Chloramphenicol, followed by Furacin, Gentamycin and Ampicillin in their studies.

It may be inferred from the ABST that in most of the cases of RFM, Gentamycin sensitive organisms were the common microbial flora present. Microflora sensitive to Kanamycin and Chloramphenicol also were frequent. Based on these findings it may be concluded that in most of the cases with RFM either Gentamycin or Kanamycin or Chloramphenicol may be helpful in controlling the postpartum uterine infections in these parts of the district, since non of the cows developed any uterine infection after administration of the antibiotic locally.

The mean weight of the foetal membranes in cows without RFM was 2.23 ± 0.09 Kg. Similar findings were reported by Kadu and Kaikini (1972 and 1975) in Sahiwal cows, Bhosrekar and Sharma (1972) in Brown Swiss-Sahiwal crossbred cows and Tomar **et al.**, (1974) in Haryana cows. But Rao **et al.**, (1966) Roberts (1971) and Goel and Singh (1988) reported higher weights of foetal membranes. The difference might be due to differences in breed and nutritional status of the cows studied.

In this observation the mean weight of the RFM was found to be less ie. 1.77 ± 0.09 Kg. There was a significant difference ($p<0.01$) in the mean weight of foetal membranes between the cows without RFM and those with RFM. The

difference in the weight might be due to sticking of pieces of the foetal membranes to the uterus or incomplete removal or due to loss of fluids.

In this study the mean number of cotyledons present in the foetal membranes in cows without RFM was 68.6 ± 2.73 with a range of 52 to 85 both in gravid and nongravid uterine horns. But in European cattle, Roberts (1971) found the number of cotyledons to vary from 75 to 120. In Indian cows Acharya and Kohli (1968), Bhosrekar and Sharma (1972) and Kadu and Kaikini (1972 and 1975) noticed it to vary from 47 to 147.

The mean number of cotyledons present in cows with RFM was 68.3 ± 2.39 both in gravid and non-gravid uterined horns. No significant difference ($P > 0.05$) was observed in the cotyledon number between cows without and with RFM.

In this investigation, 14 of the 20 cows with RFM dalivered male calf.

Lubrini (1964) observed the RFM in 2 cows following the birth of male calf and attributed the same to hormonal disturbances associated with the sex of the calf. Roberts (1971) reported that the incidence of RFM was more common following the birth of single male calves. On the contrary, Brands (1966), Muller and Owens (1974) in cows, Katoch *et al.*, (1987), Waullet *et al.*, (1990) in Jersey and Holstein cows and Saini *et al.*, (1988) in crossbred dairy cows, reported no influence on the incidence of RFM.

In this study the incidence of RFM was found to be more in the first and second calvings. Six cows each were in the 1st and 2nd calvings. From the 3rd calving the incidence declined gradually. Similar findings were noticed by Brands (1966) who observed a high incidence of RFM in primipara. But Panichi (1964) reported highest incidence of RFM at the 4th calving as well as in pleuriparous cows. Contrary to the present findings Roberts (1971) reported only 5.4% of RFM in Primipara.

SUMMARY

SUMMARY

In this investigation the various haematological and certain biochemical constituents in crossbred cows having RFM and those without RFM were estimated and compared.

The mean haemoglobin concentration, packed cell volume and total white blood corpuscle counts in the crossbred cows without RFM were 10.10 ± 0.25g percent; 31.60 ± 0.61 percent and 8.30 ±0.26 thousands/μl respectively. In the cows with RFM, though the Hb concentration (9.43 ± 0.18g%) was significantly lower ($p<0.05$). The mean PCV values and TWBC counts were insignificant (32.15 ± 0.49% and 8.76 ± 0.33 thousands/μl, respectively), when compared to those in crossbred cows without RFM.

In cows without RFM the mean blood glucose, serum calcium, serum inorganic phosphorus, Ca:P ratio and total serum proteins were 58.94 ± 0.89 mg percent 10.36 ± 0.31 mg percent; 5.20 ± 0.16 mg percent; 1.99 ± 0.03; 7.70 ± 0.22g percent respectively. In cows with RFM the mean blood glucose, serum inorganic phosphorus and total serum protiens were significantly ($p<0.05$) lower (47.68±1.93 mg% and 4.30 ± 0.13 mg% and 6.78 ± 0.28 g%, respectively), with a significantly higher ($p<0.01$) Ca:P ratio (2.22 ± 0.07:1). The mean serum calcium level was though lower (9.51 ± 0.32 mg%), the difference was insignificant when compared to that in cows without RFM.

The mean serum acid phosphatase and alkaline phosphatase activities in cows without RFM were 0.44 ± 0.03 and 4.28 ± 0.26 K.A. units, respectively and the same in cows with RFM were 1.52 ± 0.11 and 10.33 ± 0.41 K.A. units, respectively and the increase in the activity in the cows with RFM was significant ($p<0.01$).

With regard to efficacy of the two drugs viz. Exapar and Replanta, which was evaluated on the basis of expulsion of foetal membranes, time taken for uterine involution and occurrence of first postpartum heat, it was noticed that Exapar was found to be more efficacious than Replanta based on the following observations.

1. That 50% of cows expelled the foetal membranes by 2nd day.
2. In the cows which did not expel the foetal membranes, there was no difficulty while removing manually.
3. The mean time of involution of uterus and
4. the mean time of occurrence of postpartum heat were shorter.

The antibiotic sensitivity test conducted on 20 samples of uterine discharges from cows with RFM revealed that the organisms in most of the cases were sensitive to Gentamycin, Kanamycin and Chloramphenicol in that order and the organisms in all the samples were resistant to Cloxacillin indicating that the cows with RFM can be treated successfully with the

above antibiotics to prevent the postpartum uterine infections in these parts of the district.

The physical characteristics of the placenta revealed that the mean weight of the foetal membranes in cows without RFM and with RFM was 2.23 ± 0.09 and 1.77 ± 0.09 Kg, respectively, with a mean cotyledon number of 68.6 ± 2.73 and 68.3 ± 2.39 respectively.

With regard to influence of sex of calf and number of calvings on the incidence of RFM, it was seen that RFM was more frequent with the birth of male calves and in primipara.

LITERATURE CITED

LITERATURE CITED

Acharya R M, Dhillon J S and Agarwal S C 1971 A note on the factors affecting postpartum oestrous interval in Haryana cattle. Indian Journal of Animal Science 41 (7): 524-525.

Acharya R M and Kohli M D 1968 Studies on bovine foetal placenta. II. Relationship among weight of placenta, number of cotyledons and body weight of calf in Haryana cattle. Journal of Research, Punjab Agricultural University 5 (1): 99-102.

Agarwal S P, Luktuke S N and Sharma U D 1965 Studies on the influence of certain phases of reproduction on the blood picture in bovine female. Indian Journal of Dairy Science 18: 156-163.

Agarwal S K, Pandey N N, Umashankar 1985 Serum protein, Inorganic phosphorus and blood glucose in relation to different phases of reproduction in crossbred cattle. Indian Journal of Animal Reproduction 6 (2): 23-25.

Agasti M K, Choudury G, Benerjee G C and Benerjee T K 1975 Studies on certain aspects of uterine involution in Jersey x Haryana females following first calving. Indian Journal of Animal Science 45 (4): 186-188.

Arthur G H 1979 Veterinary Annual 19th issue . Bristol scientechnica p 26. Cited by Cairoli et al., 1993.

Arthur G H, Noakes D E, Pearson H 1992 Veterinary Reproduction and Obstetrics 6th edition Bailliere Tindall London.

Balasubramanian S 1993 synopsis of Ph.D. thesis, Madras Veterinary College, Tamilnadu Veterinary and Animal Sciences University.

Banerjee A K 1966 A study of the action of terramycine on the bacterial flora of the uterus in cattle following retained placenta. Indian Veterinary Journal 43: 319-326.

Benysek V and Kudlac E 1971 The red blood picture in cows in the last month of pregnancy, during parturition and in the period of puerperium. Acta Veterinaria (Brno) 40 (2): 177-185. Cited Veterinary Bulletin 42 (5): Abstract No.3089.

Benysek V and Kudlac E 1972 Red blood cell picture in cows with retention of the placenta. Zuchthygiene 7 (3): 103-110. Cited Veterinary Bulletin 43 (3): 1973. Abstract No. 1278.

Bhatia Y S 1980 Clinical trial of Replanta in reproductive disorders. Pashudhan 6,62. Cited by Hamidul Islam A F M and Nooruddin M. 1990.

Bhosrekar M R and Sharma K N S 1972 Studies on foetal placenta of cattle and Murrah buffaloes of different breeds. Indian Journal of Animal Production 3 (1): 8-15.

Boiter I, Mates N and Kadar L 1972 Electrolytes, proteins, glucose, vitamin-A, enzymes and oxytocine in the plasma of cows with placental retention. In: VII International Congress Animal Reproduction and A.I.Munchen 1: 584-589.

Boitor I, Muntean M, Mates N, Kadar L, Angi E, Bogdan A and Porumb I 1973 Studies of the aetiology, Pathogenesis and treatment of placental retention in cows. Seria Medicina Veterinara 27: 331-340. Cited Veterinary Bulletin 45 (1): 1975. Abstract No. 341.

Brands A F A 1966 Some zootechnical aspects of retained placenta in cattle. Thesis Rijksuniversiteit Utrecht pp 107 + 43 tables. Cited Veterinary Bulletin 36 (11): 1966. Abstract No. 4579.

Bretzlaff K N, Whitmore H L, Spahr S L and Ott R S 1982 Incidence and treatments of postpartum reproductive problems in a dairy herd. Theriogenology 17 (5): 527-535.

Buch N C, Tayler W J and Casida L E 1955 Journal of Dairy Science 38:73. Cited by Francis E C and Raja C K S V 1971.

Cairoli F, Ferrario L, Carli S, Soldano F 1993 Efficacy of oxytetracycline and tetracycline - benzydamine in the prevention of infection after placental retention in cattle. Veterinary Record 133 (16): 394-395.

Capaul E G and De Luca L J 1984 Placental retention as a metabolic disorder of cows and a nutritional way of preventing. Veterinaria Argentina 1 (3): 220-226. Cited Veterinary Bulletin 54 (10): 1984. Abstract No.6653.

Casida L E and venzke W G 1936 proc. Anim. Sco. Anim. Prod. 221. Cited by Francis E C and Raja C K S V 1971.

Casida L E and Wisnicky W 1952 Journal of Animal Science 9: 238 Cited by Francis E C and Raja C K S V 1971

Chakrabarti A and Pal A 1990 Therapeutic efficacy of Replanta against retained foetal membranes in crossbred cattle. Pashudhan 5, 9, 1990 pp 4.

Chalapati Rao Ch 1979 Studies on parturition and postpartum reproductive performance of crossbred cows. M.Sc(Vety) thesis, Andhra Pradesh Agricultural University, Hyderabad.

Choudhury M N, Bhattacharyya B and Ahmed S 1993 Incidence, biochemical and histopathological profiles of retained placenta in cattle and buffalo. Environment and Ecology 11 (1): 34-37.

Choudury G, Agasti M K, Benerjee G C and Ghosh M N 1974 studies on certain aspects of uterine involution in Holstein x Haryana females at first calving. Indian Veterinary Journal 51 (6): 395-400.

Doxy D L 1971 Veterinary Clinical Pathology, Bailliere, Findall, London. Cited by Tariq Ahmed **et al.**, 1984.

Dutta J C 1980 Some studies on the retained placenta in bovine. Dissertation submitted to Punjab Agricultural University, Ludhiana. Cited by Tariq Ahmed **et al.**, 1984.

Dutta J C and Dugwekar Y G 1982 Serum alkaline phosphatase and lactic dehydrogenase activity in cows with retained fetal membranes. Theriogenology 18 (4): 423-429.

Dutta J C and Dugwekar Y G 1988 Treatment of retained foetal membranes in bovines. Indian Veterinary Journal 65 (1): 76-80.

Flegmatov M A and Shipilov N S 1961 Veterinariya Moscow No.3 pp 56 (Vet. Bull 31. Abst. 3098). Cited by Shukla **et al.**, 1983

Fonseca F A, Britt J H, Mc Daniel B T, Wilk J C and Rakes A H 1983 Reproductive traits of Holsteins and Jerseys. Effects of age, milk yield and clinical abnormalities on involution of cervix and uterus, ovulation, estrous cycles, detection of estrus, conception rate and days open. Journal of Dairy Science 66 (5):1128-1147.

Francis E C and Raja C K S V 1971 A study on the genital involution in Sindhi cows. Kerala Journal of Veterinary Science 2 (2): 113-118.

Gahlot O P 1980 Usefulness of Replanta - A uterine stimulant. Pashudhan 6,62. Cited by Hamidul Islam A F M and Nooruddin. M 1990.

Garbacik A and Balon M 1978 Phosphorus content of the serum of cows with placental retention. Medycyna Weterynaryjna 34 (1): 49-50. Cited Veterinary Bulletin 48: 1978. Abstract No.6809.

Garcia M 1982 Postpartum reproductive functions in dairy cows. Sveriges Lantbruksuniversitet, Uppsala, M S thesis pp 7-69.

Gier H T and Marion G B 1968 Uterus of the cow after parturition: Involutional changes. American Journal of Veterinary Research 29 (1): 83-96.

Goel A K and Singh G D 1988 Studies on foetal membranes, involution of uterus and postpartum ovarian cyclicity in crossbred cows. Indian Journal of Animal Research 22 (1):42-44.

Hamidul Islam A F M and Nooruddin M 1990 Treatment of some uterine disorders in bovines by Replanta. Pashudhan 5 (8): pp 4.

Hugo eiler and Fred M Hopkins 1993 Successful treatment of retained placenta with umbilical cord injections of collagenase in cows. Journal of the American Veterinary Medical Association 203 (3) 436-443.

Jain N C 1986 Schalm's Veterinary Haematology Fourth edition. Lea & Febiger, Philadelphia.

Jaiswal U C, Goswami R P, Daya Singh Balaine and Shriram 1979 Reproductive traits in crossbred cattle. Indian Journal of Dairy Science 32 (1): 97-100.

Jana D and Mishra R R 1978 Studies on uterine involution and postpartum estrus in dairy cows. Indian Journal of Dairy Science 31 (2): 145-149.

Jaskowski J M and Lachowski A 1985 Relationships between puerperal disorders and blood mineral values. Medycyna Weterynaryjna 41 (5): 292-295. Cited Veterinary Bulletin 56 (3): 1986. Abstract No. 1801.

Kadu M S and Kaikini A S 1972 Studies on parturition, involution of uterus and postpartum oestrus in Sahiwal cows. FAO Sweedish Follow UP Seminar on Animal reproduction. Vol.I, Bangalore.

Kadu M S and Kaikini A S 1975 Studies on foetal placenta in Sahiwal cows. Indian Veterinary Journal 52 (1): 6-11.

Kar B A and Kamboj V P 1966 Effect of an intrauterine contraceptive suture on postpartum involution of rat uterus. Indian J. Exp. Biology 4 (4): 241-243.

Katoch R C, Manuja N K, Vaid J and Bhowmik K B D 1987 Some studies on retention of foetal membranes in Jersey cows. Indian Veterinary Medical Journal 11 (3): 153-159.

Kay R M 1978 Changes in milk production, fertility and calf mortality associated with retained placentae or the birth of twins. Veterinary Record 102 (22): 477-479

Kendall K A and Harshbarger R E 1962 Serum phosphatase levels in parturient dairy cows. Journal of Animal Science 21: 1025. Cited by Rajpal and Vadnere S V 1985.

Kudlac E and Benysek V 1972 Changes in the white blood picture of cows with retained placenta. Zuchthygiene 7 (1): 14-24. Cited Veterinary Bulletin 42 (8): 1972. Abstract No. 4844.

Kumpf A 1984 Course of the puerperal period in cows with placental retention, as indicated by clinical chemical values in the blood. Inaugural Dissertation Fachbereich Veterinarmedizin Justus Liebig Universitat, Giessen 253 pp. Cited Veterinary Bulletin 55 (11): 1985. Abstract No. 7319.

Lobel B L and Deane H W 1962 Endocrinology. 70:567 Cited by Kar B A and Kamboj V P 1966.

Lubrini A 1964 Is there a connexion between sex of the fetus and retention of the placenta in the cow? Veterinaria Milano 13: 511-513. Cited Veterinary Bulletin 35 (7): 1965. Abstract No. 2797.

Marion G B, Norwood J S and Gier H T 1968 Uterus of the cow after parturition: Factors affecting regression. American Journal of Veterinary Research 29:71-75.

Martynov V G 1964 Mineral and vitamin metabolism in cows during pregnancy and after calving. Veterinariya. Moscow 41(2) : 78-81. Cited Veterinary Bulletin 34(9): 1964. Abstract No. 3519.

Mehta J S, Bhatia J S, Kohli I S, Pareek P K, Bishnoi B L and Gupta A K 1989 Studies on serum alkaline phosphatase and protein in various reproductive states in cow. Indian Journal of Animal Reproduction 10 (2): 138-140.

Miltenburg G A J, Wensing T, Van Vliet J P M, Schuijt G, Van de Broek J and Breukink H J 1991 Blood hemoglobin, plasma iron and tissue iron in dams in late gestation, at calving and in veal calves at delivery and later. Journal of Dairy Science 74 (9): 3086-3094.

Mohanty B B 1978 White blood picture of cows during postpartum. FAO/Sida Follow UP Seminar on Animal Reproduction, Tirupati, 1978.

Mohanty K C, Mohanty B N, Ray S K H and Mohanty D N 1994 Levels of glucose, calcium and alkaline phosphatase in blood with relation to retention of placenta in bovines. Indian Journal of Animal Reproduction 15 (1): 21-23.

Morrow D A 1969 Postpartum ovarian activity and involution of the uterus and cervix in dairy cattle. Vet. Scope XIV: 2-13. Cited by Paisldy **et al**., 1986.

Morrow D A 1980 Current therapy in theriogenology: diagnosis, treatment and prevention of reproductive diseases in animals. W B Saunders Company, Philadelphia , London Toronto.

Morrow D A Roberts S J and Mc Entee K 1969 Postpartum ovarian activity and involution of the uterus and cervix in dairy cattle II. Involution of uterus and cervix Cornell. Vet. 59(2): 190-198.

Mulei C M, Mutiga E R and Gitau G K 1993 Retained foetal membranes in cattle: Relationship between bacterial isolates, blood picture and systemic involvement. Indian Journal of Animal Sciences 63 (3) : 235-238.

Muller L D and Owens M J 1974 Journal of Dairy Science 57: 725. Cited by Kay R M 1978.

Mulling M, Waizenhofer H, Brattig B 1979 Blood glucose, lactate and pH in cows and calves during and immediately after parturition. Tierarztliche Wochenschrift 92 (6): 111-117. Cited Veterinary Bulletin 49 (9): 1979. Abstract No.5626.

Olson J D and Mortimer R G 1986 Current therapy in theriogenology. 2nd edn. Ed. D A Morrow, Philadelphia, W B Saunders p 227. Cited by Cairoli *et al.*, 1993.

Paisldy L G, Mickelsen W D and Anderson P B 1986 Mechanisms and therapy for retained foetal membranes and uterine infections of cows: A review. Theriogenology 25 (2/3): 353-381.

Pandey H N, Kowl G L and Katpatar B G 1979 Postpartum oestrus and weight at calving in crossbred cows. Indian Journal of Dairy Science 32 (1): 11-15.

Panichi G 1964 Investigation of 132 cases of retained placenta in cows. Results and discussion. Veterinaria

Milano 13: 67-82, 84-93 and 95-103. Cited Veterinary Bulletin 34 (11): 1964. Abstract No. 4328.

Pareek P K and Aminu Deen 1985 Changes in blood profile from antepartum, parturition to post-partum period in anoestrous and normally reproducing Rathi cows. Indian Journal of Animal Reproduction 6 (2) : 33-36.

Payne J M and Leech F B 1964 British Veterinary Journal 120:385. Cited by Rajagopalan P 1972.

Peter A T, Bosu W T K, Mac Williams P, Gallagher S 1987 peripartal changes in serum alkaline phosphatase activity and lactate dehydrogenase activity in dairy cows. Canadian Journal of Veterinary Research 51(4): 521-524.

Prakash B S and Tondon R N 1978 Studies on haemoglobin, PCV and glucose concentration of Holstein X Tharparkar heifers during late pregnancy and early lactation. Indian Journal of Dairy Science 31 (3): 287-291.

Rajagopalan P 1972 Haematological studies of sow during pregnancy M.Sc (Vet) Thesis, Kerala Agricultural University.

Rajpal and Vadnere S V 1985 Biochemical studies and progesterone levels during placental retention and vaginal prolapse in buffaloes. Indian Journal of Animal Reproduction 6 (2): 29-32.

Rao D G, Prasad A B A, Krishna V J and Rao K S 1981 studies on some biochemical constituents of blood in Ongole cows. Indian Veterinary Journal 58:870-873.

Rao A R, Rao P N, and Rao A S P 1966 studies on parturition of Ongole cattle. Indian Veterinary Journal 43 (1): 44-49.

Rasbech N O 1950 Nord.Vet.Med. 2:655. Cited by Francis E C and Raja C K S V 1971.

Roberts S J 1956 Veterinary obstetrics and genital diseases. Ithaca, Ney York. Cited by Francis E C and Raja C K S V 1971.

Roberts S J 1971 Veterinary obstetrics and genital diseases. 2nd edition. Indian Scientific Book Agency, Calcutta-1.

Rowlands G J, Manston R, Rita M, Pocock and Dew S M 1975 Relationships between stage of lactation and pregnancy and blood composition in a herd of dairy cows and the influences of seasonal changes in management on these relationships. Journal of Dairy Research 42 (3): 349-362.

Saini M S, Khanna A S, Chopra S C 1988 Incidence of retention of placenta, its treatment and subsequent fertility in crossbred (Temperate x Zebu) dairy cattle. Indian Journal of Animal Production and Management 4 (2): 61-65.

Sharma R C and Bhatnagar D S 1975 Influence of sex of the calf and order of lactation on reproductive efficiency in dairy animals. Indian Veterinary Journal 52(11): 813-822.

Sharma R P, Bishnoi B L, Bhatia J S, Kohli I S and Gupta A K 1991 Studies on serum enzymes, inorganic constituents and haemoglobin in parturient complications in cattle. Indian Journal of Animal Reproduction 12 (1): 36-38.

Sharma M C, Umashakar, Gupta O P, Verma O P and Mishra R R 1983 Indian Journal of Aninmal Reproduction 4 : 51-53. Cited by Agarwal et al., 1985.

Shin S T, and Jo C H 1987 Effects of selenium-Vitamine E administration and serum mineral levels on incidence of retained fetal membranes in dairy cows. Korean Journal of Veterinary Research 27 (1) : 117-126.

Shukla S P, Chauhan R A S and Parekh H K B 1978 FAO/Sida follow up seminar on Animal Reproduction, Tirupati.

Shukla S P, Kharche K G and Parekh H K B 1983 Calcium and phosphorus in relation to retained placenta in crossbred cows. Indian Veterinary Journal 60 (3) : 183-188.

Singh A P, Joshi H C and Singh R 1972 Studies on certain blood constituents in cattle and buffaloes. Indian Veterinary Journal 49 (5): 473-477.

Snedecor G W and Cochran W G 1967 Statistical methods 6th edition. Oxford and IBH Publishing Company, Calcutta.

Suryanarayana Murty S 1992 Haematological and certain biochemical studies in Jersey crossbred cattle during different reproductive conditions/disorders. M.V.Sc.thesis, Andhra Pradesh Agricultural University, Hyderabad.

Tariq Ahmed, Sharma R D and Singh R 1984 Peripheral plasma, sodium, potassium, calcium and inorganic phosphorus profiles in cows retaining placenta. Indian Journal of Animal Reproduction 5(1): 44-48.

Tomar S S, Dahiya N S and Arora K L 1974 Genetic and nongenetic variation in the placental weight of Haryana cows. Indian journal of Animal Science 44 (9): 612-614.

Vukovic D, Samanc H, Damnjanovic Z, perkovic S, Ignjic D 1987 Calcium, phosphorus, carotene and vitamin A concentrations in the blood serum of Simmental cows with reference to infertility. Veterinarski Glasnik 41 (11/12): 927-930. Cited in Animal Breeding Abstract 57 (10): 1989. Abstract No. 6663.

Wautlet R G, Hansen L B, Young C W, Chester Jones H and Mar G D 1990 Calving disorders of primiparous Holsteins from designed selection studies. Journal of Dairy Science 73 (9): 2555-2562.

APPENDICES

APPENDIX I

Dosage schedule of drugs used in treating the cases with RFM

Chakrabarti.A and Pal.A

	Group II			
	Group I			
Days	**Drugs used**			
	Replanta (as electuary in gm.)		**Pivipal (number of pessaries inserted into the uterus)**	**Calcium borogluconate (subcutaneous route in cc)**
	Morning	**Evening**		
1	100	50	2	150
2	50	50	2	150
3	50	50	2	150
4	50	50		
5	50	50		

Hamidul Islam AFM and Nooruddin M

1.	Replanta 50 gm .	:	
		:	Once daily
2.	Pronapen (Pfizer) 2 million I.U. intramuscular.	:	for 3-6 days according to severity
3.	0.1% acreflavin or 0.1% Potassium permanganate	:	

APPENDIX II

Composition of drugs used for the expulsion of foetal membranes

Exapar	
Each 100 ml contains	**(in mg)**
Chitraka	160
Jewanti	160
Chandrasura	100
Harmal	160
Manjista	160
Nadihingu	80
Musta	120
Sunanda	160
Agnishikha	120
Talispatra	120
Tundakesi	160
Kuberakshi	120
Puskara	60
Kumari	80
Shalaparni	60
Prishnparni	40
Indravaruni	20
Ikshugandha	40
Pippalee	80

Replanta	
Each 100 mg Contains	**(in gm)**
Krishna	12.0
Ushan	4.0
Espand	5.0
Raktangi	10.0
Carvi	10.0
Payasvini	5.0
Hattavilasini	3.0
Utpal	4.0
Yausahya	8.0
Gundra	5.0
Nakuli	5.0
Vanspatri	2.0
Dhatripatra	4.0
Shakrapushpi	2.0
Tundkeshi	10.0
Varuni	1.0
Paribhadra	6.0
Naktaumal	4.0

APPENDIX III

The values for involution of gravid uterine horn in individual crossbred cows without RFM

Weeks

Animal Number	I	II	III	IV	V	VI	VII	VIII
1	11.00	8.00	6.50	5.00	4.50	3.50	3.00	2.50
2	12.50	9.00	7.00	5.50	4.50	3.00	2.50	2.50
3	11.00	8.00	6.00	5.00	3.50	3.00	2.00	2.00
4	13.00	9.50	8.00	6.50	4.00	4.00	3.50	3.00
5	10.00	7.50	6.00	5.00	4.00	3.00	2.50	2.50
6	14.00	10.00	8.00	7.00	4.50	3.50	3.00	3.00
7	10.00	7.50	5.50	4.50	3.00	3.50	3.00	2.50
8	9.50	7.50	5.50	4.50	4.00	3.00	2.50	2.50
9	9.50	7.50	5.50	4.50	3.50	2.50	2.00	1.50
10	11.50	8.00	6.50	5.00	3.50	2.50	2.50	2.00
Mean	11.20	8.25	6.45	5.25	3.90	3.15	2.65	2.40
Standard error	±0.46	±0.28	±0.29	±0.26	±0.15	±0.14	±0.14	±0.14

APPENDIX IV

The values for involution of nongravid uterine horn in individual crossbred cows without RFM

Weeks

Animal Number	I	II	III	IV	V	VI	VII	VIII
1	11.50	8.50	7.00	5.50	4.50	3.50	3.00	2.50
2	7.50	6.00	4.50	3.50	3.00	2.00	2.00	2.00
3	12.00	8.50	7.00	5.00	4.00	3.00	2.50	2.50
4	8.50	6.00	4.50	3.00	2.50	2.00	2.00	2.00
5	9.50	7.00	5.00	4.00	3.00	2.50	2.50	2.50
6	10.00	7.00	5.50	4.00	3.00	2.00	2.00	2.00
7	9.00	6.50	5.00	3.50	3.00	2.50	2.50	2.50
8	8.00	6.00	5.00	4.00	3.00	2.50	2.50	2.00
9	9.50	7.00	5.50	3.50	3.00	2.50	2.50	2.50
10	7.00	5.50	4.00	3.00	2.50	2.50	2.50	2.50
Mean	9.25	6.80	5.30	3.90	3.15	2.50	2.40	2.30
Standard error	±0.49	±0.31	±0.30	±0.24	±0.19	±0.14	±0.09	±0.08

APPENDIX V

The values for involution of gravid uterine horn in individual crossbred cows having RFM treated with Exapar

Weeks

Animal Number	I	II	III	IV	V	VI	VII	VIII
1	9.50	7.50	6.00	5.50	4.50	3.00	2.50	2.50
2	12.00	9.00	8.00	7.00	5.00	4.00	3.50	2.50
3	13.00	9.00	6.50	5.00	4.00	3.00	2.00	2.00
4	15.50	13.00	9.00	7.50	5.00	4.50	3.50	3.00
5	10.00	8.00	6.50	5.50	3.50	2.50	2.00	2.00
6	11.50	8.00	6.50	5.00	3.50	2.50	2.50	2.50
7	12.50	8.00	5.50	4.50	3.50	2.50	2.50	2.50
8	13.50	10.50	8.00	7.00	6.00	5.00	4.00	3.50
9	9.50	7.00	5.50	4.50	3.50	2.50	2.00	1.50
10	10.00	7.50	6.50	5.00	3.50	3.00	3.00	2.50
Mean	11.70	9.75	6.80	5.65	4.20	3.25	2.75	2.45
Standard error	±0.60	±0.54	±0.35	±0.33	±0.27	±0.28	±0.22	±0.17

APPENDIX VI

The values for involution of nongravid uterine horn in individualcrossbred cows having RFM treated with Exapar

Weeks

Animal Number	I	II	III	IV	V	VI	VII	VIII
1	8.50	6.50	4.50	3.50	3.00	2.50	2.50	2.50
2	11.00	7.50	5.50	4.00	3.00	2.50	2.50	2.00
3	10.00	7.50	5.50	4.00	3.50	2.50	2.50	2.00
4	13.00	10.00	8.50	6.00	5.00	3.50	3.00	2.50
5	9.00	6.50	4.50	3.50	3.00	2.50	2.50	2.50
6	8.00	6.00	4.00	3.00	2.50	2.00	2.00	2.00
7	10.50	7.50	5.50	4.50	3.00	2.50	2.50	2.50
8	13.50	9.50	7.50	5.50	3.50	2.50	2.50	2.50
9	10.00	7.00	5.50	4.50	3.50	3.00	2.50	2.50
10	8.00	6.00	4.00	3.00	2.50	2.50	2.50	2.50
Mean	10.15	7.40	5.50	4.15	3.25	2.60	2.50	2.35
Standard error	±0.58	±0.41	±0.44	±0.30	±0.22	±0.12	±0.07	±0.07

APPENDIX VII

The values for involution of gravid uterine horn in individual crossbred cows having RFM treated with Replanta

Weeks

Animal Number	I	II	III	IV	V	VI	VII	VIII
1	14.50	9.50	8.00	6.50	4.00	3.50	3.00	3.00
2	16.00	12.00	10.00	7.50	6.50	5.00	4.50	3.50
3	13.50	9.00	7.00	5.50	4.50	3.00	2.50	2.50
4	10.00	8.50	6.50	5.00	4.00	3.00	3.00	2.50
5	11.50	9.00	7.00	5.50	4.00	3.00	2.00	2.00
6	15.50	11.50	8.50	7.00	5.50	4.50	3.50	3.00
7	12.50	9.00	7.50	5.50	4.00	3.50	3.00	2.50
8	10.00	8.50	6.50	5.00	4.00	3.00	2.50	2.50
9	12.00	9.50	7.00	5.50	4.50	3.50	3.00	3.00
10	15.00	11.00	8.50	6.00	4.00	3.00	3.00	3.00
Mean	13.05	9.75	7.65	5.90	4.50	3.50	3.00	2.75
Standard error	±0.66	±0.38	±0.33	±0.25	±0.25	±0.21	±0.20	±0.13

APPENDIX VIII

The values for involution of nongravid uterine horn in individual crossbred cows having RFM treated with Replanta.

Weeks

Animal Number	I	II	III	IV	V	VI	VII	VIII
1	11.00	8.00	6.50	5.00	4.00	3.00	2.50	2.50
2	14.00	10.00	8.00	6.00	4.50	3.50	3.00	2.50
3	9.50	7.50	6.00	4.50	3.50	3.00	2.50	2.50
4	9.00	7.00	5.50	4.00	3.50	3.00	2.50	2.50
5	10.50	7.50	5.00	3.50	3.00	2.50	2.00	2.00
6	12.50	9.00	7.50	6.50	4.00	3.00	3.00	2.50
7	13.50	9.00	7.50	5.50	4.50	3.50	3.00	2.50
8	12.00	8.00	6.50	5.00	4.00	3.00	2.50	2.50
9	13.00	9.50	7.00	5.50	4.00	3.00	2.50	2.00
10	10.50	7.00	5.50	4.50	3.50	2.50	2.50	2.50
Mean	11.55	8.25	6.50	5.00	3.85	3.00	2.60	2.40
Standard error	±0.51	±0.32	±0.30	±0.27	±0.14	±0.10	±0.09	±0.06

APPENDIX IX

The values for involution of gravid and non gravid uterus in crossbred cows having RFM and treated with Exapar

Gravid uterine horn

S.No.	Animal Number	Foetal membranes expelled cows (diameter in cm) Weeks								Foetal membranes not expelled cows (diameter in cm) Weeks							
		I	II	III	IV	V	VI	VII	VIII	Animal Number	I	II	III	IV	V	VI	VII	VIII
1	1	9.50	7.50	6.00	5.50	4.50	3.00	2.50	2.50	2	12.00	9.00	8.00	7.00	5.00	4.00	3.50	2.50
2	5	10.00	8.00	6.50	5.50	3.50	2.50	2.00	2.00	3	13.00	9.00	6.50	5.00	4.00	3.00	2.00	2.00
3	6	11.50	8.00	6.50	5.00	3.50	2.50	2.50	2.50	4	15.50	13.00	9.00	7.50	5.00	4.50	3.50	3.00
4	9	9.50	7.00	5.50	4.50	3.50	2.50	2.00	1.50	7	12.50	8.00	5.50	4.50	3.50	2.50	2.50	2.50
5	10	10.00	7.50	6.50	5.00	3.50	3.00	3.00	2.50	8	13.50	10.50	8.00	7.00	6.00	5.00	4.00	3.50
		Nongravid uterine horn																
6	1	8.50	6.50	4.50	3.50	3.00	2.50	2.50	2.50	2	11.00	7.50	5.50	4.00	3.00	2.50	2.50	2.00
7	5	9.00	6.50	4.50	3.50	3.00	2.50	2.50	2.50	3	10.00	7.50	5.50	4.00	3.50	2.50	2.50	2.00
8	6	8.00	6.00	4.00	3.00	2.50	2.00	2.00	2.00	4	13.00	10.00	8.50	6.00	5.00	3.50	3.00	2.50
9	9	10.00	7.00	5.50	4.50	3.50	3.00	2.50	2.50	7	10.50	7.50	5.50	4.50	3.00	2.50	2.50	2.50
10	10	8.00	6.00	4.00	3.00	2.50	2.50	2.50	2.50	8	13.50	9.50	7.50	5.50	3.50	2.50	2.50	2.50

APPENDIX X

The values for zone of inhibition of growth of organisms around each antibiotic in individual crossbred cows having RFM.

Animal number	Ampicillin (mm)	Chloramphenicol (mm)	Cloxacillin (mm)	Furazolidone (mm)	Gentamycin (mm)	Kanamycin (mm)	Oxytetracycline (mm)
1.	14	-	-	24	15	23	-
2.	-	-	-	25	21	16	12
3.	-	1	-	-	22	25	15
4.	-	27	-	1	18	23	8
5.	-	10	-	23	26	25	12
6.	-	18	-	15	23	25	1
7.	-	24	-	16	12	15	-
8.	-	-	-	9	18	22	12
9.	-	23	-	-	15	-	17
10.	-	23	-	15	20	-	20
11.	-	28	-	10	20	25	-
12.	-	16	-	24	22	23	-
13.	-	20	-	-	17	18	-
14.	-	25	-	12	19	18	-
15.	-	24	-	-	15	21	-
16.	-	-	-	17	13	-	14
17.	-	22	-	-	20	20	-
18.	-	13	-	13	25	23	9
19.	-	20	-	-	15	20	-
20.	15	25	-	14	18	13	11