THERAPY FOR ANOESTRUM IN CROSSBRED CATTLE

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THESIS

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DECLARATION

I hereby declare that this thesis entitled "THERAPY FOR ANOESTRUM IN CROSSBRED CATTLE is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title of any other University or Society.

Mannuthy,
2-9-1983.

M.O. KURIEN

CERTIFICATE

Certified that this thesis entitled "THERAPY FOR ANOESTRUM IN CROSSBRED CATTLE' is a record of research work done independently by Sri. M.O. KURIEN under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to him.

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Dedicated in loving memory

of my beloved teachers

Dr T R Bharathan Namboodiripad

and

Dr C K S V Raja

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TABLE OF CONTENTS

--ooooo--

LIST OF TABLES

--ooo--

LIST OF ILLUSTRATIONS

--oOo--

Introduction

INTRODUCTION

The development of dairy industry in India during recent years has been phenomenal. The majority of low yielding indigenous cattle has been replaced by crossbreds by a massive crossbreeding programme and it is expected that by 2000 A.D. nearly 40 million high producing cattle will be able to produce the projected 50 million tons of milk. It is also expected that by implementation of the ambitious dairy development project like operation flood - II, milk production would be increased to 10.3 million litres per day and the per capita average daily availability would reach to 144 g by 1985, and by 1989 this figure would go upto 190 g nearly reaching the standard recommended by ICMR.

But, to achieve this goal, it is essential that production potential of these high yielding crossbred cows should be fully exploited by adopting scientific feeding, breeding and management. Reproduction is one of the most important factor in the economic maintenance of these animals and hence this aspect should be given most urgent consideration. Though, low fertility was accepted as 'fait accompli' by most developing countries for their indigenous cattle, introduction of exotic blood has come like the current of fresh air fully

oxygenated to revolutionise the reproductive status of these animals. The fertility status depends upon a host of factors, both intrinsic and extrinsic, and the optimum reproductive efficiency depends upon planned managemental practices to achieve this goal.

The most important factor which determines the optimum reproductive efficiency is the cyclic ovarian activity, which is under the control of hypothalamo-hypophyseal-gonadal axis. Delay in resumption of cyclic activity after calving has long been recognised as a cause for prolonged inter-calving period resulting in great economic loss. Frequently, anoestrum due to failure of cyclic sexual activity has been manifested as a serious problem affecting herd fertility. The seriousness of this condition causing infertility in cattle has been well documented (Vandeplassche, 1972· Luktuke and Sharma, 1978; Kaikini et al. 1978; Iyer, 1978; Chauhan and Singh, 1979; Deas et al. 1979a). According to Rao and Murthy (1972), about 67.71 per cent incidence of infertility was due to physiological causes out of which 72.2 per cent was true anoestrum. Luktuke and Sharma (1978) also gave a very serious picture of this condition in our cattle and reported that about 36.16 per cent and 43 per cent of infertility condition among heifers and cows respectively

was due to smooth and inactive ovaries. In Kerala too, the picture is not much different. Namboothiripad (1978), on the basis of data collected from antisterility camps in the State, reported an incidence of 76.99 per cent infertility due to anoestrum. Mathew and Namboothiripad (1979) found 21 to 51 per cent anoestrous cases among crossbred cattle of varying exotic inheritance.

Several factors have been attributed to this condition and among them environmental and physiological stress operating singly or in combination like heat stress, nutritional and lactational stress assume paramount importance (Jainudeen, 1978). In short, any factor affecting the central nervous system must be considered potentially capable of causing derangement of hypothalamo-hypophyseal function which in turn would lead to ovarian dysfunction and anoestrum. This is especially so in the case of crossbred cattle.

Several therapeutic measures like hormonal, ayurvedic, homeopathic, physical and even electrical treatment have been tried by various workers to combat this malady (Hays and Carlevaro, 1956; Dindorkar and Kohli, 1973; Deshpande et al. 1976, Porwal et al. 1976; Kaikini et al. 1978a; Patil and Khan, 1978). Each method has been reported to have its own merits and demerits. Treatment with chemical agents like

Clomiphene Citrate (Roy et al. 1963· Debeljuk et al. 1972; Moberg, 1972; Deshpande et al. 1976; Kaikini et al. 1978a· Kodagali et al. 1978; Hukery et al. 1979; Manjunath, 1979; Dugweker et al. 1980; Kodagali et al. 1982; Pattabhiraman et al. 1983) and hormonal preparations containing oestrogen, (Franguljan, 1943; Zemjanis, 1969; Araujo et al. 1973; Dindorkar and Kohli, 1973; Patil and Khan, 1978) progesterone (Hale and Symington, 1969; Shukla et al. 1972; Schimidt et al. 1973; Mia and Rahman, 1974) and a combination of oestrogen and progesterone (Smith and Zimbelman, 1968; Arbeiter, 1977; Roche, 1974; Jelcaninov and Petruskin, 1974; Deshpande and Sane, 1977; Pant and Sharma, 1979; Gupta, 1980; Umashankar and Verma, 1982; Prasad et al. 1983) have been tried previously and the results are varied. But none of these drugs has been conclusively proved to be effective in the treatment of anoestrum.

Some drug, however, is needed as a break through therapy for anoestrum in cattle to obtain crossbred progeny of higher production from such dams for economic gain of poor farmers. The present investigation to assess the efficacy of oestrogen-progesterone combination ('Secrodyl' - a product of Allenbury's Laboratories, Bombay, containing 5 mg of megesterol acetate and 0.03 mg of ethinyl oestradiol per ml) and a non-hormonal drug

('Fertivet' - a product of AR-Ex Laboratories, Bombay, containing180 mg of Cis-Clomiphene Citrate and 120 mg trans-Clomiphene Citrate per tablet) in the treatment of anoestrum in crossbred cattle has this object in view.

Review of Literature

REVIEW OF LITERATURE

Anoestrum can be described as a phenomenon where there is complete sexual inactivity with no manifestation of oestrus. Cattle are normally anoestrous before puberty, during pregnancy and short period after parturition and at all other times it is normal for cattle to show recurrence of cyclic activity with periodic oestrum.

In true anoestrum the ovaries are smooth and inactive with no palpable corpusluteum or developing follicles (Arthur, 1975). Incidence of anoestrum has been reported to be high in exotic and crossbred cattle, manifested in the form of post-service and post-partum anoestrum in cows and post-pubertal anoestrum in heifers. Hurst (1959) reported the incidence of post-partum and post-service anoestrum as 6 to 20 per cent and 5 to 19 per cent respectively. According to Zemjanis (1962), anoestrous condition in cows was to the extent of 10 per cent and 27 per cent during post-partum and post-service period respectively.

In an abattoir study of 1728 bovine genetalia, Luktuke et al. (1972) observed that in 14.69 per cent cases, both the ovaries were smooth and inactive, while Nair (1973) could observe only 2.24 per cent of quiescent ovaries in a similar

study. In Gir cows, Sane (1972) reported an incidence of 22.2 per cent post-partum anoestrum. Rao and Murthy (1972) reported that 67.7 per cent of infertility was due to physiological causes, out of which 72.2 per cent was true anoestrum. Araujo et al. (1973) opined that among anoestrous cows he examined, only 17.5 per cent was true anoestrum. He also reported that the occurrence of inactive ovaries was 70 per cent and 42.6 per cent cattle had not shown oestrus more than five months after calving. Patil and Khan (1978) observed 30 per cent incidence of true anoestrum in rural cattle. Ansari (1978) reported that true anoestrum was to the extent of 31 per cent of the cattle he examined while Iyer (1978) reported that 70 per cent of the reported cases of anoestrum among cows and 90 per cent among heifers were actually 'true anoestrum'. The incidence of 'true anoestrum' in cows and heifers was also reported to be 43 per cent and 36.16 per cent respectively (Luktuke and Sharma, 1978).

Namboothiripad (1978) reported that among the cases presented in the anti-sterility camps with anoestrum, the majority of the cases was anoestrum due to unobserved oestrus. Among crossbred cattle, Sudarsan (1979) could observe 'true anoestrum' to the extent of 70 per cent whereas Mathew and Namboothiripad (1979) observed 23.07 to 41.42 per cent anoestrus in cows and 20 per cent

to 51.72 per cent cases in heifers, depending upon the level of exotic inheritance of Brown Swiss crossbred cattle.

Fielden et al. (1973) reported that anoestrum was highest in the youngest age groups with a decreasing trend in the older ones. They also reported that the incidence of inactive ovaries in two year old heifers, three year old and mature animals was 92, 82 and 53 per cent respectively. Ghosh (1982) observed anoestrus condition with under developed genitalia in 50.5 per cent heifers aged 2 to 3 years, 33.9 per cent heifers aged 3 to 4 and 26.6 per cent above 4 years.

Anoestrum has been reported to be high in buffaloes also. Rao and Murthy (1971b) reported an incidence of 47.22 per cent true anoestrum in buffaloes while Luktuke and Sharma (1978) observed 32.8 and 56.8 per cent of true anoestrum among the buffaloe cows and heifers respectively. On the other hand, Chaudhari et al. (1978) found that the incidence of anoestrum in buffaloes was 31.28 per cent, but on detailed examination it was observed that 34.59 per cent were in silent heat and 2.4 per cent were in anoestrum due to retained corpusluteum. According to Chauhan and Singh (1979), anoestrum in buffaloes was 71 per cent and among this 46.6 per cent were pre-service anoestrum and 24.4 per cent were post-service anoestrum. It was also observed that true anoestrum was only 30.8 per cent.

The etiological factors for anoestrum are multifold and in many cases the exact cause has not been well elucidated. Any factor affecting the central nervous system must be considered potentially capable of causing derangement of hypothalamo-hypophyseal function which in turn would lead to ovarian dysfunction and subsequent anoestrum (Jainudeen, 1978). Laing (1970) reported anoestrum as a functional abnormality and clinical features associated with it were due to suppression of ovarian function.

Malnutrition or under nutrition could be one of the most important cause for anoestrum by reducing the secretion of pituitary gonadotrophin (Lamond, 1970). Jainudeen (1978) postulated that diets which were qualitatively complete but quantitatively deficient and vice-versa, if fed for a long period, could cause anoestrum probably by depressing the hypothalamo-hypophyseal function. In milder forms, even though, gonadotrophins are synthesised uninterrupted, they are not released in sufficient quantities to induce ovarian activity. In more severe cases of malnutrition, even synthesis of gonadotrophins is depressed. Low energy ration could depress the ovarian function resulting in anoestrum (Dawson, 1970; Boyd, 1970· King, 1971 Roberts, 1971; Deas et al.1971b). According to Brochart et al. (1972), both energy and nitrogen

excess or deficiency could adversely affect reproduction. They could solve the problem of anoestrum in energy deficient cows by feeding additional concentrate mixture. The functional relationship of energy and protein has been elaborated by O'Brien (1972). He also reported that protein was the most important and single nutrient affecting reproduction. Roberts (1971) found that deficiency of protein and carbohydrate might cause delayed onset of puberty in heifers and post-partum anoestrum in cows. Hewett (1972) postulated that there was definite correlation of serum protein and serum phosphorus levels on fertility in cows. Sane (1972) found that low serum glucose level could definitely affect the sexual cycle in cows and opined that hypoglycemia could depress the hypothalamus which would reduce the gonadotrophin release from the pituitary. This was supported by Cuenca (1973) and Boyd (1977). Low energy protein diet has been reported to cause late maturity in heifers and cessation of oestrous cycle and infertility in cows (Maynard and Loosli, 1973; Hafez and Jainudeen, 1974). Deopurkar (1974) found that there was significant difference in the average serum cholesterol levels in post-partum anoestrus (157.4 $\pm$ 30.1 mg per cent) and oestrus (192.7 $\pm$ 48.7 mg per cent). Sampath and Kumar (1977) and Deshpande *et al.* (1978) also considered the level of protein and sugar in

blood as good parameters to identify the infertility condition in cows.

The mineral imbalance or their deficiency can cause anoestrum in cattle. Infertility associated with phosphorus deficiency was first reported by Hignett and Hignett (1951). This finding was later supported by Salisbury and VanDemark (1961); Boyd (1970); King (1971); Roberts (1971); Vujovic et al. (1972); Cuenca (1973); Maynad and Loosli (1973); Sattar (1973); Hafez and Jainudeen (1974); Arthur (1975) Morrow (1977), Sampath and Kumar (1977); Scharp (1979); Murtuza et al. (1979); Deas et al. (1979 a & b); Neelakantan and Nair (1979) and Samad et al. (1980). Regarding calcium, there are no reports to show that deficiency would affect fertility in animals. Salisbury and VanDemark (1961) remarked that cattle would reproduce normally with very low levels of calcium. However, King (1971) found that very low levels of calcium for a continued period would affect the normal physiology of cattle.

Ford (1972) reported that excess of calcium or phosphorus would reduce the availability of other minerals like iron or copper which in turn might affect fertility. This was also supported by Maynard and Loosli (1973).

Hignett and Hignett (1951) observed that feed containing high calcium with low phosphorus level would affect the calcium phosphorus ratio which in turn would retard the fertility of animals. Boyd (1970); Sampath and Kumar (1977) and Neelakantan and Nair (1979) also reported that a wide calcium phosphorus ratio would lead to low reproductive efficiency. Samad et al. (1980) also observed that non functional ovaries in cows would result from a wide calcium phosphorus ratio. The detrimental effect of narrow calcium phosphorus ratio on normal reproductive behaviour of cattle has also been reviewed widely (King, 1971; Sane, 1972; Maynard and Loosli, 1973 Carsen et al. 1978; Scharp, 1979). Anoestrum due to copper deficiency has been reported earlier (Salisbury and VanDemark, 1961; Elwishy et al. 1966, Mahadevan and Zubairy, 1969; King, 1971; Roberts, 1971; Sattar, 1973; Arthur, 1975; Sampath and Kumar, 1977; Deas et al. 1979a). The importance of normal calcium, phosphorus and copper in the ration for normal fertility in cattle has been well elucidated by Sattar (1973). Thus, it could be seen that deficiency of any dietary constituent which is necessary for normal metabolism such as iron, copper, cobalt, manganese, iodine, phosphorus and vitamin-A would affect the normal reproductive behaviour resulting in reproductive problems including anoestrum. Moreover, any chronic debilitating

diseases, such as heavy intestinal parasitic infestations that would interfere with assimilation or utilisation of food would also lead to anoestrum in cows (Roberts, 1971).

Murray (1974) reported that age, condition of the body, disease, management, excessive heat and cold weather would also interrupt oestrous cycle. Lactation and suckling have variable influence on suppression of oestrus (Gravis et al. 1968; Riesen et al. 1968; Saiduddin et al. 1968; Symington, 1969; Wetterman, 1976). Lactation stress especially in early post-partum period has been reported to cause anoestrum in cows. However, it cannot be said whether this type of anoestrum is due to negative energy balance induced by high milk yield or whether it has any physiological basis such as high production of prolactin inhibiting the release of gonadotrophins. Jainudeen (1978) reported that during the period of high temperature, suckling cows especially on poor diets were more prone to be in anoestrum.

According to Namboothiripad and Luktuke (1978), ovaries of anoestrous buffaloes weighed less with reduced amount of follicular fluid. The graafian follicles were smaller, fewer in number and were atretic. The gonadotrophic potency and concentration of gonadotrophin were reported to be less in the pituitary of anoestrous animals. The serum leutinizing

hormone (LH) levels were observed to be considerably less when compared to normal cycling animals (Kodagali, 1978; Kodagali and Deshpande, 1978; Kodagali et al. 1980). Kodagali (1981) reported that the initial mean LH level observed in 64 cows having post-partum anoestrus was 4.03 ± 0.40 ng/ml. It was further observed that in prolonged anoestrum the serum LH levels were characteristically low (1.36 ± 0.29 ng/ml.) The study, thus revealed that there was a significant association between serum LH levels and onset of post-partum heat. Kaikini et al. (1978b) reported that in anoestrous cows progesterone was barely detectable in peripheral blood.

Luktuke et al. (1979) reported that the endocrine glands of anoestrous buffaloes revealed evidence of at least in-optimal functional status and were generally low in weight. Contrary to this, Foote (1974) reported that pituitary LH activity, which was low at calving, increased throughout anoestrum, whereas follicle stimulating hormone activity of pituitary showed a reverse trend. He postulated that the post-partum anoestrum could be due to inadequate release of pituitary gonadotrophin and low ovarian sensitivity.

Perusal of literature revealed that various drugs have been tried to combat the problem of anoestrum and the results

are varied. Treatment based on haematological studies and providing deficient constituents in the feed or by additional supplementation has been widely reviewed (Mahadevan and Zubairy, 1969; King, 1971; Sampath and Kumar, 1977; Hunter, 1977; Scharp, 1979; Pillai, 1980; Samad et al. 1980).

Recently 'Clomiphene' a derivative of Chlorotrianisene has been widely used for treatment of anoestrum in cattle. The safe and satisfactory induction of ovulatory heat in anoestrous animals by this chemical agent was a surprising development in the management of anoestrum in cattle. Clomiphene Citrate (2 - P - (2 - Chloro - 1, 2 - diphenyl-vinyl phenoxy) triethylamine dihydrogen citrate is an analogue of the non-steroidal oestrogen Chlorotrianisene (Tace) and has the basic structure of Stilboestrol. There are two isomers of Clomiphene, Cis and trans forms (Fig. 1). It was first indicated as a contraceptive for both men and women. Later it was found to have slight oestrogenic and antioestrogenic effect and in small doses was found to inhibit gonadotrophic function and cessation of oestrous cycle. The mechanism by which Clomiphene brings about release of gonadotrophins is not clearly understood. Igarshi et al. (1967) and Kato et al. (1968) indicated uptake of Clomiphene by the pituitary glands and hypothalamus. Roy et al. (1963) opined that the action of Clomiphene to release gonadotrophin

and cause ovulation was achieved in two ways, one by stimulating the hypothalamo-pituitary axis directly and other by mitigating the inhibitory effect of oestrogen on this axis, because of the competitive oestrogenic effect of this compound. Baier and Taubert (1968) suggested that Clomiphene would act directly on the hypothalamus receptor sites or interacts with oestrogen in these sites resulting in the release of FSHRH. However, Greenbalt (1979) suggested that Cis clomid neutralises the excessive oestrogen that inhibits gonadotrophic secretion and trans clomid acting as a weak oestrogen, stimulates gonadotrophic release and that Clomiphene may act either way.

Czygan and Schulz (1972) postulated that Clomiphene was able to display a positive as well as negative regulatory effect on the hypothalamo-hypophyseal axis as demonstrated by serum gonadotrophin levels. It was also reported that the action of Clomiphene could depend mainly on the endocrine status of the animal. In those with low oestrogen secretion and high gonadotrophin levels Clomiphene could not act as an anti-oestrogen on the hypothalamo-hypophyseal axis by a negative feed back mechanism. The series of events taking place by administration of Clomiphene was well elucidated by Greenbalt (1979). When Clomiphene citrate is administered it

is transported to the hypothalamic pituitary area and thought to displace the oestradiol in the tonic centre of hypothalamus. This creates a hypo-oestrogenic state at the cellular level and the neurons in the tonic centre respond by releasing LHRH, consequently the pituitary gland releases FSH and LH to stimulate the ovary which initiates follicular maturation. Plasma levels of FSH and LH rise gradually during the five days of treatment reaching its peak on the 5th day, the "Clomid Peak . Plasma oestradiol level also rises gradually, suggesting ovarian response to LH and FSH. The rising oestradiol level signals the cyclic centre in the hypothalamus to release large amount of LHRH by positive feed back which results in ovulation.

The indication that Clomiphene could cause ovulatory oestrum in animals, prompted studies for possible application of this drug in the control of reproduction in animals. Perez'-Y-Perez' (1972) using 10 to 12 mg of Clomiphene per sheep induced synchronization of oestrum in a batch of sheep. Oestrus appeared in all animals treated but only 70 per cent was ovulatory, of which 20 per cent was multiple ovulation and 40 per cent double ovulation. Land (1979) also studied the efficacy of Clomiphene to increase ovulation rate in sheep. A dose between 10 to 100 ug per day was found to

increase ovulation rate. Based on this study, he concluded that the effective dose varied according to the breed and stage of the breeding season. Debeljuk et al. (1972) observed that low doses of Cis Clomiphene was capable of augmenting LH release induced by administration of LHRH in ovariectomised rats whereas trans-Clomiphene inhibited the LHRH release.

Moberg (1972) reported that Clomiphene was capable of inducing ovulation in 90.9 per cent of mares but conception rate was only 42.2 per cent. The oestrus inducing effect of Clomiphene has been advantageously used in recent years in the treatment of anoestrum in cattle. Anon (1976) reported that 'Fertivet', brand of 'FVT 300' tablets having 120 mg of trans Clomiphene and 180 mg of Cis Clomiphene citrate, had action to stimulate the hypothalamo-pituitary axis to release GnRH. Based on this, several trials have been carried out in the recent past with 'FVT 300' for the treatment of anoestrum in cattle. Deshpande et al. (1976) studied the effect of 'Fertivet' tablets in 41 anoestrous cows and 15 anoestrous buffaloes at a dose of 1 tablet daily for five days. It was found that the drug was capable of inducing ovulatory heat in 80 per cent cows and 100 per cent buffaloes within a period of 4 to 8 days without any adverse effect. Kaikini et al. (1977) also obtained good results with 'Fertivet' and recommended that 300 mg tablet daily for five

days was effective than smaller doses. Pendse et al. (1977) used 'Fertivet' to treat 57 repeat breeding cows with delayed ovulation. It was observed that all the cows responded to the treatment within 24 to 72 hours. The best response was obtained at a dose of 450 mg daily for three days and obtained a conception rate of 71 per cent. Comparing the effect of 'Fertivet' with various other drugs such as indigenous homeopathic and hormonal preparations, Kaikini et al. (1978a) reported the superiority of this drug over the other drugs in the induction of ovulatory oestrum in cattle. Similarly, Kodagali et al. (1978) also reported that 'Fertivet' was capable of inducing ovulation in all the cows he tried within 80 hours at a dose of 750 mg per cow. Kodagali (1978) found that out of 63 anoestrous cows treated with 'Fertivet' 51 (80.95 per cent) showed oestrum within a period of 12.431 $\pm$ 1.9222 days after treatment of which 38 cows conceived (60.31 per cent). Based on this trial, he recommended that 300 mg on the first two days and 150 mg on the third day was more effective than 300 mg for five days. Hukery et al. (1979) administered 'FVT 300' at the rate of one tablet daily for five days to a group of buffaloes in anoestrous condition. Eightyfive per cent of buffaloes evinced oestrum within a period of 11.3 days with a conception rate of 80 per cent. However, he also reported that the conception rate was more

in the second service than in the first service. Manjunath (1979) studied the relative efficacy of 'Fertivet' as a therapy for anoestrous condition in cattle recovered from 'Foot and Mouth' disease. They found 90 per cent of animals showed signs of heat and obtained a conception rate of 66.6 per cent. It was further observed that better results could be obtained when an injection of Tonophosphan was given along with 'Fertivet'.

Kodagali et al. (1980) estimated serum LH levels of Gir cows before and after treatment with 'FVT 300' tablets. The mid-cycle LH levels were significantly higher than initial levels in those cows which became pregnant after treatment. They concluded that the serum LH level was not significantly high during induction of oestrum, but for induction of fertile oestrum the level was significantly more than initial levels.

Dugwekar et al. (1980) also demonstrated that 'Fertivet' was capable of inducing ovulatory oestrum. Pillai (1980) tried 'Fertivet' in anoestrous cows and heifers. Twentyfour crossbred cows and 29 heifers in true anoestrum which had shown normal values of various nutrients by haematological studies were treated with 'Fertivet' at the dose of one tablet (300 mg) daily for five days. It was observed that all the cows (100 per cent) and 89.47 per cent of heifers showed

ovulatory oestrum within a period of 5.73 and 5.43 days respectively. The cows and heifers which showed heat in the control group were only 33.3 and 30 per cent respectively. The variations were highly significant. The conception rate in the experimental animals was also significantly higher than that of control group.

Though, the general route of administration of the drug is oral, intra-peritoneal and intra-vaginal routes have also been tried with satisfactory results. In order to reduce the cost of treatmcnt by oral administration, intra-abomasal administration of 'Fertivet' was tried by Kodagali et al. (1982). It was observed that ovulatory oestrum could be induced with a minimum dose of 600 mg by this route within a period of 10.10 ± 1.40 days. Pattabhiraman et al. (1983) considered the vaginal administration of 'Fertivet' would also induce ovulatory oestrum and the results compared favourably with other modes of administration.

Prasad et al. (1983) tried the efficacy of 'Fertivet' tablets alone and in combination with copper sulphate and found that cows which received a combination of 'Fertivet' and copper sulphate responded better than those that received 'Fertivet' alone.

Many hormonal preparations have been widely used recently for treatment of anoestrum. But the success of hormonal therapy lies in accurate identification of the nature of imbalance and the use of appropriate hormonal preparation in a judicious dose schedule. Releasing hormones such as gonadotrophin releasing hormone (GnRH), due to their smaller molecular size and poor antigenicity, does not possess the property of antibody formation. Schally (1979) demonstrated that synthetic gonadotrophin releasing hormone could release enough gonadotropins for follicular maturation and ovulation in women with anovulation resulting from idiopathic hypothalamic dysfunction. Reeves et al. (1972) were the first to report that gonadotrophinreleasing hormone causes release of LH and FSH in sheep. Subsequently, similar results were reported in mares (Evans and Irvine, 1976) and in cows (Kattenbach et al. 1974). Since then, several trials were carried out in animals to induce follicular maturation and oestrus by using synthetic GnRH. Zolday and Szenci (1975) reported 84.4 per cent induction of oestrus with 45.6 per cent conception by administering 5 ml of 'Lutal', a synthetic gonadotrophin-releasing hormone (GnRH). Humke and Zuber (1977) used new LHRH analogue 'Hoe 766' to treat acyclic cows and found that 105 out of 156 cows treated, exhibited oestrum and 93.7 per cent conceived. Kodagali et al. (1981) observed that administration

of LHRH was effective in inducing post-partum heat in anoestrous cows with good conception rates. Khurana et al. (1982) also observed good results in the induction of oestrus in anoestrous buffaloes having smooth ovaries by treatment with synthetic GnRH. But the study revealed that all the treated animals showed only poor signs of oestrus as reported by Mauer and Rippel (1972). Madhavan and Raja (1983) treated eight cows with five ml of GnRH analogue (Receptol) and found that six cows responded to the treatment with poor signs of heat within 42 hours after the administration of the drug. It was also observed that out of six animals only one ovulated and none conceived. But the next heat in these animals was observed at an average of 92 days with behavioural signs of heat. They opined that GnRH could stimulate the ovarian function by expression of behavioural signs of heat, after a period of time as reported by Gupta and Dhooli (1980). Contrary to this, Schams et al. (1972) and Allen and Alexeev (1980) observed that GnRH was not effective in the treatment of anoestrum in cows. Fonseca et al. (1980) reported that cows which were given progesterone following GnRH administration had better ovulatory response than those that received GnRH alone. It has been suggested that the pituitary LH release after GnRH is dampened in cows and progesterone treatment might help to over come this dampening effect. It has also

been reported that the treatment with GnRH alone or in combination with other drugs may not establish regular oestrous cycles in cows that are in poor body condition and in those that are underfed.

During the past 50 years, gonadotrophic hormones have been extracted from various sources like mammalian pituitary glands, serum of pregnant mare, urine of pregnant women and more recently from extracts of human hypophysis (post-mortem) and post menopausal urine. All these extracts have been shown to be potent gonadal stimulants in laboratory animals. They were used in clinical trials to stimulate the ovaries of women with resultant ovulation and corpusluteum formation (Kotz and Herrmann, 1961). These hormones are also reported to be effective for ovarian stimulation in cattle and buffaloes. But the repeated use of these hormones in the same animals reduced the effectivity of the hormone due to the antibody formation in the host animal against the previously administered doses of hormones (Dugwekar, 1981). Zemjanis et al. (1969) found that administration of 800 to 1000 iu of PMS brought 58.1 per cent of cows in heat and 48.5 per cent conceived on induced heat. Glotra et al. (1971) found that administration of 1000 i.u. of PMS and 500 i.u. of HCG either once or repeated after four days brought 90 per cent of the

buffaloes in heat and 83.3 per cent of them conceived. Follicle stimulating hormone alone or in combination with LH has been recommended as an ideal treatment for true anoestrum in cows. Reece (1969) and Deas et al. (1979) remarked that, though, PMS (Pregnant mare serum) could induce ovulation in anoestrous animals, the possibility of excess ovarian stimulation and consequent cyst formation in the ovaries might not be over ruled. Arthur (1975) stated that though, gonadotrophin was theoretically indicated to induce ovulation in anoestrous cows it might cause super follicle production with heat, but it might not induce ovulation and the animal might relapse into anoestrous state.

The positive feed back effect of oestrogen and progesterone upon gonadotrophin release in womenwas well documented (Yen and Tsai, 1972). In experimental animals Leyendecker et al. (1972) and Nillus and Wide (1972) also demonstrated the positive feed back effect of oestrogen and progesterone in gonadotrophin release. Earlier workers have indicated that, in animals also, ovarian hormones play significant role in modulating and controlling the function of hypothalamus and pituitary glands in the secretion of gonadotrophin which in turn would regulate ovarian function. Frangulgan (1943) observed that administration of oestrogen

was effective for induction of ovulation probably due to the release of LH. Zemjanis (1969) reported that 73.5 per cent of oestrogen treated animals evinced oestrum, but the conception rate was only 25.3 per cent. Favourable results by using oestrogen in anoestrous cows were reported by Araujo et al. (1973); Dindorkar and Kohli (1973) and Patil and Khan (1978). Dugwekar (1981) revealed that administration ofoestrogen might trigger the hypothalamo-hypophysio-ovarian axis with restoration of cyclicity. The role of progesterone in gonadotrophin secretion is enigmatic. The work of several investigators clearly established that, in experimental animals, the effect of progesterone is facilatory to gonadotrophin release (Fverett, 1948; Zeilmaker, 1966; Ross et al. 1970; Swerdloff et al. 1972). The facilatory effect of progesterone on gonadotrophin release is well explained in animals also. Hale and Symington (1969) reported that Chlormadinone acetate (CAP), melengesterol acetate (MGA) and megesterol acetate (MA) were effective in inducing oestrum in cattle. But they reported high incidence of unovulatory heat. Shukla et al. (1972) reported that melengesterol acetate was effective in hastening post-partum oestrum in buffaloes. The conception rate at first synchronised oestrum was significantly reduced. Second oestrum appeared late but the conception rate was better.

Schimidt et al. (1973) observed CAP was effective in reducing post-partum anoestrous period in cows after oral administration. Mia and Rahman (1974) found that administration of 25 mg of progesterone daily for 10 days to anoestrous cows resulted in cyclicity within a period of 18 days.

Progesterone in combination with oestrogen has been extensively used for induction of cyclic activity in bovines. Smith and Zimbelman (1968) studied the effect of melengesterol acetate and oestradiol cypionate (ECP) on induction ovulation and conception rate. ECP increased the overall incidence of oestrum and ovulation and appeared to have a favourable effect. Arbeiter (1977) also reported that progesterone in combination with oestrogen was effective in inducing cyclicity in animals. Roche (1974) studied the effect of short term progesterone treatment on oestrus response and fertility in Hereford cows. Progesterone implants were inserted in Hereford cows and heifers for nine days and oestradiol benzonate 5 mg was given at the time of insertion of implant. It was found that oestrus response was low in animals receiving implants alone between day 5 to 15. Injecting 50 mg of progesterone with 5 mg of oestrogen increased the oestrus response in animals receiving implants on day 17. Jelcaninov and Petruskin (1974) obtained encouraging results with the treatment of combination of oestrogen and progesterone in acyclic cows. Deshpande and Sane (1977) used progesterone and a combination of oestrogen

and progesterone parenterally for anoestrous cows and found that 70 per cent of the animals exhibited oestrum within three to four days of treatment. Pant and Sharma (1979) reported that administration of melengesterol acetate given orally for 14 days or 0.5 mg of MGA given for 14 days plus an intra muscular injection of 250 ug of oestradiol benzoate given for 48 hours after the last day of MGA induced ovulatory oestrum in 55.5 per cent and 100 per cent cows respectively. Gupta (1980) also reported favourable results with administration of a combination of oestrogen and progesterone. Prasad et al. (1983) found that 'Secrodyl injection' (combination of oestrogen and progesterone) was useful in the induction of oestrum in post-partum cows. Out of 20 anoestrous animals which were given 'Secrodyl' injection the percentage of success was 60 per cent. Uma Shankar and Verma (1982) obtained 93.75 per cent oestrus induction by administration of low doses of oestrogen and progesterone ('Secrodyl') in anoestrous buffaloes. But they reported that the intensity of induced oestrum was weaker than natural oestrus, although, the fern pattern of oestral mucus was normal. All the above workers, however, reported low percentage of ovulation at the induced oestrus with poor conception rate. Tripathy et al. (1979) considered that, though, it might be possible to induce oestrum by parenteral

administration of small doses of oestrogen and progesterone, the occurrence of ovulation and restoration of normal pattern of oestrus cycle could not be guaranteed. Drew et al (1978), Roche et al. (1978) and Bulman et al. (1978) successfully induced heat in cows having functionless ovaries by administration of PRID (progesterone releasing intra vaginal devise), but the conception rate in the induced oestrus was not satisfactory. Petit et al. (1978) also tried progesterone intra vaginally in the form of Sialistic Coil (PRID) along with oestradiol benzoate in a gelatin capsule attached to it for 12 days followed by 600 i.u. of PMSG injected intra muscularly. Removal of PRID resulted in ovulation in 98.5 per cent of cows and 78 to 100 per cent heifers. Fonseca et al. (1980) reported that cows given progesterone via a PRID had slightly better ovulatory response following GnRH than the cows which did not receive progesterone.

Mathai et al. (1971) observed that injection of 50 units of oxytocin within six hours after calving was effective to hasten the onset of post-partum heat in cows.

Several other drugs have also been tried successfully by various workers to hasten the post-partum oestrum in cows. Mathai et al. (1973) found that 'Tonophosphan' (Phosphorus

compound) and 'Prepalin forte' (vitamin A preparation) were effective in inducing early post-partum oestrum in cows. Singh et al. (1978) also found that 58.8 per cent of anoestrous cows came into heat following administration of 'Tonophosphan' and 'Prepalin forte'. Bhattacharya and Sundaram (1982) confirmed the above findings and remarked that a combination of 'Tonophosphan' and vitamin A was effective in inducing heat in post-partum cows under farm and field conditions. They recommended a dose of 5 ml of 'Tonophosphan' and 2 ml of 'Prepalin forte' daily for five days and claimed a success of 86 per cent and 85 per cent under farm and field conditions respectively. The corresponding conception rate was 73 and 69 per cent in the above respective groups.

Porwal et al. (1976) and Sampath and Kumar (1977) recommended administration of 'supermindif' (mineral mixture) for hastening ovulatory oestrum.

Ermaeenkov (1964) claimed lavage of cervix with two per cent Lugol's iodine was helpful to induce oestrum in cows. Porwal et al. (1976) obtained 43.33 per cent conception by application of Lugol's iodine at the cervix for eight days. Deshpande and Sane (1977) also tried intra uterine administration of Lugol's iodine to induce ovulation in anoestrous cows.

But, Chauhan and Singh (1959) found intra uterine administration of 50 to 150 ml of 0.5 per cent of Lugol's iodine was not useful in inducing oestrum. Deas et al. (1979a) reported that intra uterine irrigation with Lugol's iodine in a dilution of 1:500 might stimulate initiation of oestrus cycle. But Prasad et al. (1983) found that only 10 per cent of anoestrus cows evinced oestrum by application of Lugol's iodine.

Hays and Carlevaro (1956) and Grigor'ev et al. (1978) reported that electrical stimulation of cervix induced oestrum in anoestrous cows within few days after treatment. Ermaeenkov (1964) massaged the uterus and ovaries of anoestrous cows twice daily for three days and reported that 22.7 per cent of cows had ovulatory heat after four days. Hintanaus (1965) massaged the clitoris of 32 cows seven minutes daily for six consecutive days and reported that oestrum appeared in 31 of them within 8 days. The conception rate was 55 per cent. Porwal et al. (1976) reported that utero-ovarian massage and application of Tincture iodine into the cervix induced oestrum in 46.66 per cent anoestrous cows, out of which, 92.85 per cent conceived. But Araujo et al. (1973) could not find any beneficial effect in ovarian massage.

Perusal of literature reveals the use of various indigenous and homeopathic drugs in the treatment of anoestrum. 'Prajana'

was first tried by Rao and Murthy (1971b). They reported that 84.78 per cent of anoestrous cows exhibited oestrum and 72.72 per cent conceived on subsequent insemination. Porwal et al. (1976) and Deshpande and Sane (1977) tried Ayurvedic drugs like 'Prajana', Heatrone','Samudrapala' and 'Aloes compound' and found that 'Prajana' and Heatrone' gave promising results. Kodagali et al. (1981) studied the ovarian response following 'Prajana' in post-partum anoestrous cows and post-pubertal anoestrous heifers and obtained promising results. Shah et al. (1983) also obtained good results with 'Prajana' in anoestrous Surthi buffaloes. On the contrary, Kaikini et al. (1978a) reported that indigenous drugs like 'Samudrapala', 'Guggul', 'Palarpapda seeds','Heatrone' and homeopathic drugs like 'Graphitis' were of no value in inducing oestrum in anoestrous cows.

Materials and Methods

MATERIALS AND METHODS

Materials for the present study consisted of 575 cross-bred cows and 446 heifers (Jersey x Sindhi, Jersey x Local, Holstein Friesian x Local and Brown Swiss x Local) belonging to the University Livestock Farm and animals brought for various infertility camps. The breeding history of all animals were collected. One hundred and eighty cows which failed to exhibit oestrum even after 60 days post-partum and 165 heifers which failed to exhibit oestrum even after 24 months of age were identified as anoestrous. The animals identified as anoestrous were subjected to detailed gynaeco-clinical examination at 10 days interval and 56 cows and 61 heifers having smooth inactive ovaries and without any cyclical activity were declared as in 'true anoestrum' and alloted randomly into the following treatment groups.

Group I

Nineteen cows and thirty three heifers were administered orally with one tablet of 'Fertivet FVT 300'* daily for five consecutive days, while 9 cows and 8 heifers were kept as control. The cows and heifers in the treated group were administered one tablet of 'Fertivet FVT 300' per day for five days. Administration consisted of 125 ml of one per cent

copper sulphate solution followed by one pulvarized tablet dissolved in 300 ml of water daily for five days. If heat symptoms were observed during the courseof treatment, further medication was stopped. The control animals were given only 125 ml of one per cent copper sulphate solution daily for five days.

Group II

Twenty cows and 14 heifers were given one ml 'Secrodyl'** intra muscularly for five consecutive days while 8 cows and 6 heifers were kept as control. If heat symptoms were observed during the course of treatment further administration of the drug was stopped.

After the commencement of the treatment both experimental and control animals in both the groups were kept under close observation for manifestation of heat symptoms. Detection of oestrus was done by close observation and repeated examination. A positive response to treatment was assessed by induction of visible heat with behavioral signs and the

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* 'Fertivet FVT 300' is a product of AR-Ex Laboratories, Bombay, containing 180 mg of Cis-Clomiphene Citrate and 120 mg of trans-Clomiphene Citrate per tablet(Anon, 1976).

** 'Secrodyl' is a product of Allenbury's, Bombay, containing 5 mg of megesterol acetate and 0.03 mg of ethinyl oestradiol per ml.

presence of graafian follicles in the ovary. All the animals in the induced heat were inseminated with good quality chilled semen. Those animals which failed to settle with first insemination were re-inseminated on the subsequent heat. Pregnancy diagnosis was done by rectal examination 45 to 60 days after insemination. The following observations were made:

1) Interval from treatment to onset of heat. Each animal under treatment was closely watched for signs of heat and the interval from the treatment to the onset of oestrum was recorded.

2) Ovulation: The animals in oestrum were examined per rectum at four hour interval until ovulation occurred. The ovaries and follicles were examined carefully for evidence of ovulation which was later on confirmed by the presence of corpusluteum seven to ten days after the end of heat.

3) Conception rate: All the inseminated cows were examined 45 to 60 days after the last insemination and pregnancy was confirmed by rectal examination.

The data were analysed statistically to find out the

efficacy of each drug in cows and heifers and the overall efficacy of the drug on the induction of oestrum and conception rate (Snedecor and Cochran, 1967).

Results

RESULTS

Results of the investigation on the incidence of anoestrum and the comparative efficacy of administration of 'Fertivet FVT 300' and 'Secrodyl' to improve the breeding efficiency of anoestrous cows and heifers are presented in table 1 to 15.

It could be seen from table 1, that out of 575 cows and 446 heifers, 180 cows (31.3 per cent) and 165 heifers (36.99 per cent) were reported to be anoestrous beyond 60 days post-partum and 24 months of age respectively. But, detailed repeated examination revealed that 56 cows (9.74 per cent) and 61 heifers (13.68 per cent) were in true anoestrum as evidenced by inactive ovaries with no indication of cyclical activity.

Results of treatment with 'Fertivet FVT 300' in cows are presented in table 2 to 4 and Figure 2. It could be seen that treatment with 'Fertivet' was initiated on an average of 111.6 $\pm$ 11.17 days and 94.22 $\pm$ 4.87 days after calving in the experimental and control groups respectively. Among the 19 cows treated with 'Fertivet FVT 300', oestrum was induced within a mean period of 4.57 $\pm$ 0.16 days after the

commencement of treatment in all the cows (100 per cent) while only three out of nine cows (33.33 per cent) showed oestrum among the control groups, within a mean period of 22 ± 4.36 days. This difference between the two groups was significant ($P/0.05$). Among the treated groups 13 (68.42 per cent) ovulated while only three (33.33 per cent) ovulated in the control group, the variation was also significant ($P/0.05$). The number of cows conceived for the first A.I. was 8 (42.11 per cent) and one (11.11 per cent) in the experimental and control groups respectively, the difference being significant ($P/0.05$). The animals which failed to conceive at first insemination were re-inseminated in the subsequent heat in both the groups and the overall conception rate was 57.89 per cent and 22.22 per cent in the above respective groups, the variation being significant ($P/0.05$).

Results of treatment with 'Fertivet FVT 300' in heifers are presented in table 5 to 7 and Figure 3. It could be observed that treatment was initiated in heifers at an average of 39.06 ± 1.53 months in the experimental group and 33.5 ± 2.06 months in the control group. Among the 33 heifers treated with 'Fertivet', 31 heifers (93.94 per cent) showed oestrum within a mean period of 4.48 ± 0.21 days. In the control group, among eight heifers, only three (37.5 per cent) showed oestrum at a mean period of 5 ± 0.58 days. Statistical analysis

revealed the variation in the induction of oestrum between the two groups was highly significant ($P/0.01$). The induced heat was ovulatory in 21 heifers (63.64 per cent) in the experimental, while only three heifers (37.50 per cent) showed ovulatory oestrum in the control group, the variation was also significant. Ten heifers (30.30 per cent) from the treated group conceived for the first A.I. while none from the control group became pregnant. Analysis of the data revealed that this difference was highly significant ($P/0.01$). The heifers which returned to oestrum, subsequently were re-inseminated and four heifers conceived in the treated group, while only two conceived in the control group. The overall conception rate in the above respective groups were 42.42 per cent and 25 per cent.

Results of treatment of anoestrous cows with 'Secrodyl' are presented in table 8 to 10 and figure 4. It could be seen that treatment was initiated at a mean interval of 66.2 ± 1.65 days after calving in the experimental and 97.13 ± 10.73 days in the control group. It is evident from the table that out of 20 cows treated with 'Secrodyl' 19 cows (95 per cent) expressed oestrum within a mean period of 4.89 ± 0.72 days after the commencement of treatment. In the control group, out of eight cows, two cows (25 per cent) evinced oestrum within a mean period of 26.5 ± 5.49 days. Statistical

analysis revealed highly significant variation in the induction of oestrum between these two groups ($P/0.01$). The induced oestrum was ovulatory in ten cows (50 per cent) in the experimental group, while two cows (25 per cent) showed ovulatory oestrum in the control group. This difference was statistically significant ($P/0.01$). Among the cows in the treated groups, three (15 per cent) conceived for the first A.I. whereas none conceived in the untreated control. The overall conception rate in the experimental and control animals were 30 and 12.5 per cent respectively. Statistical analysis showed highly significant variation ($P/0.01$) in the conception rate for the first A.I. and significant variation ($P/0.05$) in the overall conception rate between the two groups.

Results of treatment with 'Secrodyl' in heifers are presented in table 11 to 13 and figure 5. Perusal of data revealed that treatment was initiated at an average of 40.36 ± 2.72 months and 32 ± 2.13 months in the experimental and control groups respectively. Among the 14heifers treated with 'Secrodyl',nine (64 per cent) showed oestrum within a mean period of 4.77 ± 0.15 days, while none of the control animals showed oestrum during the period of study. Among the treated animals, 7 (50 per cent) showed ovulatory oestrum and two (14.28 per cent) conceived for the first A.I., the overall

conception rate being 28.57 per cent. The difference in the induction of ovulatory heat and conception between the two groups was highly significant ($P < 0.01$).

The overall effect of 'Fertivet' and 'Secrodyl' in the induction of oestrum in cows and heifers are presented in table 14 and figure 6. It was found that out of 52 cows and heifers, 34 (60.28 per cent) expressed ovulatory oestrum when treated with 'Fertivet' while only 17 (50 per cent) out of 34 animals showed ovulatory oestrum when treated with 'Secrodyl'. The difference was found to be significant ($P < 0.05$). Similarly among 52 animals treated with 'Fertivet', 18 (34.61 per cent) became pregnant for the first A.I. while only five (14.71 per cent) animals became pregnant out of 34, in the 'Secrodyl' treated group. This variation was also found to be statistically significant ($P < 0.05$).

When the data were grouped according to parity of cows, (Table 15) it was found that parity did not have any significant influence either on the induction of oestrum or the conception rate in cows.

Table 1. Incidence of true anoestrum in crossbred cattle.

Source	No. of animals examined			No. of animals reported to be in anoestrum					No. of animals in true anoestrum					
	Cows	Heif-ers	Total	Cows	Perce-ntage	Heif-ers	Perce-ntage	Total	Perce-ntage	Cows	Perce-ntage	Heif-ers	Perce-ntage	Total	Perce-ntage
Livestock Farm	195	120	315	60	30.77	30	25.00	90	28.57	20	10.26	5	4.17	25	7.94
Sterility camps	380	326	706	120	31.58	135	41.41	255	36.11	36	9.47	56	17.18	92	13.03
Total	575	446	1021	180	31.30	165	36.99	345	33.79	56	9.74	61	13.68	117	11.46

Table 2. Trials with 'Fertivet' - experimental.
(cows)

Sl No	Parity	Type of anoestrum	Period of anoestrum (days)	Interval from the commencement of treatment to oestrum (days)	Ovulatory or Non ovulatory	Result of first A.I.	Result of subsequent A.I.
1	C1	Post-partum	150	5	Ovulatory	Pregnant	
2	C1	,,	165	5	Ovulatory	Pregnant	
3	C2	,,	90	4	Ovulatory	Not pregnant	Not pregnant
4	C3	,,	80	3	Ovulatory	Not pregnant	Pregnant-IInd A.I.
5	C2	,,	64	5	Non ovulatory	Not pregnant	Not pregnant
6	C2	,,	68	5	Non ovulatory	Not pregnant	Not pregnant
7	C3	,,	62	3	Ovulatory	Not pregnant	Pregnant IIIrd A.I.
8	C4	,,	150	4	Ovulatory	Pregnant	
9	C3	,,	165	5	Ovulatory	Not pregnant	Not pregnant
10	C2	,,	60	4	Ovulatory	Pregnant	
11	C3	,,	62	5	Non ovulatory	Not pregnant	Pregnant IInd A.I.

contd.....

Table 2. contd.....

Sl No	Parity	Type of anoestrum	Period of anoestrum (days)	Interval from the commencement of treatment to oestrum (days)	Ovulatory of Non ovulatory	Result of first A.I.	Result of subsequent A.I.
12	C1	Post-partum	180	5	Non ovulatory	Not pregnant	Not pregnant
13	C1	,,	150	5	Ovulatory	Not pregnant	Not pregnant
14	C4	,,	182	5	Ovulatory	Pregnant	
15	C2	,,	145	5	Ovulatory	Pregnant	
16	C3	,,	60	5	Non ovulatory	Not pregnant	Not pregnant
17	C4	,,	64	5	Ovulatory	Pregnant	
18	C4	,,	65	5	Ovulatory	Pregnant	
19	C2	,,	150	5	Not ovulatory	Not pregnant	Not pregnant

Mean period of anoestrum = 111.16 $\pm$ 11.17 days.

Mean period taken from commencement of treatment to oestrum = 4.57 $\pm$ 0.16 days.

Table 3. Trials with 'Fertivet' - control.
(cows)

Sl No	Parity	Type of anoestrum	Period of anoestrum (days)	Interval from the commencement of treatment to oestrum (days)	Ovulatory or Non ovulatory	Result of first A.I.	Result of subsequent A.I.
1	C2	Post-partum	120	No response			
2	C3	,,	90	15 days	Ovulatory	Not pregnant	Pregnant IInd A.I
3	C4	,,	88	No response			
4	C1	,,	92	21 days	Ovulatory	Pregnant	
5	C2	,,	110	No response			
6	C3	,,	100	30 days	Ovulatory	Not pregnant	Not pregnant
7	C2	,,	96	No response			
8	C3	,,	72	No response			
9	C3	,,	80	No response			

Mean period of anoestrum = 94.22 ± 4.87 days.

Mean period taken from commencement of treatmentto oestrum = 22 ± 4.36 days.

Table 4. Trials with 'Fertivet' - Summary (cows)

Sl No	Particulars	Experimental	Control	
1	Total Number	19	9	
2	Number in which heat induced	19 (100)	3(33.33)	*
3	Interval from commencement of treatment to oestrum in days	4.57±0.16	22±4.36	
4	Number ovulated	13 (68.42)	3 (33.33	*
5	Number pregnant at first A.I.	8 (42.11)	1 (11.11)	*
6	Number pregnant with subsequent A.I.	3	1	
7	Overall conception rate	11 (57.89)	2 (22.22)	*

* Significant at 5% level.

Figures in parenthesis shows percentage.

Table 5. Trials with 'Fertivet' - experimental.
(Heifers)

Sl No	Age (months)	Interval from commencement of treatment to oestrum (days)	Ovulatory or Non ovulatory	Result of first A.I.	Result of subsequent A.I.
1	36	4	Ovulatory	Pregnant	
2	30	3	Ovulatory	Not pregnant	Not pregnant
3	36	4	Ovulatory	Pregnant	
4	30	4	Ovulatory	Pregnant	
5	60	5	Non ovulatory	Not pregnant	Not pregnant
6	48	5	Non ovulatory	Not pregnant	Not pregnant
7	48	4	Non ovulatory	Not pregnant	Not pregnant
8	58	4	Ovulatory	Pregnant	
9	42	4	Non ovulatory	Not pregnant	Not pregnant
10	45	5	Non ovulatory	Not pregnant	Not pregnant
11	40	5	Non ovulatory	Not pregnant	Not pregnant
12	46	5	Ovulatory	Not pregnant	Not pregnant
13	42	5	Ovulatory	Pregnant	
14	36	4	Ovulatory	Pregnant	
15	36	5	Ovulatory	Not pregnant	Not pregnant
16	42	5	Non ovulatory	Not pregnant	Not pregnant
17	30	5	Ovulatory	Pregnant	
18	48	5	Non ovulatory	Not pregnant	Not pregnant
19	30	5	Ovulatory	Pregnant	
20	30	5	Non ovulatory	Not pregnant	Not pregnant

(contd.....)

Table 5. contd.....

Sl No	Age (months)	Interval from commencement of treatment to oestrum (days)	Ovulatory or Non ovulatory	Result of first A.I.	Result of subsequent A.I.
21	30	5	Ovulatory	Pregnant	
22	54	5	Ovulatory	Pregnant	
23	42	5	Ovulatory	Not pregnant	Pregnant - IInd A.I.
24	31	3	Non ovulatory	Not pregnant	Not pregnant
25	48	3	Ovulatory	Not pregnant	Not pregnant
26	30	3	Ovulatory	Not pregnant	Not pregnant
27	36	5	Ovulatory	Not pregnant	Pregnant-IInd A.I.
28	30	No response			
29	45	No response			
30	36	5	Ovulatory	Not pregnant	Pregnant-IIIrd A.I.
31	30	5	Ovulatory	Not pregnant	Not pregnant
32	34	5	Ovulatory	Not pregnant	Not pregnant
33	30	5	Ovulatory	Not pregnant	Pregnant-IInd A.I.

Mean period of anoestrum = 39.06 $\pm$ 1.53 months.

Mean period taken from commencement of treatment to oestrum = 4.48 $\pm$ 0.21 days.

Table 6. Trials with 'Fertivet' - Control
(Heifers)

Sl No	Age (months)	Interval from commencement of treatment to oestrum (days)	Ovulatory or Non ovulatory	Result of first A.I.	Result of subsequent A.I.
1	30	6	Ovulatory	Not pregnant	Pregnant-IInd A.I.
2	36	No response			
3	34	4	Ovulatory	Not pregnant	Pregnant-IInd A.I.
4	24	No response			
5	32	No response			
6	30	No response			
7	40	5	Ovulatory	Not pregnant	Not pregnant
8	42	No response			

Mean period of anoestrum = 33.5 ± 2.06 months

Mean period taken from the commencement of treatment to oestrum = 5 ± 0.58 days.

Table 7. Trials with 'Fertivet' - Summary
(Heifers)

Sl No	Particulars	Experimental	Control	
1	Total Number	33	8	
2	Number in which heat induced	31 (93.94)	3 (37.50)	**
3	Interval from commencement of treatment to oestrum in days	4.48 ± 0.21	5 ± 0.58	
4	Number ovulated	21 (63.64)	3 (37.50)	*
5	Number pregnant in first A.I.	10 (30.30)	-	**
6	Number pregnant in subsequent A.I.	4 (	2	
7	Overall conception rate	14 (42.42)	2 (25.00)	

* Significant at 5% level

** Significant at 1% level

Figures in parenthesis denote percentage

Table 8. Trials with 'Secrodyl' - Experimental (cows)

Sl No	Parity	Type of anoestrum	Period of anoestrum (days)	Interval from the commencement of treatment to oestrum (days)	Ovulatory or Non ovulatory	Result of first A.I.	Result of subsequent A.I.
1	C2	Post-partum	80	4	Ovulatory	Pregnant	
2	C1	,,	65	5	Ovulatory	Pregnant	
3	C1	,,	75	5	Ovulatory	Pregnant	
4	C3	,,	60	5	Ovulatory	Not pregnant	Pregnant-IInd A.I.
5	C4	,,	62	5	Non ovulatory	Not pregnant	Not pregnant
6	C4	,,	62	5	Non ovulatory	Not pregnant	Not pregnant
7	C3	,,	68	5	Ovulatory	Not pregnant	Pregnant-IIIrd A.I.
8	C3	,,	78	5	Non ovulatory	Not pregnant	Not pregnant
9	C2	,,	85	5	Non ovulatory	Not pregnant	Not pregnant
10	C3	,,	60	5	Ovulatory	Not pregnant	Not pregnant
11	C2	,,	60	5	Ovulatory	Not pregnent	Pregnant-IInd A.I.
12	C3	,,	62	5	Ovulatory	Not pregnant	Not pregnant
13	C3	,,	64	5	Non ovulatory	Not pregnant	Not pregnant
14	C2	,,	66	5	Non ovulatory	Not pregnant	Not pregnant
15	C3	,,	64	5	Non ovulatory	Not pregnant	Not pregnant
16	C3	,,	60	5	Ovulatory	Not pregnant	Not pregnant
17	C2	,,	63	No response			
18	C3	,,	65	5	Non ovulatory	Not pregnant	Not pregnant
19	C4	,,	60	4	Non ovulatory	Not pregnant	Not pregnant
20	C3	,,	65	5	Ovulatory	Not pregnant	Not pregnant

Mean period of anoestrum = 66.2 ± 1.65 days.

Mean period taken from the commencement of treatment to oestrum = 4.89 ± 0.072 days.

Table 9. Trials with 'Secrodyl' - control (cows)

Sl No	Parity	Type of anoestrum	Period of anoestrum (days)	Interval from the commencement of the experiment to oestrum (days)	Ovulatory or Non ovulatory	Result of first A.I.	Result of subsequent A.I.
1	C1	Post-partum	120	No response			
2	C2	,,	150	No response			
3	C1	,,	90	21	Ovulatory	Not pregnant	Not pregnant
4	C4	,,	60	No response			
5	C3	,,	75	No response			
6	C5	,,	72	32	Ovulatory	Not pregnant	Pregnant-IIIrd A.I.
7	C1	,,	90	No response			
8	C2	,,	120	No response			

Mean period of anoestrum = 97.13 ± 10.73 days.

Mean period taken from the commencement of the experiment to oestrum = 26.5 ± 5.49 days.

Table 10. Trials with 'Secrodyl' - Summary
(cows)

Sl No	Particulars	Experimental	Control	
1	Total Number	20	8	
2	Number in which heat induced	19 (95.00)	2 (25.00)	**
3	Interval from commencement of treatment to oestrum in days	4.89 ± 0.72	26.5 ± 5.49	
4	Number ovulated	10 (50.00)	2 (25.00)	**
5	Number pregnant in first A.I.	3 (15.00)	--	**
6	Number pregnant in subsequent A.I.	3 (15.00)	1 (12.50)	
7	Overall conception rate	6 (30.00)	1 (12.50)	*

* Significant at 5% level

** Significant at 1% level

Figures in parenthesis denote percentage.

Table 11. Trials with 'Secrodyl' - Experimental (Heifers)

Sl No	Age (months)	Interval from the commencement of treatment to oestrum (days)	Ovulatory or Non ovulatory	Result of first A.I.	Result of subsequent A.I.
1	36	5	Ovulatory	Pregnant	
2	40	4	Ovulatory	Not pregnant	Pregnant-IInd A.I.
3	42	5	Ovulatory	Pregnant	
4	30	4	Non ovulatory	Not pregnant	Not pregnant
5	48	No response			
6	36	No response			
7	30	5	Ovulatory	Not pregnant	Not pregnant
8	36	5	Non ovulatory	Not pregnant	Not pregnant
9	60	No response			
10	36	No response			
11	60	No response			
12	48	5	Ovulatory	Not pregnant	Not pregnant
13	30	5 5	Ovulatory	Not pregnant	Not pregnant
14	33	5	Ovulatory	Not pregnant	Pregnent- IIIrd A.I.

Mean period of anoestrum = 40.36 $\pm$ 2.72 months

Mean period taken from the commencement of treatment to oestrum = 4.77 $\pm$ 0.15 days.

Table. 12. Trials with 'Secrodyl' - Control
(Heifers)

Sl No	Age (months)	Interval from the commencement of experiment to oestrum (days)	Ovulatory or Non ovulatory	Result of first A.I.	Result of subsequent A.I.
1	32	No response			
2	30	No response			
3	34	No response			
4	32	No response			
5	24	No response			
6	40	No response			

Mean period of anoestrum = 32 $\pm$ 2.13 months.

Table 13. Trials with 'Secrodyl' - Summary
(Heifers)

Sl No	Particulars	Experimental	Control	
1	Total Number	14	6	
2	Number in which heat induced	9 (64.00)	-	**
3	Interval from the commencement of treatment to oestrum in days	4.77 ± 0.15	-	
4	Number ovulated	7 (50.00)	-	**
5	Number pregnant in first A.I.	2 (14.28)	-	**
6	Number pregnant in second A.I.	2	-	
7	Overall conception rate	4 (28.57)	-	**

On statistical analysis the difference in the induction of heat and number conceived for the first A.I. and the overall conception rate was highly significant.

The figures in parenthesis denote percentage.

Table 14. Overall efficacy of 'Fertivet' and 'Secrodyl' in experimental animals

Sl No	Particulars	Fertivet			Secrodyl			
		Cows	Heifers	Total	Cows	Heifers	Total	
1	Total Number	19	33	52	20	14	34	
2	Ovulatory oestrum	13 (68.42)	21 (63.64)	34 (60.28)	10 (50.00)	7 (50.00)	17 (50.00)	*
3	Conception for the first A.I.	8 (42.11)	10 (30.30)	18 (34.61)	3 (15.26)	2 (14.20)	5 (14.71)	*
4	Overall conception rate	11 (56.89)	14 (42.42)	25 (48.08)	6 (30.00)	4 (28.57)	10 (29.41)	

*Significant at 5% level.

Figures in parentheis denote percentage.

Table 15. Effect of parity on treatment in cows

	Fertivet					Secrodyl			
Parity	No treated	No in which heat induced	No conceived for Ist A.I.	Overall conception	Parity	No treated	No in which heat induced	No conceived for Ist A.I.	Overall conception
1	4	4	2	2	1	2	2	2	2
2	6	6	2	2	2	5	4	1	2
3	5	5	-	3	3	10	10	-	2
4	4	4	4	4	4	3	3	-	-
Total	19	19	8	11		20	19	3	6

Inference : Parity has no significant effect either on induction of oestrum or in the conception rate.

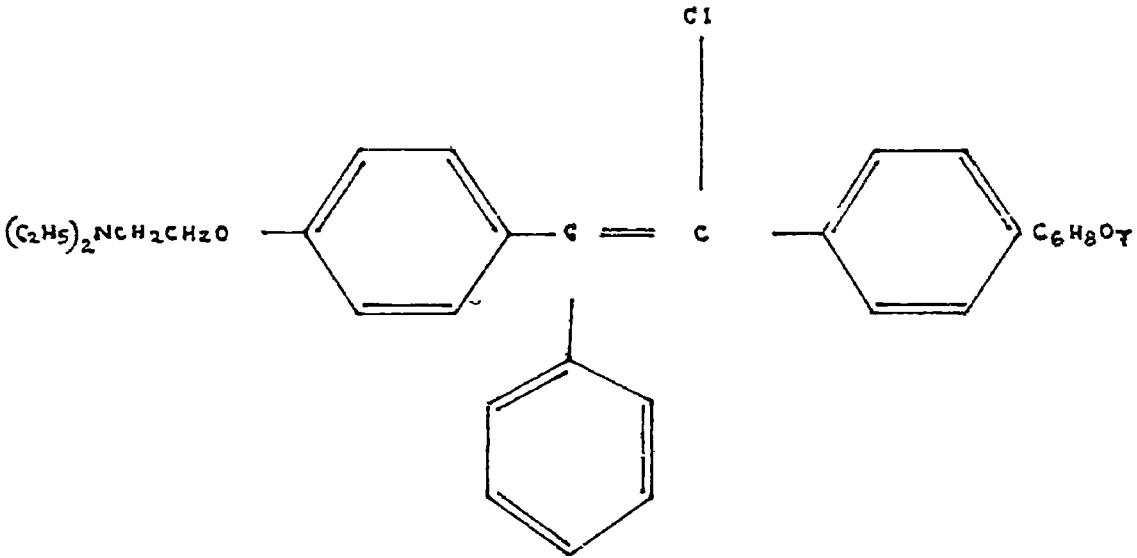

Fig. 1. Clomiphene Citrate - Chemical Structure.

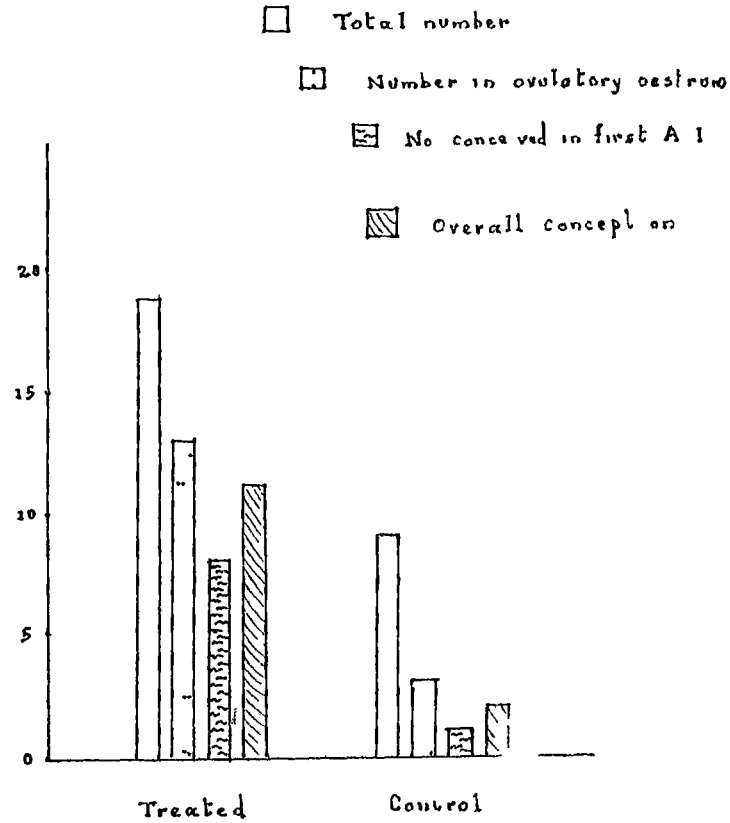

Fig. 2. Trials with 'Fertivet - cows

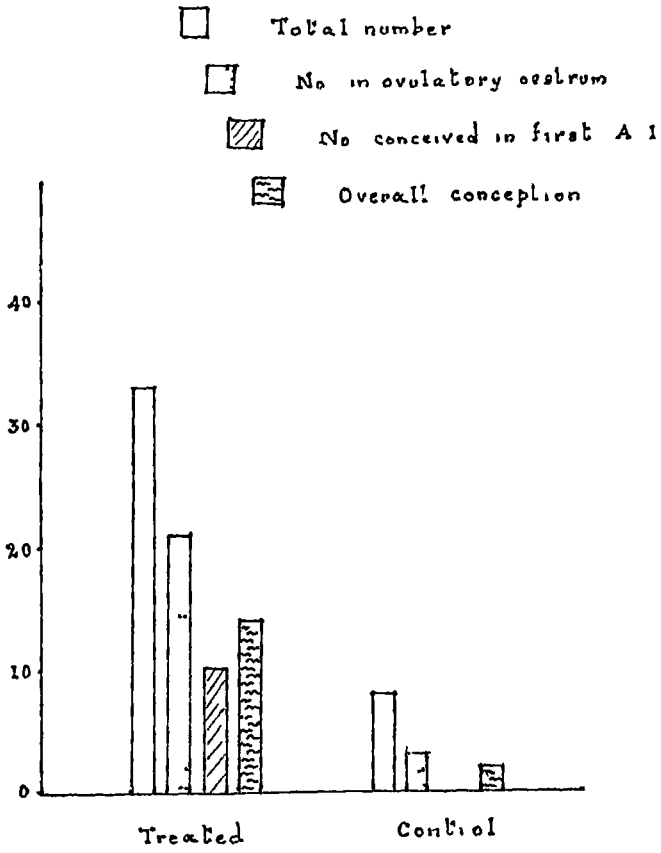

Fig. 3. Trials with 'Fertivet - Heifers

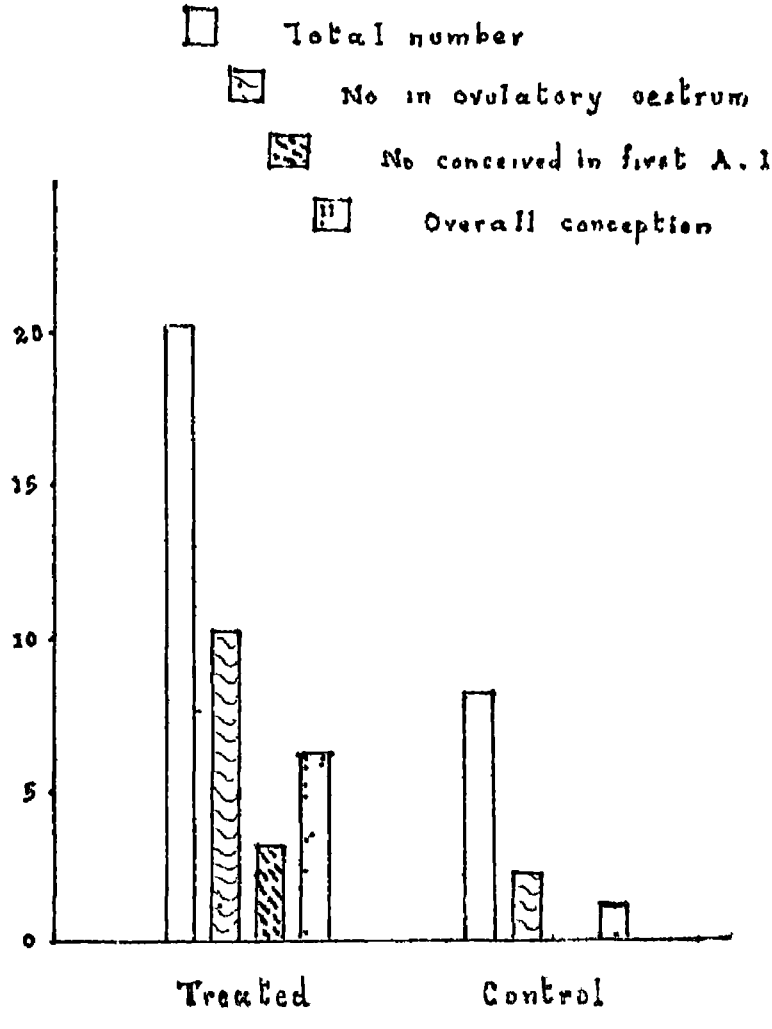

Fig. 4. Trials with 'Secrodyl' - cows.

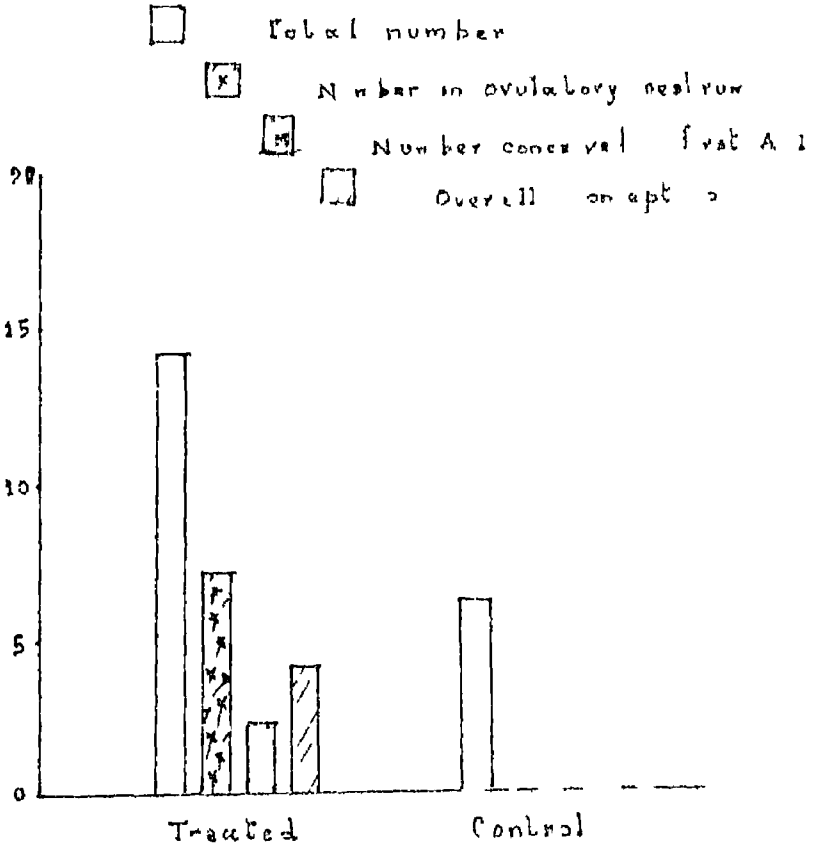

Fig 5 Trials with Sexed Heifers

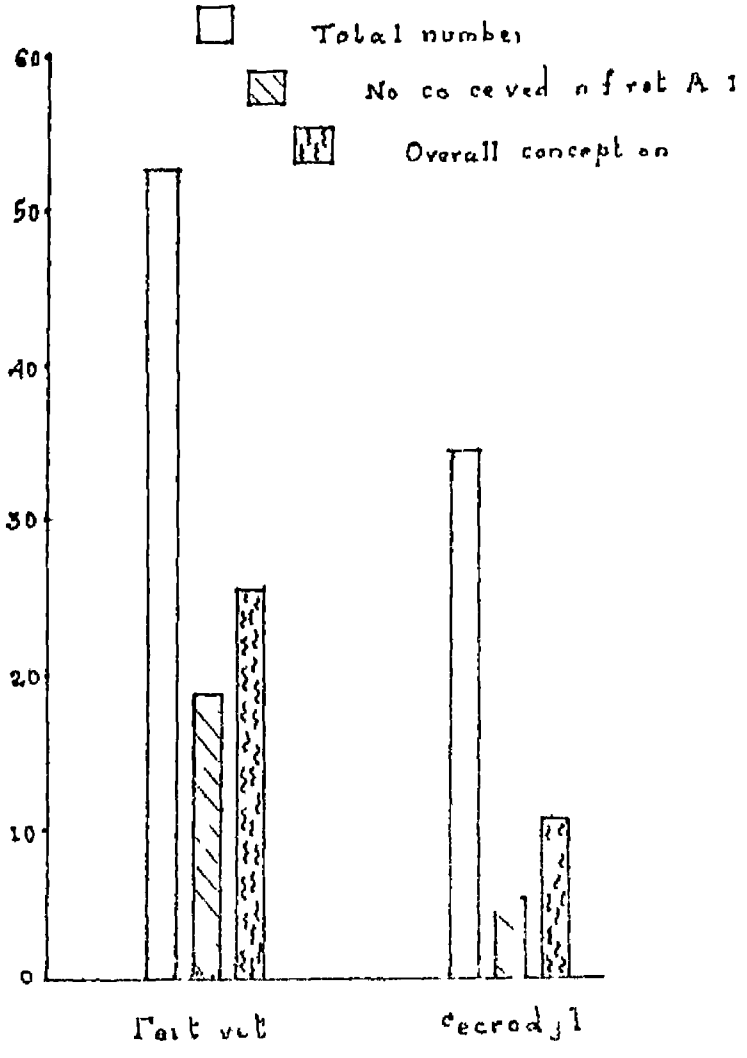

Fig 6 Overall cffic cy Fer vet nd fer xivl
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Discussion

DISCUSSION

Anoestrum due to inactive ovaries resulting in subfertility in cows and heifers is a major infertility problem resulting in great economic loss. Under Indian conditions, this problem needs more specialised attention because the etiological factors are multifold and in many cases it is difficult to ascertain the exact cause with limited facilities available for quick and reliable diagnosis. Probably due to complex causes of this problem, treatment aspect remained varied in general and received very limited attention.

The use of 'Clomiphene' for induction of oestrum in anoestrous animals is based on the earlier findings of Greenbalt et al. (1961); Roy et al. (1962); Igarshi et al. (1967); Kato et al. (1968) and Baier and Taubert (1968), who reported the effectiveness of this drug in the induction of ovulation in human beings. Deshpande etal. (1976) observed for the first time the effect of 'Fertivet FVT 300' (a product of AR-Ex Laboratories, Bombay, containing 180 mg of Cis-Clomiphene Citrate and 120 mg of Trans-Clomiphene Citrate) on the induction of heat in cows and buffaloes. Since then, several trials were carried out to study the utility of this drug in the treatment of anoestrum in cattle (Pendse et al. 1977; Kodagali et al. 1978; Hukery et al. 1979; Dugwekar et al. 1980; Pillai, 1980).

The positive feed back effect of oestrogen and progestrone upon gonadotropin release was also well documented (Yen and Tsai, 1972) in women and in experimental animals (Leyendeaker et al. 1972; Nillus and Wide, 1972). Progesterone and oestrogen have been extensively used for the induction of cyclic activity in bovines (Smith and Zimbelman, 1968; Arbeiter, 1972; Jelcaninov and Petruskin, 1974; Roche, 1974; Deshpande and Sane, 1977; Pant and Sharma, 1979), but the results are varied. The present investigation was therefore, taken up to find out the incidence and magnitude of infertility condition due to anoestrum in crossbred cattle and to compare the efficacy of hormonal preparation containing oestrogen and progesterone (Secrodyl) and Clomiphene Citrate ('Fertivet') in such cases with the ultimate object of evolving a suitable remedial measure for this problem.

The materials forthe present study consisted of 56 crossbred cows which did not show signs of heat beyond 60 days postpartum and 61 crossbred heifers beyond 24 months of age and declared as true anoestrous by repeated clinico-gynaecological examination.

The perusal of data presented in table 1 revealed that out of 575 cows and 446 heifers, 180 cows (31.30 per cent) and 165 heifers (36.99 per cent) were reported to be anoestrous beyond

60 days post-partum and 24 months of age respectively, though, detailed repeated examination could reveal only 56 cows (9.74 per cent) and 61 heifers (13.68 per cent) were in 'true anoestrum'. From this, it is evident that, though, the reported anoestrous condition in the above bovine population was high, wide variation exists in the actual incidence of true anoestrous condition in crossbred cattle. This variation in the cows reported to be in anoestrum and the true functional status based on the gynaecological examination may be attributed to the high incidence of silent heat during post-partum period in cows and pubertal period in heifers as reported by Roberts (1971); Kruif (1977) and Luktuke and Sharma (1978). Authentic data on the incidence of true anoestrum in cows and heifers are lacking and the reports available show wide variation. Sane (1972) reported an incidence of 22.22 per cent post-partum anoestrum in Gir cows, while Araujo et al. (1973) reported an incidence of 17.5 per cent true anoestrum under similar conditions. The incidence of anoestrum in cows was also reported to be varied from 30.42 to 52.4 per cent (Hollan and Branton, 1975; Jain, 1979) in crossbred cattle of different genetic groups. Kaikini et al. (1977) reported an incidence of 15.2 per cent of anoestrum in Indian cattle, while Deshpande and Sane (1977) reported that the incidence ranged from 20 to 30 per cent. Similarly, the

incidence of post-partum anoestrum was reported to be 43 per cent (Luktuke and Sharma, 1978) 30 per cent (Patil and Khan, 1978) 31 per cent (Ansari, 1978) and 13.16 per cent (Patil, 1979). Mathew and Namboothiripad (1979) observed that the incidence of infertility due to anoestrum ranged from 23.07 to 41.42 per cent in crossbred cows of different genetic groups. There is paucity of information on the actual incidence of anoestrum among crossbred heifers. Mathew and Namboothiripad (1979) reported that the incidence of anoestrum among crossbred heifers varied from 20 to 51.72 per cent while Ghosh (1982) reported that the incidence varied from 24.44 to 29.89 per cent under different age groups. Thus, it could be observed that, wide variation exists in the incidence of true anoestrum reported by various workers, which could be attributed to the different managemental condition as reported by Kodagali (1978). The different genetic groups of animals used and the varying climatic conditions of the area might have also contributed to the above variation.

Though, different dose levels of 'Fertivet' have been tried by various workers with varying results, 300 mg daily for five days was reported to be satisfactory in the induction of oestrum in anoestrous cows and heifers (Deshpande et al. 1976; Kodagali et al. 1977; Dugwekar et al. 1980; Pillai,1980).

The present investigation is based on the above reports.

On an average treatment was initiated at 111.16 ± 11.17 days after calving and 94.22 ± 4.87 days in the control animals. It could be seen from table 2 to 4 that, out of 19 cows treated, ovulatory oestrum was observed only in 13 (68.42 per cent) at an average interval of 4.57 ± 0.16 days in the experimental animals, while only three out of nine (33.83 per cent) in the control animals came into heat within mean period of 22 ± 4.36 days, the variation between the two groups being significant. It could also be seen from table 5 to 7 that among 33 treated heifers, 21 (63.64 per cent) evinced ovulatory oestrum within a mean period of 4.48 ± 0.21 days, while only 3 out of 8 (37.5 per cent) exhibited oestrum within a mean period of 5 ± 0.58 days, the variation also being significant. This is essentially in keeping with the findings of Deshpande et al. (1976), Pense et al. (1977); Kaikini et al. (1978) and Manjunath (1979). Pillai (1980) reported that all the cows treated with 'Fertivet' (100 per cent) and 89.47 per cent of heifers came into oestrum when they were treated at the same dose level.

The interval from the administration of the drug to the expression of oestrum varied from 3 to 5 days in cows and heifers. It was also observed that on an average 4.57 ± 0.16 days and 4.48 ± 0.21 days were required to induce heat in cows

and heifers respectively. Similar observations were made by Pendse et al. (1977), Kodagali (1978); Dugwekar et al. (1980) and Pillai (1980). Contrary to the favourable results of 'Fertivet' in the induction of oestrum in cows and heifers, Chauhan and Singh (1979) reported a poor response on heat induction in cows and heifers with deep anoestrous conditions.

The present study also revealed that among 19 treated cows, 8 (42.11 per cent) conceived at the induced oestrum while only 1 (11.11 per cent) conceived at the induced oestrum in the control animals. The difference in the conception rates between the two treatment groups was significant. In the case of heifers, the percentage of conception at the induced oestrum was 30.30 while none conceived in the control group. Variation in the conception rate between the treated and the control animals was highly significant. This is consistant with the findings of Kodagali (1978); Manjunath (1979) and Pillai (1980) in cattle and Hukeri et al. (1979) in buffaloes. The overall conception rate in cows and heifers after subsequent insemination in the present study was found to be 57.89 per cent and 42.42 per cent respectively as against 22.22 per cent and 25 per cent in the control groups. This tends to indicate that 'Fertivet' would correct the anoestrous conditions of cows and heifers and bring them into normal cyclic activity as reported by Deshpande et al. (1976); Kaikini et al. (1977); Pendse et al.

(1977) and Dugwekar et al. (1980). The satisfactory conception rate obtained in the present study confirmed the findings of earlier workers and suggest that 'Fertivet' is effective in the induction of ovulatory oestrum with satisfactory fertility and the drug is suitable for the treatment of 'true anoestrum' in cows and heifers.

Perusal of data presented in table 8 to 13 revelaed that among 20 cows treated with 'Secrodyl' at a mean period of 66.2± 1.65 days after calving, 10 (50 per cent) showed ovulatory oestrum. In the control animals the mean interval of treatment after calving was 97.13 ± 10.73 days. It could be seen that out of eight cows only two, (25 per cent) expressed ovulatory oestrum within a mean period of 26.5 ± 5.49 days. The difference in the induction of ovulatory oestrum between the experimental and control animals was highly significant. Heifers were treated at an average age of 40.36 ± 2.72 months and 82 ± 2.13 months in the experimental and control groups respectively. Among the treated animals, seven heifers (50 per cent) showed ovulatory oestrum within a mean period of 4.77 ± 0.15 days, while none of the control animals showed oestrum during the period of study. This is essentially in keeping with the findings of Gonzalez-padilla et al. (1975); Short et al. (1976) and Pant and Sharma (1979) in heifers.

Arbeiter (1972) reported that progesterone in combination with oestrogen was effective in inducing cyclicity in animals. Roche (1974) and Jelcaninov and Petruskin (1974) also obtained encouraging results by treatment with a combination of oestrogen and progesterone in acyclic cows. The present observation concurs with the above findings. It was also found that the treated animals evinced oestrum within a mean period of 4.89 ± 0.72 days and 4.77 ± 0.15 days in cows and heifers respectively. The oestrous induction time from the administration of the drug also concurs with the report of Deshpande and Sane (1977). Favourable results of 'Secrodyl' in the induction of oestrum in cows and heifers was also reported by Gupta (1980) and Prasad et al. (1983) and Uma Shankar and Verma (1982) in buffaloes. However, Tripathi et al. (1979) considered that,though, it might be possible to induce oestrum by parenteral administration of small doses of oestrogen and progesterone the occurrence of ovulation and restoration of normal pattern of oestrous cycle could not be guaranteed. The present study also revealed that among 20 treated cows three (15 per cent) conceived at the induced oestrum and the overall conception rate was 30 per cent in the experimental animals. In the control animals, none of the cows conceived at the induced oestrum, but insemination in the subsequent heat resulted an overall conception rate of 12.5 per cent. The

conception rate at the induced heat in heifers was 14.28 per cent while subsequent inseminations resulted in the overall conception rate of 28.57 per cent. Thus, it could be observed, that the conception rate was significantly higher in the experimental animals than in the control animals. Though, the conception rate was found to be significantly higher than in the control animals, it is evident that the fertility rate when treated with 'Secrodyl' in cows and heifers was comparatively low. The present findings are in agreement with that of Gupta (1980) and Prasad et al. (1983) in cattle and Uma Shankar and Verma (1982) in buffaloes, who opined that, though, oestrous could be induced with small doses of oestrogen and progesterone favourable fertility rates could not be guaranteed.

Data presented in table 14 gives the comparative efficacy of the two drugs under trial in improving the breeding efficiency of anoestrous cattle. It is evident from the table that the percentage of animals whowing ovulatory oestrum was significantly higher (60.28 per cent) when treated with 'Fertivet' than those treated with 'Secrodyl' (50 per cent). Similarly, the conception rate at the induced oestrum was also significantly higher (34.61 per cent) when treated with 'Fertivet' than when treated with 'Secrodyl' (14.71 per cent). The overall conception rate of animals when treated with 'Fertivet' (48.08 per cent) was also higher than those treated with 'Secrodyl'

(29.41 per cent).

The present study also suggested that the effectiveness of treatment with 'Fertivet' or 'Secrodyl' was not influenced by the parity of animals (Table 15). It was revealed from the table that there was no significant difference either in the induction of oestrum or in the conception rate due to parity of animals under trial.

Thus, it could be inferred that 'Fertivet' and 'Secrodyl' were effective in the treatment of anoestrum in cows and heifers. But, it appeared that, 'Fertivet' is superior in inducing oestrum of anoestrous animals with satisfactory fertility rate. But detailed investigation on the level of blood serum LH, FSH, Plasma oestrogen and progesterone, urinary oestrogen and pregnanediol levels of animals would throw more light on its mode of action, site of receptors and excretion before, during and after treatment.

Summary

SUMMARY

A study involving 56 crossbred cows and 61 crossbred heifers was carried out in order to assess the efficacy of Clomiphene Citrate ('Fertivet FVT 300') and a combination of oestrogen and progesterone ('Secrodyl') in the treatment of 'true anoestrum'. As an integral part of this investigation, the incidence and magnitude of prevalence of 'true anoestrum' in crossbred cows and heifers was also assessed. The materilas used, salient observations made and valid inferences drawan are summarised below.

Five hundred and seventy five crossbred cows and 446 crossbred heifers belonging to the University Livestock Farm and animals brought for various infertility camps formed the material for the study. Among these 180 cows (31.3 per cent) and 165 heifers (36.99 per cent) were reported to be anoestrous beyond 60 days post-partum and 24 months of age respectively. But, detailed repeated gynaecological examination revealed that 'true anoestrum' existed only in 56 cows (9.74 per cent) and 61 heifers (13.68 per cent). The experimental animals were randomly alloted into two groups, containing 28 cows and 41 heifers in group I and 28 cows and 20 heifers in group II. Nineteen cows and 33 heifers in the group I were administered orally one tablet of 'Fertivet FVT 300' daily for five

consecutive days while 9 cows and 8 heifers were kept as control. Twenty cows and 14 heifers in group II were administered 1 ml 'Secrodyl' intramuscular while 8 cows and 6 heifers were kept as control. If heat symptoms were observed during the course of the treatment further medication of the drug was stopped. After commencement of treatment the experimental animals were closely watched for signs of heat. Detection of oestrum was confirmed by rectal examination. Cows in heat were inseminated with good quality chilled semen. Pregnancy diagnosis was done 45 to 60 days after insemination. Those, which failed to conceive at first insemination were reinseminated at subsequent heats. The efficacy of treatment with 'Fertivet' and 'Secrodyl' in the experimental animals was assessed on the basis of number of animals showing ovulatory oestrum after administration of the drug and number conceived at the induced heat.

It was found that, among 19 cows treated with 'Fertivet', oestrum was induced within a mean period of 4.57 $\pm$ 0.16 days in all the cows (100 per cent), while only three out of nine (33.33 per cent) showed oestrum among the control animals within a mean period of 22 $\pm$ 4.36 days. The difference between the two groups was significant. Among the treated group, 13 (68.42 per cent) ovulated while only 3 (33.33 per cent) ovulated in the control group. This variation was also significant. Eight cows (42.11 per cent) conceived in the induced heat while only

1 cow (11.11 per cent) conceived in the control group. The variation in the conception rate between the two groups was significant. Overall conception rate was found to be 57.89 per cent and 22.22 per cent in the experimental and control groups respectively by subsequent insemination, which also showed significant variation. Among 33 heifers treated with 'Fertivet', 31 (93.94 per cent) showed oestrum within a mean period of 4.48 $\pm$ 0.21 days, while only 3 out of 8 heifers (37.5 per cent) responded to the treatment within a mean period of 5 $\pm$ 0.58 days. Statistical analysis showed highly significant variation in the induction of oestrum between the two groups. The induced heat was ovulatory among 63.64 per cent of heifers in the experimental, while 37.50 per cent of heifers showed ovulatory oestrum in the control group. This variation was also significant. Ten heifers (30.30 per cent) from the treated group conceived for the first A.I., while none became pregnant in the control group. Statistical analysis showed significant variation in the conception rate between the two groups. The overall conception rate by subsequent insemination was 42.42 per cent and 25 per cent in the above respective groups.

Results of treatment with 'Secrodyl' revealed that out of 20 cows, 19 (95 per cent) expressed oestrum within a mean period of 4.89 $\pm$ 0.72 days of which 50 per cent was ovulatory.

In the control group, out of 8 cows only 2 (25 per cent) evinced ovulatory oestrum within a mean period of 26.5 ± 5.49 days. This difference was statistically significant. Among the cows in the treated group, 3 (15 per cent) conceived at the first A.I. while none conceived in the untreated control. The overall conception rate in the experimental and control animals was 30 and 12.5 per cent subsequently. The conception rate at the first A.I. and the overall conception rate showed significant variation between the two groups. Results of treatment of heifers with 'Secrodyl' revealed that among 14 heifers, 9 (64 per cent) showed oestrum within a period of 4.77 ± 0.15 days of which 50 per cent were ovulatory. In the control group none of the heifers showed ovulatory oestrum. Among the treated animals, 2 (14.28 per cent) conceived for the first A.I. and the overall conception rate was 28.57 per cent with subsequent insemination. The difference in the induction of ovulatory oestrum and conception between the experimental and control groups was highly significant.

Among a total of 52 cows and heifers, 34 (60.28 per cent) showed ovulatory oestrum when treated with 'Fertivet', while only 17 (50 per cent)out of 34 animals showed ovulatory oestrum when treated with 'Secrodyl'. The difference was found to be significant. Among these, 18 (34.61 per cent)

became pregnant for the first A.I. in 'Fertivet' treated group while only 5 (14.71 per cent) out of 34 in the 'Secrodyl' treated group became pregnant, which showed significant variation. The overall conception rate in the 'Fertivet' treated group was higher (48.08 per cent) than 'Secrodyl' treated animals (29.41 per cent).

Parity of the cows did not influence the effect of the drug either in the induction of oestrum or in the conception rate.

The results of the present investigation suggest that both the drugs ie 'Fertivet' and 'Secrodyl' are effective in the induction of ovulatory oestrum with satisfactory fertility. But, the superiority of 'Fertivet' over 'Secrodyl' on the above parameters advocates the better suitability of this drug for the treatment of 'true anoestrum'in cows and heifers.

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THERAPY FOR ANOESTRUM IN CROSSBRED CATTLE

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ABSTRACT OF A THESIS

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ABSTRACT

The object of the study was to assess the efficacy of 'Clomiphene Citrate' ('Fertivet FVT 300') and oestrogen and progesterone ('Secrodyl') in the treatment of 'true anoestrum' in crossbred cows and heifers. As an integral part of the study, the incidence of anoestrum among crossbred cows and heifers was also assessed. The material for the investigation involved 575 cows and 446 crossbred heifers belonging to the University Livestock Farm and animals brought for examination in infertility camps. Though, the reported cases of anoestrum was 31.3 per cent and 36.99 per cent among cows and heifers respectively, detailed gynaeco-clinical examination revealed a lesser incidence of 9.74 and 13.68 percentage of 'true anoestrum' among cows and heifers respectively.

The experimental animals were alloted randomly into two groups, consisting of 28 cows and 41 heifers in group I and 28 cows and 20 heifers in group II. Nineteen cows and 33 heifers in group I were administered orally one tablet of 'Fertivet FVT 300' for five consecutive days, keeping 9 cows and 8 heifers as control. Twenty cows and 14 heifers in group II were given one ml of 'Secrodyl' intramuscularly for five consecutive days, while 8 cows and 6 heifers were kept as control. The experimental animals were watched for signs of

heat and confirmed by rectal examination. Pregnancy diagnosis was done 45 to 60 days after insemination. Those which failed to conceive at first insemination were reinseminated at the subsequent heats.

'Tertivet' was capable of inducing ovulatory oestrum in 68.42 per cent of cows and 63.64 per cent of heifers in 'true anoestrum' while only 33.33 per cent cows and 37.50 per cent of heifers came into heat in the control group. The variation was statistically significant. Similarly, the conception rate at the induced heat was 42.11 per cent in cows and 33.30 per cent in heifers when treated with 'Tertivet', while only 11.11 per cent of cows conceived in the control group. Among control heifers none of them conceived at the induced heat. Statistical analysis showed significant variation between the two groups in the conception rate. The overall conception rate by subsequent insemination was 57.89 per cent in cows and 42.42 per cent in heifers while the corresponding figures in the control animals were only 22.22 per cent and 25 per cent. This variation was also significant.

Treatment with 'Secrodyl' could induce ovulatory oestrum in 50 per cent of cows and 50 per cent of heifers, while the response in the control group was only 25 per cent among cows. None of the heifers in the control group showed ovulatory

oestrum. The difference was statistically significant. Significant variation was also observed in the conception rate at the induced heat between the experimental and control groups, values being 15 per cent for cows and 14.28 per cent for heifers in the treated groups and 12.5 per cent for cows and none for heifers in the control group. The overall conception also showed significant variation between the two groups among cows and heifers.

The overall efficiency of 'Fertivet' and 'Secrodyl' among cows and heifers revealed that 60.28 per cent showed ovulatory oestrum among 52 animals when treated with 'Fertivet' while among 34 animals only 50 per cent showed ovulatory oestrum when treated with 'Secrodyl', the variation being significant. Significant variation was also observed in the conception rate at the induced heat, the values being 34.61 per cent when treated with 'Fertivet' and 14.71 per cent when treated with 'Secrodyl'. The overall conception rate was also higher (48.08 per cent) when treated with 'Fertivet' than when treated with 'Secrodyl' (29.41 per cent).