EFFECT OF PROSTAGLANDIN - PREGNANT MARE SERUM GONADOTROPIN (PMSG) COMBINATION FOR ENHANCING PROLIFICACY IN MALABARI GOATS

By

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THESIS

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DECLARATION

I hereby declare that this thesis entitled **"EFFECT OF PROSTAGLANDIN-PREGNANT MARE SERUM GONADOTROPIN (PMSG) COMBINATION FOR ENHANCING PROLIFICACY IN MALABARI GOATS"** is a bonafide record of research work done by me during the course of research and that this 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,
30-1-2002

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CERTIFICATE

Certified that the thesis, entitled **"EFFECT OF PROSTAGLANDIN-PREGNANT MARE SERUM GONADOTROPIN (PMSG) COMBINATION FOR ENHANCING PROLIFICACY IN MALABARI GOATS"** is a record of research work done independently by **Dr. P. SENTHILKUMAR** 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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Dr. P. SENTHILKUMAR

"Teaching consists of causing or allowing people to get into situations from which they cannot escape except by thinking"

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Introduction

INTRODUCTION

Agro climatic and socio economic constraints of the humid tropical state of Kerala necessitate the identification and propagation of livestock species that are adaptable, prolific and aid in the sustainable development of the state. Goat production possess tremendous potential due to the unique biological attributes of the species that can be ideally utilised in the agroclimatic realities of the state. According to FAO statistics (1998), India has 17 per cent of World goat population of 120.6 millions. Malabari goat of Kerala is a unique blend of Arab, Missopatomian, Local native and Surti breed of goats. This breed which is highly adapted to the tropical climate of the state is an approved improver breed for prolificacy (Devendra and Burns, 1982). This necessitates selection and propagation of improved Malabari strain using the recent advances in controlled breeding and assisted reproductive technologies.

In the years ahead, the application of biotechnology in animal husbandry will become important in meeting worldwide requirements for animal products. In commercial farming, the controlled breeding technique can be expected to contribute substantially in improving the efficiency of animal production. Reproductive efficiency in goats is usually measured as the kidding percentage, the number of kids born alive or surviving to weaning. This depends to a large extent on reproductive performance of the individual animal.

Controlled breeding programme in goats is a technique to control the oestrus, ovulation and litter size of goats with insemination carried out at a pre determined time. Compact kidding programme permit the knowledge of approximate mating, kidding dates and feed requirements both in mating period and supplementary period prior to kidding. Supervision of parturition, providing optimum housing and thereby reducing the kid losses is also advantageous. To obtain an extremely compact kidding in the flock, goats are bred on the same day and kids are born in the flock during a predetermined period.

Domestic goats are seasonally polyoestrous and their breeding activities are influenced by photoperiodism. The length of oestrous cycle averages 21 days with a range of 19 to 24 days. Estrus in goats lasts on an average for 28 h with a range of 24 to 72 h and ovulation occurs at 30 to 36 h after the onset of oestrus. The oestrous cycle of goat is regulated by endocrine and neuroendocrine mechanisms. Pituitary gonadotrop·ins are mainly involved in follicular growth, proliferation, and differentiation of theca and granulosa cells, leading to increase in the oestradiol production. Thus the follicle will gain the LH receptors necessary for ovulation and luteinization.

In controlled breeding programme progestagen or prostaglandin are commonly used in goats. Progestagen compounds are administered parenterally, subcutaneous implants, intravaginal pessaries or orally for a period of 12 to 18 days to inhibit the release of gonadotrophins and prevent the initiation of cycle. Prostaglandin and its analogues are used as single or double injections with or

without progestagen treatment. According to Robertson (1977) oestrus synchronization with progestagen impeded transport of gamates and reduced fertility. Double dose prostaglandin treatment is given at 11 days apart for effective synchronization of oestrus and timed artificial insemination in goats (Bretzlaff *et al.*, 1980).

Controlled reproduction technique can be used for increasing prolificacy with synchronization of oestrus using Pregnant Mare Serum Gonadotropin (PMSG). Evans and Robinson (1979) opined that PMSG directly acts on the ovary and stimulates the folliculogenesis and ovulation, thus increasing the lambing rate and litter size in ewes. However, protocol for oestrus synchronization using combination of exogenous gonadotrophic hormones and prostaglandin in order to obtain better reproductive efficiency in goats has not been established. Considering the significance role of Malabari goats play in the rural economy of the state and the role of controlled breeding programme for rapid improvement of the genetic potentialities, a detailed investigation on the effect of prostaglandin-PMSG combination for enhancing prolificacy in Malabari goats was undertaken with the ultimate object of evolving a suitable protocol for the same.

Review of Literature

REVIEW OF LITERATURE

Controlled breeding technique is one of the tools for enhancing the prolificacy of goat in order to meet the increasing requirement of animal products through profitable commercial goat farming. The reproductive efficiency of goats can be improved by producing two crops of kids per year through oestrous cycle management and induction of multiple ovulation. Even though this can be achieved by administration of prostaglandin and gonadotrop in, the dosages and treatment regimen for optimum results have not been established till date.

Dufour *et al.* (1979) found that the importance of gonadotropins in follicle growth was dependent on the stage of follicular development. They opined that total withdrawal of gonadotropins in hypophysectomised animals resulted in failure of follicle development beyond 0.06 to 0.07mm and absence of antral follicle formation. In medium and large sized Indian goat breeds an ovulation rate of 1.2 and 4.0 respectively were recorded (Rao and Bhattacharyya, 1980; Goel *et al.*, 1992). Studies in sheep revealed that preovulatory follicles were presented in the ovary throughout the oestrous cycle and the ovulatory follicle derived from a pool of follicles greater than 2mm in diameter at the time of luteolysis (Draincourt *et al.*, 1986; Webb *et al.*, 1989).

Plasma concentrations of FSH tended to be higher for one to three days before the onset of luteolysis in ewes subsequently had twin ovulations than in those with a single ovulation (McNatty *et al.*, 1985). Preovulatory follicular growth

in goat was dependent on FSH although no precise relationship appeared to exist between plasma concentrations of FSH and the number of preovulatory follicles (McNeilly *et al.*, 1991).

2.1 Methods to increase the prolificacy

Hafez and Hafez (2000) reported practical methods for increasing the ovulation rate and thereby enhancing prolificacy in goats. Flushing by improving the plain of nutrition was one of the methods to increase the ovulation rate. Artificial control of litter size by using exogenous gonadotrophin combined with synchronization technique and A.I at a pre-determined time was one of the methods to fully exploit the genetic potential of a particular breed. An alternate approach to gonadotrop in therapy was using steroid immunization. Immunity to estrone or androstenedione leads to an increased frequency of LH pulses and FSH levels in anoestrous ewes. The ovulation rate was increased by 0.6 ovulations per ewe. This technique involved two injections at three to four week interval before the ram introduction.

2.1.1 PMSG as exogenous gonadotrophin

Administration of PMSG was found to be effective for induction of multiple ovulation. (Van Resburg, 1964; Armstrong *et al.*, 1982; Pandiya and Rathor, 1986; Indramani and Vadnere, 1989; Ritar *et al.*, 1994; Zarkawi *et al*, 1999). Armstrong *et al.* (1982) reported that PMSG administration in does resulted in high incidence of twin pregnancies through increasing mean ovulation rate.

Gordon (1975) opined that PMSG was used to achieve mild super ovulatory response and acceptable twining percentage in breeds of sheep characterized by low litter size. Hay and Moor (1975) showed that follicles were activated by PMSG administration at different times in the luteal phase of oestrous cycle in ewes. The mode of action of PMSG was by increasing the ovulation rate through activating the granulosa cell aromatase enzyme system and subsequent increased estradiol secretion (Dott *et al.*, 1979; Henderson *et al.*, 1985). Evans and Robinson (1950) observed that PMSG administration induced and advanced the oestrus, LH surge and ovulation in ewes. Follicular growth, maturation and ovulation were stimulated by PMSG administration in female goats (Cameron and Batt, 1991; Fasanya, 1997).

PMSG exhibited an inherently long half-life that resulted in inducing superovulation in various species when administered as a single injection at an appropriate dose (Mc Intosh *et al.*, 1975). Ott *et al.* (1979) reported that average number of ovulations per female goat was 1.6 and 6.8 respectively on treatment with 250 and 750 IU of PMSG along with prostaglandin. Evans and Robinson (1980) found that there was significant linear relationship between dose and response on PMSG administration in terms of number of corpora lutea and follicles, quantity of progesterone and oestrogen. Agrawal (1986) observed that mean ovulation rates in goats at different dose levels of PMSG viz. 0, 400, 600, 800 and 1000 IU was 1.41, 2.60, 3.44, 5.16 and 7.83 respectively. Ritar *et al.*

(1994) found that ovulation was induced with either 200 or 400 IU of PMSG in Cashmere and Angora goats at six months of age.

Treatment of ewes with PMSG (Mauleon and Mariana, 1977) or pure FSH (Mc Natty *et al* 1985) resulted in a variable and uncontrollable increase in follicle growth subsequent ovulation rate was better than FSH treatment and was initiated on 24 h before the onset of luteolysis. Scaramuzzi and Radford (1983) suggested that gonadotropins such as PMSG had mixed activity that mainly acted through the FSH action in sheep.

2.2 Methods to control the oestrus

Attempts have been made by various workers to control the time of oestrus and ovulation in cyclic goats and in many instances the procedures have been directed toward the synchronization of oestrus in flocks coupled with artificial insemination (Moore and Eppleston, 1979; Agrawal, 1987; Corteel *et al.*, 1988; Greyling and Van Niekerk, 1991; Baril *et al.*, 1993; Ritar *et al.*, 1994) In cyclic goats prostaglandin or synthetic analogues either alone or combination with progestagen was effectively used for synchronization of oestrus. But most attempts of controlled breeding in goats involved repeated doses of oral or parenteral progestagens. The time and labour involved in giving these agents constituted a serious obstacle to general acceptance of the techniques into commercial goat farming. Hence the easiest and most cost effective technique of

double dose prostaglandin treatment was found to be useful in synchronization of oestrus in goats at 10 or 11 days apart (Ian Gordon, 1996).

2.2.1 Use of Progestagen compounds

Agrawal (1987) synchronized the oestrus in Barbari goats by orally administering Melengesterol acetate (MGA) 0.15mg per animal consecutively for 16 days along with concentrate mixture. Corteel *et al.* (1988) and Selvaraju (1994) attempted synchronization of goats using vaginal sponges impregnated with Fluorogestone acetate (FGA) 45 mg per animal, Medroxy progesterone acetate (MAP) 60 mg per animal, and Controlled internal drug release device (CIDR) 0.332g of micronized natural progesterone for 18 days coupled with 600 IU of PMSG at the time of sponge removal and the result was encouraging. Doijode *et al.* (1991) successfully induced oestrus by lutocycline 0.5 ml per day (12.5 mg progesterone) intramuscularly consecutively for 14, 15, 16 and 17 days in four groups of goats. Greyling and Van Niekerk (1991) tried synchronization in Boer goats using intravaginal sponges of MAP, consecutively for eight days followed by 62.5 micrograms PGF2α intramuscularly and 500 IU PMSG subcutaneously at sponge withdrawal.

2.2.2 Use of prostaglandin

Exogenous PGF2α induced luteal regression in sheep with functional corpora lutea in ovaries during 5 to 18 days of oestrus cycle and during pregnancy.

(Inskeep, 1973). Prostaglandin or its analogue cloprostenol was used successfully by many workers in synchronization of oestrus in domestic animals (Bosu *et al.*, 1978; Moore and Eppleston, 1979; Bretzlaff *et al.*, 1980; Ott *et al.*, 1980; Shivkumar, 1993; Goel and Agrawal, 2000).

A dose of 100 micrograms (Hughes *et al.*, 1976; Trounson *et al.*, 1976; Acritopoulou *et al.*, 1977; Boland *et al.*, 1978; Lopez-Sebastian *et al.*, 1993) or 125 micrograms (Fairnie *et al.*, 1977) of cloprostenol was effective in regression of corpus luteum and induction of oestrus in sheep. Oestrus synchronization using two injections of prostaglandin 10 to 14 days apart was found to be effective in goats. (Perera *et al.*, 1978; Ogumbiyi *et al.*, 1980; Ott *et al.*, 1980; Pandey *et al.*, 1985; Pandiya and Rathor, 1986; Meinecke-Tillmann, 1988; Ishwar and Pandey, 1990; Simplicio and Machado, 1991; Shivkumar and Thomas, 1995). Moore and Eppleston (1979) reported that administration of a single intramuscular injection of Estrumate at a dose rate of 100 micrograms was effective in goats. Ott *et al.* (1980) reported that prostaglandin had luteolytic effect in goats as early as day four of the cycle. Bretzlaff *et al.* (1983) found that between 4 and 16 days of the oestrous cycle prostaglandin injection induced the luteolysis and oestrus in goats El-Amrani *et al.* (1993) observed that two doses of 8 mg prostaglandin at an interval of 11 days was found to induce the oestrus in cyclic goats. For synchronization of oestrus two doses of PGF2α was administered at an interval of seven (Humicutt *et al.*, 1995) or 10 (Godfrey *et al.*, 1999) or 11 days apart (Mathur *et al.*, 1987) in sheep. Castro *et al.* (1999) suggested that two injections of PGF2α analogue at nine days apart used for studying the interoestrus interval in goats.

2.2.3 Use of prostaglandin-PMSG combination

Boland *et al.* (1978) suggested that estrus and ovulation were induced by administration of two intramuscular injections of 100 micrograms of cloprostenol at 11 days apart combined with 500 IU PMSG injection along with second injection of cloprostenol. In sheep gonadotrophin treatment two days (Schiewe *et al.*, 1990; Takarkhede *et al.*, 1998; Naqvi *et al.*, 2000) or one day (Honnappagol *et al.*, 1999) prior to the second injection of prostaglandin used for superovulation. Study conducted by Pandey *et al.* (1991) in Black Bengal goats revealed that treatment with 5mg PGF2 alpha on day 11 of the oestrous cycle in conjunction with PMSG was found to induce oestrus. Lopez-Sebastian *et al.* (1993) reported that induction of superovulation was effected by administration of FSH-P in propylene glycol and cloprostenol on day 13 of the oestrous cycle in goats. Arthur *et al.* (1996) suggested prostaglandin administration 24-72 h after gonadotrophin treatment at mid to late cycle for better superovulatory response in domestic animals. Bharali *et al.* (2000) reported PMSG administration at a dose rate of 500 IU intramuscularly 24 h before prostaglandin treatment regime was used for synchronization of oestrus in goats.

2.3 Incidence of oestrus

2.3.1 Synchronization with prostaglandin

Moore and Eppleston (1979) reported that among does treated with single injection of prostaglandin, 82 per cent exhibited oestrus. Ogumbiyi *et al.* (1980) recorded an oestrus response of 64 and 84 per cent in goats, which were

treated with single and double dose of prostaglandin respectively. Ott *et al.* (1980); Ishwar *et al.* (1990); Pandey *et al.* (1991) and Shivkumar (1993) observed that after the first and second injection of prostaglandin incidence of oestrus were 75 and 100 per cent respectively in goats. Bharali and Dutta (2001) noticed 100 per cent oestrus synchronization in crossbred goats treated with prostaglandin.

2.3.2 Synchronization with prostaglandin-PMSG combination

Boland *et al.* (1978) observed that 90.8 per cent of ewes showed oestrus after administration of cloprostenol combined with PMSG. Armstrong and Evans (1983); Espeschit *et al.* (1988); Indramani and Vadnere (1989); Pandey *et al.* (1991); Artiningsih *et al.* (1996); Takarkhede *et al.* (1998); Zarkawi *et al.* (1999) and Bharali and Dutta (2001) found that prostaglandin-PMSG treated ewes and does had showed 100 per cent of oestrus synchronization. Oliverira and Resende (1990) reported that 80 per cent of goats exhibited oestrus on vaginal sponges-prostaglandin-eCG combination therapy.

2.4 Onset of oestrus

2.4.1 Synchronization with prostaglandin

Acritopoulou *et al.* (1977) reported that when PGF2∝ analogue was used as a single injection for induction of oestrus in ewes, the mean time taken for the onset of oestrus was 44.0±1.9 h. Bosu *et al* (1978) and Moore and Eppleston (1979) reported that time taken for the onset of oestrus ranged from 48 to 72 h after the second prostaglandin administration in cycling goats. Ott *et al* (1980) reported

a mean time interval of 53±2 and 50±1 h respectively in goats synchronized with single and double prostaglandin administration. Ishwar and Pandey (1990) found that time interval between prostaglandin treatment and onset of oestrus varied between 93.66±5.05 and 94.86±2.13 h. According to Bretzlaff *et al.* (1983) time interval from prostaglandin administration to onset of standing oestrus was 36 to 96 h in goats. EI-Amrani *et al.* (1993) and Shivkumar and Thomas (1995) suggested that mean time interval of onset of oestrus after first prostaglandin injection was 46 h and the time taken after second dose of prostaglandin injection was 48 h. Takarkhede *et al.* (1998) reported that average time required for the onset of oestrus was 53.00±14.39 h after second dose of prostaglandin in ewes.

2.4.2 Synchronization with prostaglandin-PMSG combination

Boland *et al.* (1978) found in ewes oestrus was exhibited within 56 h after cloprostenol-PMSG combination treatment. Evans and Robinson (1980) noted that mean time interval of onset of oestrus in ewes at the dose rate of 0, 200, 400, 800 and 1600 I.U of PMSG and prostaglandin was 57.0, 50.2, 67.0, 52.0 and 44.0 h respectively.

According to Armstrong and Evans (1983), Goel and Agrawal (1990) and Selgarth *et al.* (1992) does that received prostaglandin–PMSG combination exhibited onset of oestrus between 30 and 48 h after the prostaglandin administration. Schiewe *et al.* (1990) reported that exogenous gonadotrophin treated ewes generally demonstrated oestrus at 24 to 36 h after prostaglandin

injection and the corresponding value in ewes receiving prostaglandin alone was 48-60 h. Greyling and Van Niekerk (1991) reported that PMSG treated goats had a significantly shorter onset interval than those the control group. Pandey *et al.* (1991) recorded that the onset of oestrus after prostaglandin administration in prostaglandin-PMSG treated goats was 39.33±2.15 h. The values obtained by Thilagar *et al.* (1992) were in consonance with the above report. Artiningsih *et al.* (1996) reported that does exhibited onset of oestrus within the period of 39 to 59 h after PMSG injection. Takarkhede *et al.* (1998) studied in ewes mean onset of oestrus was 46.28±9.5 h after prostaglandin-PMSG administration. According to Bharali and Dutta (2001) crossbred goats which received PGF2α alone, PGF2α+hCG and PGF2α+hCG+PMSG recorded the onset of oestrus was 23.50±0.99, 23.67±1.19 and 28.17±12.64 h respectively.

2.5 Duration of oestrus

Bretzlaff *et al.* (1983) and Greyling and Van Niekerk (1986) reported that maximum duration of oestrus in does treated with prostaglandin was 48 h. In oestrus synchronization study conducted by Ishwar and Pandey (1990) on Black Bengal goats treated with progesterone and prostaglandin, duration of oestrus was 36.55±2.86 and 35.29±3.09 h respectively. Shivkumar (1993) found that mean duration of oestrus was 32.9±2.65 h in the prostaglandin treated does.

Pandey *et al.* (1991) recorded that mean duration of oestrus was 18.66±2.6 h in prostaglandin-PMSG treated goats. According to Selvaraju (1994)

over all mean duration of oestrus in goats treated with FGA, MAP and CIDR combined with PMSG and control group was 29.28±1.62, 45.57±2.27, 31.83±3.04 and 27.83±1.77 h respectively. Uphale *et al.* (1998) recorded that the mean duration of oestrus was 44.67±0.15 h after the administration of PGF2∝- PMSG combination in ewes. The duration of oestrus in the crossbred goats treated with PGF2α alone, PGF2α+hCG and PGF2α+hCG+PMSG was 46.33±5.04, 45.67±7.87 and 61.50±12.06 h respectively (Bharali and Dutta, 2001).

2.6 Oestrus behaviour and intensity of oestrus

Perera *et al.* (1978) noticed vulval swelling, relaxation of vaginal orifice, raised tail and mucous discharge as the principle signs of oestrus in goats, which were synchronized with cloprostenol. Llewelyn *et al.* (1993) suggested that onset of frequent wagging of tail considered as the most useful signs for detecting oestrus behaviour in goats. According to Shivkumar (1993) Malabari does synchronized with prostaglandin exhibited common signs of mounting behaviour, sniffing of the male and their receptivity score was higher than the control group. Selvaraju (1994) opined that more pronounced oestrous signs noticed in PMSG treated does than the control group. Bharali *et al.* (2000) reported that goats synchronized with PMSG exhibited typical well defined physiological and behavioral signs of oestrus such as bleating, wagging of tail, frequent micturition, swelling of vulva and oestrual discharge.

2.7 Conception rate

2.7.1 Effect of prostaglandin

Hughes *et al.* (1976) reported that optimum lambing rate was observed following the use of synthetic prostaglandin analogue with natural service during induced oestrus. Fuki and Roberts (1976) obtained a conception rate of 76 per cent in ewes bred artificially following synchronization of oestrus using prostaglandin. Boland *et al.* (1978) found reduced fertility in cloprostenol treated ewes following a single set-time insemination. Simplicio and Machado (1991) reported that kidding rates in goats were 10, 44.7 and 21.4 per cent respectively when inseminated at 60,72 and 84 h respectively after the second dose of prostaglandin. Shivkumar (1993) reported 85 per cent conception rate of natural service in does synchronized with prostaglandin injection. Dankowski *et al.* (1998) obtained 35 per cent pregnancy rate in ewes following administration of two doses of cloprostenol (0.25 mg each) 11 days apart.

2.7.2 Effect of Prostaglandin - PMSG combination

Robinson (1950) found a decrease in conception rate following high doses of PMSG in ewes. Trounson *et al.* (1976) reported that fertilization rate was 55 per cent in PMSG treated ewes bred by natural service. Evans and Robinson (1980) reported that over all lambing percentage increased from 67 per cent to 121 per cent on PMSG administration. According to Bretzlaff and Madrid (1985) the conception rates in goats treated with norgestomet-PMSG-cloprostenol combination

and norgestomet implant alone were 74.2 and 75 per cent respectively. Corteel *et al.* (1988) could obtain satisfactory fertility in 9 to 10 month old goats with reduced dose (250-300 IU) of PMSG and fixed dose of cloprostenol (0.1 mg). Robinson *et al.* (1989) could obtain a fertilization rate of 35.9 and 77.9 per cent in two experiments with cervical or laproscopic insemination of FSH superovulated ewes. According to Al-Kamali *et al.* (1990) ewes synchronized with progestagen sponges and 500 IU of PMSG recorded high conception rate when subjected to AI. Oliverira and Resende (1990) reported a conception rate of 80 per cent in the vaginal sponges-eCG-prostaglandin combination treatment in goats. Simplicio and Machado (1991) found that the percentage of kidding was 10.8, 31.3 and 34.1 respectively among goats synchronized with 50mgMAP+eCG+cloprostenol, 50mgMAP+cloprostenol and 60mgMAP+eCG+cloprostenol. Ritar *et al.* (1994) suggested that among goats aged 8 and 20 months kidding rates were 75 and 84 per cent respectively on CIDR-PMSG treatment. Overall kidding rates of induced with PMSG and untreated control does with natural service were 70 and 83.33 per cent and whereas corresponding values were 60 and 50 per cent in natural service and A.I respectively (Selvaraju, 1994). Laliotis *et al.* (1998) observed that mean conception rate was higher in goats synchronized with progestagen impregnated sponges and PMSG when served naturally than artificially inseminated using frozen semen. Zarkawi *et al.* (1999) obtained a conception rate was 65.8 per cent in goats treated with PMSG.

2.8 Litter size

Asdell (1964) opined that average litter size was influenced by breed, average number of kids born per kidding and the corresponding values were 1.8, 1.8, 1.8, 1.1 and 2 1 respectively in Alpine, Saanen, Toggenberg, Jamnapari and Black Bengal goats. The number of kids born per litter was 1.5 and 2.1 among goats below and above 18 months of age respectively. Sudarsanan and Raja (1973) observed that Malabari breed of goat had higher incidence of single birth than twins. According to Stephen Mathew (1999) the litter size at birth in Jamnapari, Betal, Black Bengal and Malabari breeds were 1.45, 1.70, 2.2 and 1.4 respectively.

2.8.1 Effect of prostaglandin

Costa *et al.* (1982) reported that the litter size was 1.17 in goats synchronized with prostaglandin. Greyling and Van Niekerk (1986) recorded an average litter size of 2.2, 2.1 and 2.4 in three groups of Boer goats treated with prostaglandin at varying dose levels. According to Shivkumar (1993) the incidence of single and twin births in Malabari goats were 85.71 and 14.29 per cent respectively and there was no significant difference with respect to litter size between prostaglandin treatment and control groups.

2.8.2 Effect of prostaglandin-PMSG combination

Aurstad and Gysler (1979) reported that among MAP-PMSG treated goatsaverage litter size was 1.66 as against 1.57 in the untreated control. Sinha *et al.* (1979) obtained a litter size of 1.66 and 3.00 in Black Bengal goats

synchronized with a combination of MGA-400 IU and MGA-600 I.U PMSG respectively. Bretzlaff and Madrid (1985) reported a mean litter size of 2.1±0.8 and 2.3±0.7 among goats synchronized with a combination of 6mg norgestomet-PMSG-cloprostenol and 3mg norgestomet-PMSG-cloprostenol respectively. Espeschit *et al.* (1988) obtained a litter size of 2.9±0.8 in goats treated with 200 IU PMSG. Crosby *et al.* (1991) found that increasing the dose of PMSG from 500 to 1000 IU has resulted in reduced litter size (1.9 vs 1.52) in cyclic ewes. Simplicio and Machado (1991) found that among three groups of goat treated with 50mgMAP+eCG+cloprostenol, 50mgMAP+cloprostenol and 60mgMAP+eCG+ cloprostenol and the control group average litter size was 2.3, 2.0, 1.3 and 1.8 respectively. Artiningsih *et al.* (1996) on administration of PMSG at the dose rate of 0,10,15,20 IU per kg body weight in goats one day prior to sponge withdrawal could obtain the average litter size of 1.0, 1.8, 2.4 and 1.0 respectively. According to Laliotis *et al.* (1998) the mean litter size in ewes treated with intravaginal sponge and PMSG was 1.52. Zarkawi *et al.* (1999) opined that treatment of goats with 150 to 200 IU of PMSG group could increase the incidence of multiple birth upto 76.2 per cent.

2.9 Birth weight

Datta *et al.* (1963) found that mean birth weight of Indian breeds of goats ranged from 1.50 – 3.62 kg. Mukundan (1976) reported that the average birth weight of male of kids Malabari, Alpine × Malabari and Saanen × Malabari does

were 1.79, 1.95 and 2.39 and female kids of 1.76, 2.33 and 2.11 kg respectively. Nair (1979) obtained a mean birth weight of 1.73±0.02 kg in Malabari goats. According to Roberts (1986) among ewes subjected to multiple ovulation individual twin lamb weighed 16 per cent less than singleton, but their combined weight was 67 per cent more than that of the singleton.

2.9.1 Effect of hormone treatment

Bretzlaff and Madrid (1985) reported a litter weight of 3.1±0.8 and 3.06±0.86 kg among goats synchronized with a combination of 6mg norgestomet-PMSG-cloprostenol and 3mg norgestomet-PMSG-cloprostenol respectively. Shivkumar (1993) found that average birth weight of kids born to synchronized and control does were not significantly different at 5 per cent level. Yang Shenglin *et al.* (1999) reported that there was no significant difference in litter weight between goats treated with prostaglandin and with out prostaglandin. Zarkawi *et al.* (1999) reported that average birth weight of singleton kid was significantly ($P<0.05$) higher than that of individual twins born to PMSG treated goats.

2.10 Preweaning mortality of kids

Nandakumar (1981) opined that kids died within two months of age had significantly lower mean immunoglobulin level (56.771 mg/ml) than the populations mean (73.588mg/ml). Roberts (1986) observed that mortality in twin lambs with lower birth weight was 30 to 40 per cent higher than in singletons. According to him the other causes of mortality in the newborn kids were lack of

vigour due to inbreeding, prematurity, lack of nutrition for the dam during gestation and a failure of the dam to own or accept her newborn. The amount of immunoglobulins received by the kids through the colostrum was directly related to the resistance developed against neonatal diseases like scours, septicaemia and pneumonia in the new born kids. Twinning in ewe was associated with increased rate of premature births, abortions, dystocia and expulsion of dead or weak foetus at term. Premature birth was more common between 130 to 140 days of gestation and mortality rate in twin lamb with lower birth weight was 30 to 40 per cent higher than singletons.

2.10.1 Effect of hormone treatment

Aurstad and Gysler (1979) the incidence of stillbirth was 13 among MAP- PMSG treated goats as against five in the control. Out of nine goats treated with FGA sponge-PMSG, Borghese *et al.* (1987) obtained that preweaning mortality of 12 kids and high incidence of embryo and foetal mortality noticed in this group. Yang Shenglin *et al.* (1999) reported that the number of kids born was the same among goats treated with or with out prostaglandin.

Materials and Methods

MATERIALS AND METHODS

Forty eight Malabari nulliparous does aged eight to ten months with a body weight of 18 to 20 kg belonging to Kerala Agricultural University Goat Farm, Mannuthy, Trichur were selected as experimental animals for the study (Plate I). The study was conducted over a period of one year from October 2000. All the does were maintained in the farm under ideal conditions of feeding and management throughout the period of study. The does were kept in well-ventilated pens and maintained under semi-intensive system of management. They were fed regularly with concentrate mixture containing 20 per cent digestable crude protein (DCP) and allowed for grazing in the morning and evening hours.

All the experimental does were administered with two doses of cloprostenol, a prostaglandin analogue (SYNCHROMATE*) at the rate of 0.5ml (each ml contains 263 micrograms) intramuscularly 11 days apart. The does were randomly divided into four groups viz. Group I, II, III and IV with 12 does in each group one day prior to the second prostaglandin administration. On the same day Group I, II and III were administered PMSG (FOLLIGON**) intramuscularly at the dose rate of 200, 400 and 600 IU respectively. Group IV was maintained as control with the prostaglandin treatment alone. All the does were closely observed in the morning and evening after second prostaglandin administration for the incidence, onset, duration and intensity of oestrus. An apronised buck was also used to assist in detecting oestrus.

SYNCHROMATE* (Inj) 4ml vial (Prima vet care Pvt Ltd., Mfd. Bremer pharma GmbH, Bremerhaven, Germany)
Each ml contains cloprostenol 263 micrograms
FOLLIGON** (Inj) 1000 IU vial (Intervet India Pvt Ltd)
It consists of the hormone Pregnant Mare Serum Gonadotropin (PMSG) as a white crystalline powder together with solvent for reconstitution.

3.2 Time taken for onset of oestrus

Each doe after the administration of second dose of prostaglandin was closely observed for onset of oestrus and those found to be in oestrus were further confirmed by noting behavioural and physiological changes during oestrus. The interval from the time of second dose of prostaglandin administration to the time of onset of oestrus was recorded as the time taken for the onset of oestrus.

3.3 Duration of oestrus

The period from the time of onset of oestrus to the end of behavioural and physiological signs of oestrus was considered as the duration of oestrus.

3.4 Intensity of oestrus

The intensity of oestrus was graded by giving score to behavioural signs and physiological changes (Plate II) associated with oestrus in goats. The scoring pattern recommended by Selvaraju (1994) was used for this study.

Parameters	Score
I. Behavioural signs	
Wagging of tail	2
Mounting on other animals	1
Bleating	1
Circling with the buck	1
Standing to be mounted	5
II. Physiological changes	
Vulval redness	2
Vulval oedema	3
Vulval discharge	5
Total	20

Plate I. Experimental Malabari goats

Plate II. The doe at center exhibiting vulval discharge following prostaglandin - PMSG administration (Group - II)

3.5 Semen collection

Semen was collected from healthy breeding bucks using artificial vagina. (Perry, 1969). Immediately after collection of semen, the collection vial containing ejaculate was transferred into a water bath at 37°c and preliminary evaluation of semen was carried out. Semen volume, colour, density, mass activity and individual motility were determined by the following the standard procedures (Balakrishnan, 1979). For preparation of goat milk extender, fresh goat milk was heated to 95°c for 10 minutes allowed to cool and the cream layer was removed Crystalline penicillin and streptomycin sulphate were added at the rate of 1000 IU and 1000 micrograms respectively to each milliliter of the prepared diluents. The semen samples selected after preliminary examinations were diluted with the prepared diluents at 1: 5 ratio, so as to get 200 millions of motile spermatozoa per dose of diluted semen.

3.6 Insemination

All the does, which exhibited oestrus, were inseminated with sterile glass pipette containing 0.2 ml freshly prepared liquid semen at 24 h interval till the heat ceased. Insemination was done by vaginal speculum method (Plate III) as described by Balakrishnan (1979) and the semen was deposited at the intracervical in does.

3.7 Pregnancy diagnosis

Pregnancy was diagnosed by considering cessation of oestrus after insemination and confirmed 100 days of post insemination by abdominal

ballottement (Ibraheemkutty, 1995). Udder development was also noted as a criterion to assess pregnancy.

3.8 Conception rate

Conception rate was calculated as the percentage of does conceived to total number of does inseminated.

3.9 Litter size

The number of kids born per kidding was observed.

3.10 Birth weight

The weight of kids at birth was recorded in kilograms.

3.11 Preweaning mortality

The weaning was carried at 60 days and the number of kids died from birth to weaning was recorded

3.12 Statistical analysis

The data obtained were compiled and subjected to statistical analysis as per Snedecor and Cochran (1987).

Results

RESULTS

Results of the investigation on effect of prostaglandin-PMSG combination for enhancing the prolificacy of Malabari goats are presented in Tables 1 to 11 and Figures 1 to 6.

4.1 Incidence of oestrus

Incidence of oestrus after the administration of second dose of prostaglandin in group I, II, III and IV are presented in Table 1. Out of 12 does in each group, all the animals in group I, II and III (100%) and 11 does in group IV (91.67%) exhibited oestrus.

Overall incidence of oestrus in prostaglandin-PMSG group and control group are shown in Table 2. The corresponding figures were 100 and 91.67 per cent respectively.

4.2 Time taken for onset of oestrus

Time taken for onset of oestrus after second dose of prostaglandin in does belonging to group I, II, III and IV are presented in Table 3 and Fig. 1. In prostaglandin-PMSG group onset of oestrus ranged from 24 to 72 h whereas in control group it ranged from 48 to 60 h. The mean time taken for onset of oestrus in group I, II, III and IV was 28.00±2.70, 30.00±4.31, 24.00, 43.64±4.36 h respectively Overall onset of oestrus in the prostaglandin-PMSG group and control group was 27 33±2.34 and 43.64±4 36 h respectively (Table 2). Time taken for onset of oestrus in all prostaglandin-PMSG groups varied significantly

(P<0.01) from that of control group; there was no significant difference among prostaglandin-PMSG group I, II and III.

4.3 Duration of oestrus

Duration of oestrus of goats in group I, II, III and IV are presented in Table 4 and Fig. 2. Duration of oestrus in prostaglandin-PMSG group ranged from 48 to 120 h whereas that in control group ranged from 24 to 48 h. The mean duration of oestrus in group I, II, III and IV was 84.00±6.94, 64.00±7.44, 86.00±7.52 and 34.91±4.97 h respectively. Overall mean duration of oestrus in prostaglandin-PMSG group and control group was 78.00±7.30 and 34.91±4.97 h respectively (Table 2). In prostaglandin-PMSG group mean duration of oestrus was significantly higher ($P < 0.01$) than that of control group.

4.4 Intensity of oestrus

Intensity of oestrus among group I, II, III and IV are presented in Table 5 and Fig. 3. The oestrus intensity scores in group I, II, III and IV ranged from 7 to 13, 10 to 14, 11 to 17 and 2 to 17 respectively. The mean scores were 11.50±0.49, 12 25±0.33, 14.25±0.72 and 8.82±1.59 respectively.

Overall mean score of prostaglandin-PMSG group and control group was 12.67±0.51 and 8.82±1.59 respectively (Table 2). In prostaglandin-PMSG group intensity of oestrus score was higher significant than that of control group and between prostaglandin-PMSG groups I and III were a high significant difference ($P < 0.01$).

Behavioural signs and physiological changes noted for scoring the intensity of oestrus group I, II, III and IV are presented in Table 6. Does of prostaglandin-PMSG groups had more pronounced heat signs than the control group. The common behavioural signs and physiological changes noted in prostaglandin-PMSG groups were wagging of tail, standing to be mounted, vulval redness, vulval oedema and vulval discharge. In control group wagging of tail, vulval redness and vulval oedema were noticed

4.5 Conception rate

Conception rate in group I, II, III and IV are shown in Table 7 and Fig. 4. The percentage of conception in group I, II, III and IV was 41.67, 50.00, 33.33 and 45.45 respectively. Groups II recorded a better conception rate than the other groups.

4.6 Litter size

Litter size in group I, II, III and IV are presented in Table 8 and Fig. 5. The mean litter size in group I, II, III and IV was 1.60±0.25, 1.50±0.43, 1.50±0.65 and 1.20±0.20 respectively. Litter size was not significantly different between treatment groups. However, group I recorded the highest mean litter size of 1.60±0.25.

Incidence of multiple birth in group I, II, III and IV are presented in Table 9 and Plate IV, V and VI The incidence of single, twins and triplets was 40, 60 and 0; 40, 40 and 20; 50, 25 and 25 and 80, 20 and 0 percent respectively in

Plate III. Insemination of doe by using vaginal speculum

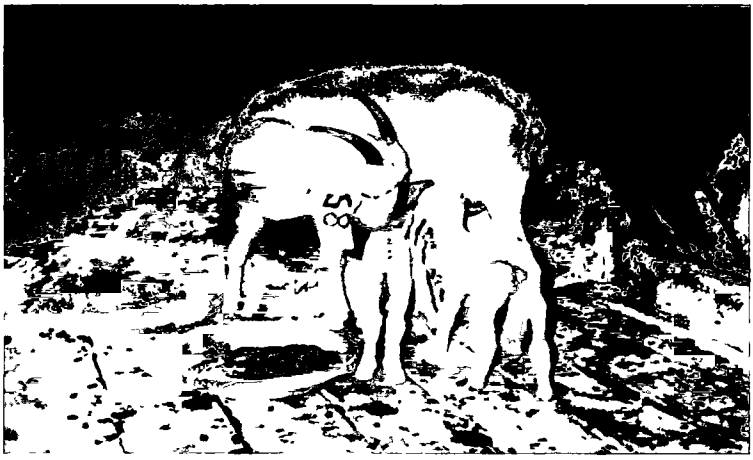


Plate IV. Twin kids with dam of group I

Plate V. Triplet kids and mummified foetus with dam of group II

Plate VI. Single kid with dam of group IV (Control)

group I, II, III and IV. In the present study two cases of mummified foetus were observed in group I and II, one case of still birth was observed in group II.

4.7 Birth weight

Birth weights of kids in groups are presented in Table 10 and Fig. 6. The mean birth weight of kids in groups I, II, III and IV was 1.45±0.14, 1.24±0.13, 1.27±0.18 and 1.62±0.24 kg respectively. Mean birth weight of kids in prostaglandin-PMSG groups and control group was not significantly different. However the control group recorded the highest mean birth weight of kids.

4.8 Preweaning mortality of kids

Preweaning mortality of kids in groups I, II, III and IV are presented in Table 11. The corresponding values were 50.00, 44.44, 50.00 and 33.33 per cent respectively. Out of the total 29 kids born alive, 13 died before weaning (44.83%). Analysis of the results revealed that preweaning mortality percentage in group I, II and III was higher than that of control group.

The common causes of kid mortality from birth to weaning age of 60 days were pneumonia, enteritis and other etiological factors such as sudden death of weak born kids. Out of total 13 kids died before weaning, four (30.77%) were due to pneumonia, three (23.07%) were enteritis and six (46.15%) due to other etiological factors.

Table 1. Incidence of oestrus after second dose of prostaglandin administration

Groups	Number of animals treated	Number of animals evinced oestrus	Incidence (%)
Group I	12	12	100
Group II	12	12	100
Group III	12	12	100
Group IV	12	11	91.67

Table 2. Overall incidence, onset, duration and intensity of oestrus in prostaglandin-PMSG group and control group

Groups	Incidence (%)	Onset (hours)	Duration (hours)	Intensity (score)
Prostaglandin-PMSG group	100	27.33 ± 2.34	78.00 ± 7.3	12.67 ± 0.51
Prostaglandin group (control)	91.67	43.64 ± 4.36	34.91 ± 4.97	8.82 ± 1.59

Inference: Overall onset, duration and intensity of oestrus between prostaglandin-PMSG groups and control group were highly significant ($P \leq 0.01$).

Table 3. Time taken for onset of oestrus after second dose of prostaglandin administration

Groups	Onset of oestrus (hours)	
	Range	Mean
Group I	24 – 48	28.00 ± 2.70
Group II	24 – 72	30.00 ± 4.31
Group III	24	24.00
Group IV	48 – 60	43.64 ± 4.36

Inference: Time taken for onset of oestrus in group IV was significantly different from other group ($P < 0.01$).

Table 4. Duration of oestrus

Groups	Duration of oestrus (hours)	
	Range	Mean
Group I	48 – 120	84.00 ± 6.94
Group II	48 – 120	64.00 ± 7.44
Group III	48 – 120	86.00 ± 7.52
Group IV	24 - 48	34.91 ± 4.97

Inference: Duration of oestrus in group IV was significantly different from other group ($P< 0.01$).

Table 5. Intensity of oestrus

Groups	Intensity of oestrus (score)	
	Range	Mean
Group I	7 – 13	11.50 ± 0.49
Group II	10 – 14	12.25 ± 0.33
Group III	11 – 17	14.25 ± 0.72
Group IV	2 – 17	8.82 ± 1.59

Inference: Intensity of oestrus in goup IV was significantly different from other group ($P< 0.01$). Group I showed highly significant from group III ($P < 0.01$).

Table 6. Oestrus behaviour in synchronized goats

Behavioural signs and physiological changes	Percentage			
	Group I	Group II	Group III	Group IV
Wagging of tail	100 (12)	100 (12)	100 (12)	100 (12)
Mounting on other animals	0	25 (3)	8.33 (1)	0
Bleating	0	8.33 (1)	0	0
Circling with buck	33.33 (4)	41.67 (5)	8.33 (1)	8.33 (1)
Standing to be mounted	66.67 (8)	41.67 (5)	66.67 (8)	33.33 (4)
Vulval redness	100 (12)	100 (12)	100 (12)	75 (9)
Vulval oedema	100 (12)	100 (12)	100 (12)	66.67 (8)
Vulval discharge	16.67 (2)	50 (6)	75 (9)	25 (3)

(Figures in the parenthesis indicate the number of does)

Table 7. Conception rate

Groups	Number of animals inseminated	Number of animals conceived	Percentage of conception
Group I	12	5	41.67
Group II	12	6	50.00
Group III	12	4	33.33
Group IV	11	5	45.45

Table 8. Litter size

Groups	Number does kidded	Number of kids born			Mean litter size per doe
		Mummified	Still born	Live	
Group I	5	1	0	8	1.60 ± 0.25
Group II	6	1	1	9	1.50 ± 0.43
Group III	4	0	0	6	1.50 ± 0.65
Group IV	5	0	0	6	1.20 ± 0.20
Total	20	2	1	29	1.45 ± 0.32

Inference: Litter size among groups I, II, III and IV was not significantly different.

Table 9. Incidence of multiple birth

Groups	Percentage		
	Singleton	Twins	Triplets
Group I	40 (2)	60 (3)	0
Group II	40 (2)	40 (2)	20 (1)
Group III	50 (2)	25 (1)	25 (1)
Group IV	80 (4)	20 (1)	0

(Figures in the parenthesis indicate the number of does)

Table 10. Birth weight of kids

Group	Birth weight (kgs)	
	Range	Mean
Group I	1.0 - 2.2	1.45 ± 0.14
Group II	0.8 - 2.0	1.24 ± 0.13
Group III	0.8 – 2.0	1.27 ± 0.18
Group IV	0.9 - 2.3	1.62 ± 0.24

Inference: Mean birth weight was not significantly different among groups I, II, III and IV.

Table 11. Preweaning mortality of kids

Groups	Number of kids born alive	Number of kids died before weaning	Preweaning mortality (%)
Group I	8	4	50.00
Group II	9	4	44.44
Group III	6	3	50.00
Group IV	6	2	33.33
Total	29	13	44.83

Fig. 2. Duration of oestrus

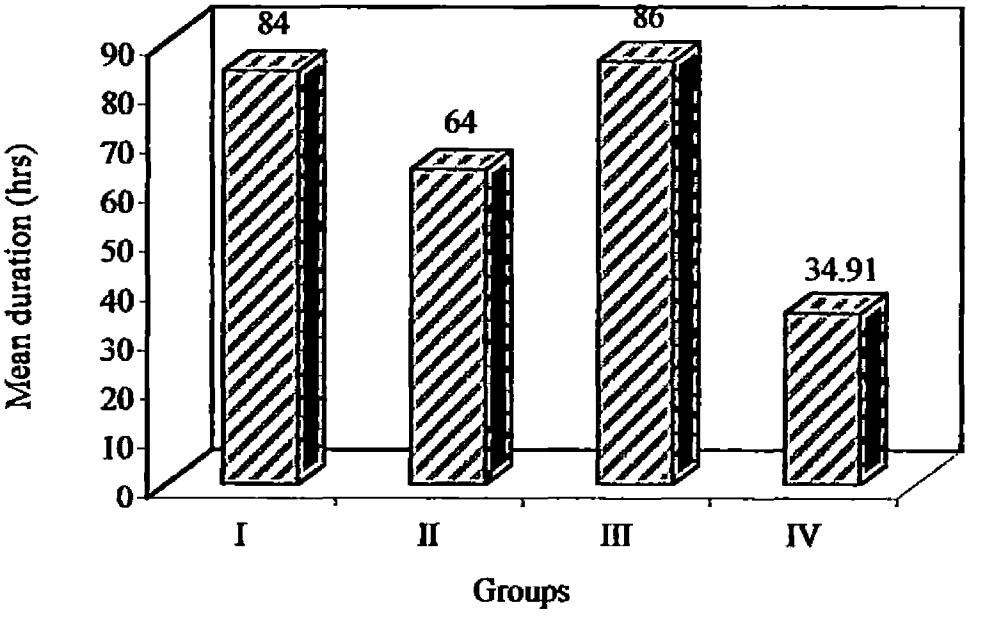


Fig. 1. Time taken for onset of oestrus

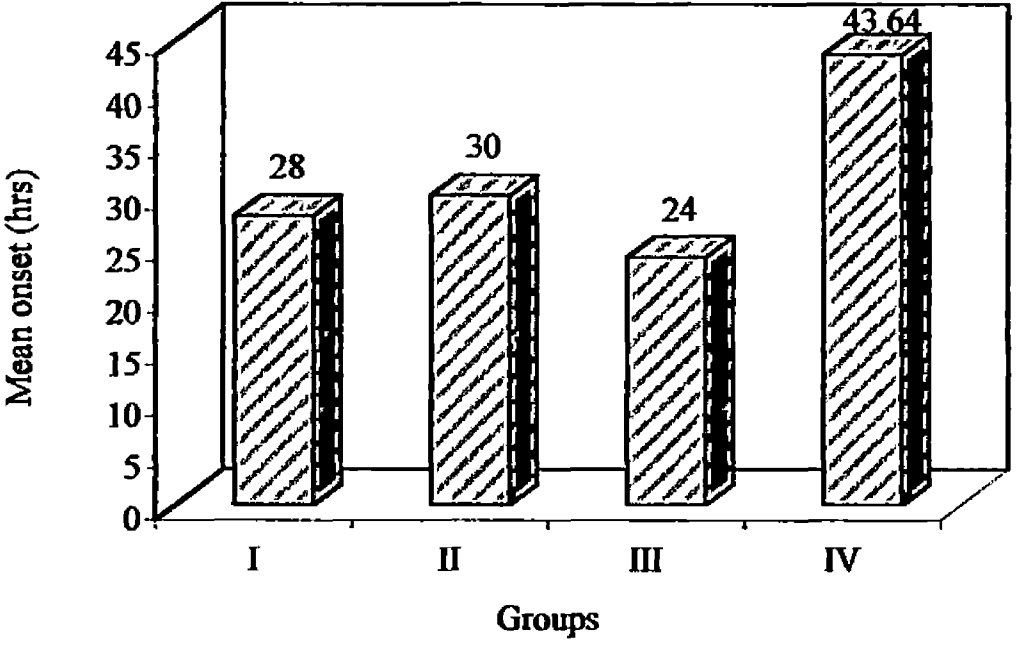


Fig. 3. Intensity of oestrus

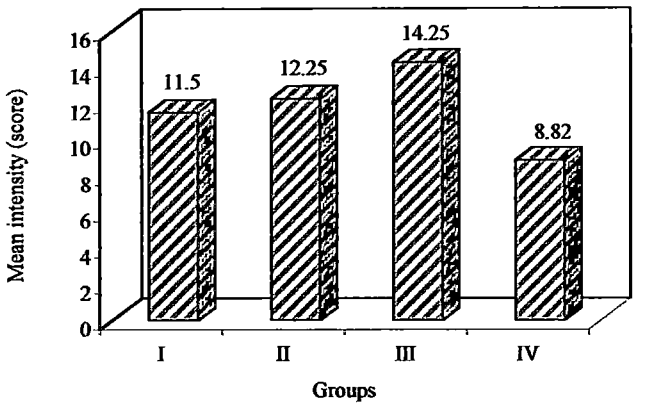


Fig. 4. Conception rate

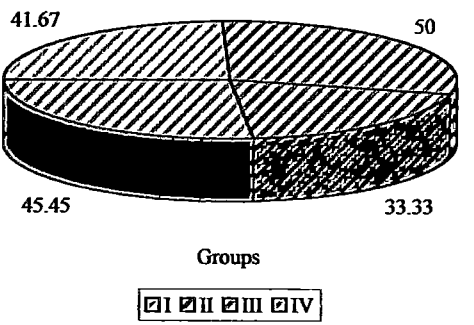


Fig. 6. Birth weight

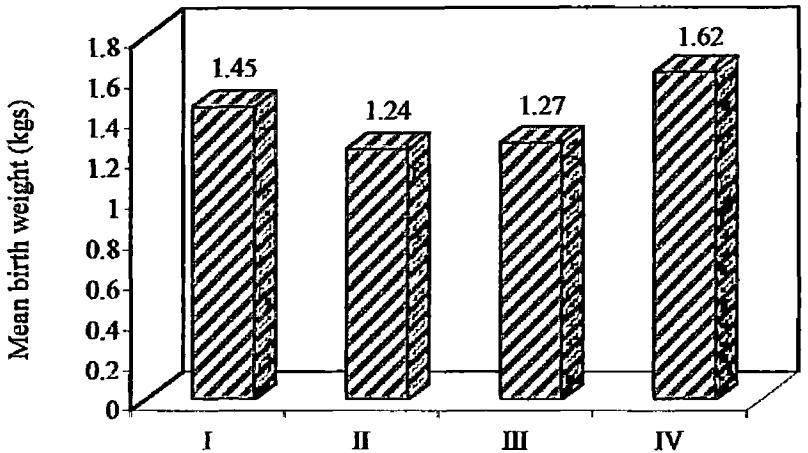
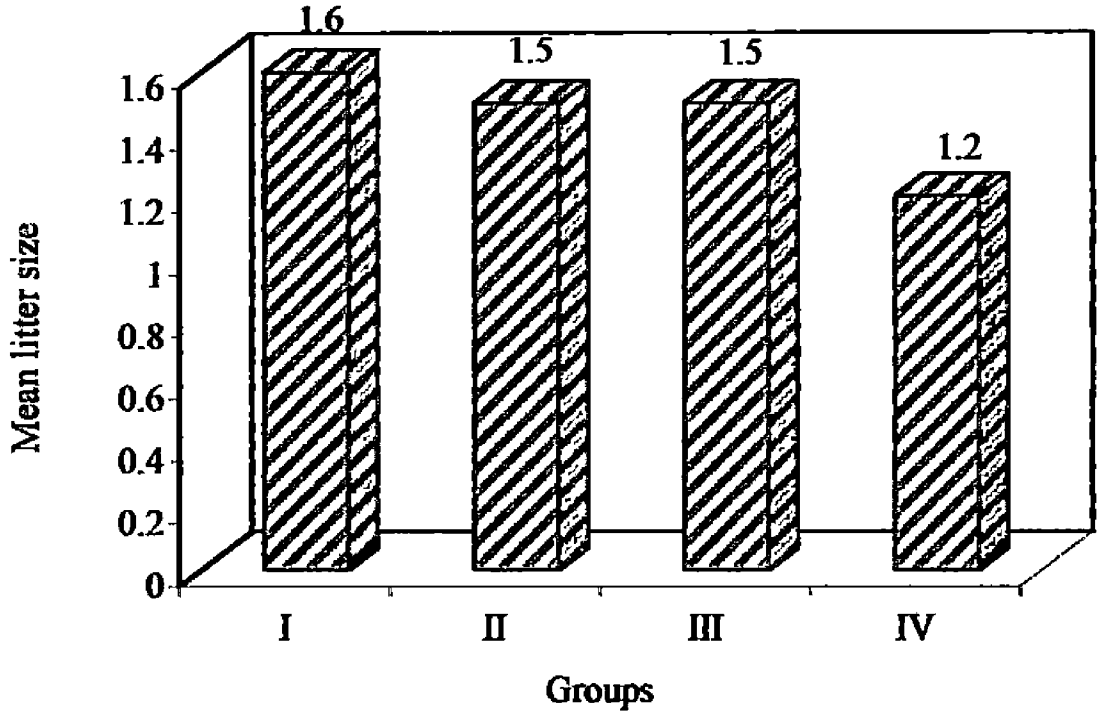


Fig. 5. Litter size



Discussion

DISCUSSION

Controlled breeding of goat and its standardisation for humid tropical climate has become an urgent priority taking into account the pausitive of research work from these regions of the world. Many hormonal preparations and their combinations have been recommended for the synchronization of oestrus and enhancement of prolificacy in sheep and goat. The lacuna of information on the use of prostaglandin-PMSG combination treatment among goats in humid tropics, the present investigation was taken up with the object of studying the efficacy of prostaglandin-PMSG combination treatments on prolificacy and fertility in forty eight cycling nulliparous Malabari does belonging to Kerala Agricultural University Goat Farm, Mannuthy.

5.1 Incidence of oestrus

In the present study all does in groups I, II and III which were treated with prostaglandin-PMSG combination exhibited oestrus. In group IV the incidence of oestrus was 91.67 per cent. The cent per cent result obtained in prostaglandin-PMSG group in the present study was in agreement with the results reported by Armstrong and Evans (1983), Indramani and Vadnere (1989), Pandey *et al.* (1991), Artiningsih *et al.* (1996), Takarkhede *et al.* (1998) and Zarkawi *et al.* (1999).

Ott *et al.* (1980), Iswhar and Pandey (1990), Pandey *et al.* (1991), Shivkumar (1993) and Bharali and Dutta (2001) reported that 100 per cent success

noticed for synchronization of oestrus in goats after the double dose of prostaglandin.

5.2 Onset of oestrus

Perusal of data presented in Table 2 and Fig. 1 revealed that the time taken for onset of oestrus after second prostaglandin administration in groups I, II, III and IV was 28.00±2.70, 30.00±4.31, 24.00 and 43.64±4.36 h respectively. Significant difference between prostaglandin-PMSG group and control group was observed in the present study. Boland *et al.* (1978) observed the onset of oestrus in ewes within 56 h after the cloprostenol and PMSG administration. Greyling and Van Niekerk (1991) recorded that administration of PMSG combination resulted in early onset of oestrus in goats. According to Pandey *et al.* (1991) in goats treated with prostaglandin-PMSG combination the onset of oestrus was 39.33±2.15 h after prostaglandin administration. Thilagar *et al.* (1992) reported that prostaglandin-PMSG treated Tellichery goats recorded a mean oestrus interval of 32±1.22 h after the prostaglandin treatment. Artiningsih *et al.* (1996) could obtain the onset of oestrus with in a period of 39 to 59 h after PMSG injection. Takarkhede *et al.* (1998) reported that onset of oestrus in ewes as 46.28±9.5 h after PMSG-Prostaglandin administration. According to Bharali and Dutta (2001), PGF2α, PGF2α+hCG, PGF2α+hCG+PMSG and control groups of crossbred goats exhibited the onset of oestrus was 23.50±0.99, 23.67±1.19, 28.17±12.64 and 31.00±1.75 h respectively. The reduced time interval taken by the does of

prostaglandin-PMSG groupsfor the onset of oestrus in the present study was in agreement with the previous reports. All prostaglandin-PMSG groups showed the shorter time interval for the onset of oestrus than the control Group. The early onset of oestrus in postaglandin-PMSG might be due to the effect of PMSG on folliculogenesis, thus advancing the oestrus, LH surge and ovulation in ewes. (Evans and Robinson, 1980).

The delay noticed in onset of oestrus in control group does was in consonance with the earlier findings of Acritopoulou *et al.* (1977), Bosu *et al.* (1978), Moore and Eppleston (1979), EI-Amrani *et al.* (1993) and Shivkumar and Thomas (1995).

5.3 Duration of oestrus

Data presented in Table 3 and Fig. 2 revealed that the duration of oestrus in groups I, II, III and IV was 84.00±6.94, 64.00±7.44, 86.00±7.52 and 34.91±4.97 h respectively. There was significant difference between the prostaglandin-PMSG groups and control group. On administration of PGF2α, PGF2α+hCG and PGF2α+hCG+PMSG in crossbred goats, Bharali and Dutta (2001) observed the duration of oestrus 46.33±5.04, 45.67±7.87 and 61.50±12.06 h respectively after the treatment. In the present study prostaglandin-PMSG groups showed higher duration of oestrus than the control group. This finding was in agreement with the result of Bharali and Dutta (2001); on the contrary shorter duration of oestrus was noticed by Pandey *et al.* (1991) on administration of

prostaglandin-PMSG in goats. The long duration of oestrus noticed in prostaglandin-PMSG groups might be due to the fact that PMSG had a longer half life (Mc Intosh *et al.*, 1975).

In control group the duration of oestrus was 34.91±4.97 h. Similar results were obtained by Ishwar and Pandey (1990) and Shivkumar (1993). On the other hand longer duration was observed by Bretzlaff *et al.* (1983) Greyling and Van Niekerk (1986) and Bharali and Dutta (2001).

5.4 Intensity of oestrus

In the present study the oestrus intensity score in treatment groups I, II, III and IV was 11.50±0.49, 12.25±0.33, 14.25±0.72 and 8.82±1.59 h respectively. Prostaglandin-PMSG groups had intensity scores higher than that of control group. There was significant difference between prostaglandin-PMSG groups and control group with respect of intensity of oestrus in the present study. Similar findings were reported by Shivkumar (1993), Selvaraju (1994) and Bharali *et al.* (2000).

All does of the prostaglandin-PMSG groups exhibited tail wagging, vulval redness and vulval oedema as the prominent oestrous signs where as in the control group only tail wagging was prominent signs. In the present study bleating was not pronounced in prostaglandin-PMSG group and the control group. This result was in contrast to Bharali *et al* (2000) who reported 100 per cent bleating, 80 percent swelling of vulva and 80 percent estrual discharge in PMSG treated

does. Results of the present study also revealed that as dose of PMSG in prostaglandin increased, slight increase in the oestrus intensity score was observed.

5.5 Conception rate

Perusal of data presented in Table 7 and Fig. 4 showed that the conception rate in groups I, II, III and IV was 41.67, 50.00, 33.33 and 45.45 per cent respectively. Robinson (1950) obtained a decrease in conception rate following high doses of PMSG in ewes. Trounson *et al.* (1976) reported a fertilization rate of 55 per cent in PMSG treated ewes bred by natural service. Espeschit *et al.* (1988) recorded a kidding rate of 64.3 per cent and 53.3 per cent using MAP sponges, cloprostenol and 200 I.U PMSG in two groups of goats. According to Selvaraju (1994) the kidding rate in PMSG synchronized and control groups of does was 70, 83.33 per cent and 60, 50 per cent in natural service and A.I respectively. Zarkawi *et al.* (1999) reported that the conception rate was 65.8 per cent in PMSG treated goats.

The conception rate in the control group, which was treated with two doses of cloprostenol 11 days apart was 45.45 per cent. Fuki and Roberts (1976) obtained a better conception rate of 76 per cent in ewes synchronized with prostaglandin and inseminated artificially. Boland *et al.* (1978) found reduced fertility in cloprostenol treated ewes following a single set-time insemination. Dankowski *et al.* (1998) reported that 35 per cent pregnancy rate was noticed in ewes treated with two doses of cloprostenol administered 11 days apart.

In the present study no significant increase in conception rate was noticed in the prostaglandin-PMSG treated does. But by increasing the PMSG dose from 400 IU to 600 IU slight reduction in conception rate could be noticed. Faulty timing of events following excessive stimulation with PMSG had been suggested as a reason for poor ovulation responses observed in sheep during the anoestrus season (Evans and Robinson, 1980). Over stimulation with PMSG, creating an unfavourable estrogen environment for ovum transport and possibly sperm survival, might have resulted in reduced fertilization rates associated with impeded transport of the gamates in the female reproductive tract (Robertson, 1977).

5.6 Litter size

In the present study the litter size was 1.60±0.25, 1.50±0.43, 1.50±0.65 and 1.20±0.20 respectively in groups I, II, III and IV. There was no statistically significant difference between the litter size of prostaglandin PMSG groups and control group. Even though Sudarsanan and Raja (1973) reported low twinning rate in Malabari does noticed and twinning was more common in prostaglandin-PMSG groups than the control group in the present study. This might be due to increased ovulation rate on PMSG treated does (Armstrong *et al.*, 1982). Aurstad and Gysler (1979) and Zarkawi *et al.* (1999) also obtained an increase in litter size following PMSG administration in goats.

In the current study revealed that as the dose rate of PMSG increased the litter size also declined. This was in consonance with the findings of Crosby *et*

al. (1991) who observed that increase in PMSG doses from 500 to 1000 I.U resulted in reduced litter size (1.9 Vs 1.52) cyclic ewes.

5.7 Birth weight

Average birth weight of kids in groups I, II, III and IV was 1.45± 0.14, 1.24±0.13, 1.27±0.18 and 1.62±0.24 kg respectively. Datta *et al.* (1963) found that mean birth weight of Indian breeds of goats ranged from 1.50 to 3.62 kg. Mukundan (1976) observed that the average birth weight of kids born to Malabari, Alpine × Malabari and Saanen × Malabari were 1.79, 1.95 and 2.39 kg for males 1.76, 2.33 and 2.11 kg for females respectively. According to Nair (1979) the mean birth weight of Malabari kid was 1.73±0.02 kg.

Shivkumar (1993) and Yang Shenglin *et al.* (1999) found that there was no significant difference in the mean birth weight of kids born to does with or without prostaglandin treatment. In the present study average birth weight in prostaglandin-PMSG group was slightly lower than the control group. This might be due to increased incidence of twinning in does treated with PMSG (Roberts, 1986; Zarkawi *et al.*, 1999) which adversely affect the birth weight.

5.8 Preweaning mortality

In group I, II, III and IV the percentage of preweaning mortality of kids was 50.00, 44.44, 50.00 and 33.33 respectively. Roberts (1986) reported that mortality in twin lambs with lower birth weight was 30 to 40 per cent

higher than in single birth and also reported that the main causes of mortality were pneumonia and diarrhoea. Similar observation could be made in the present investigation.

In the present study, prostaglandin alone treated group had a lower per cent of mortality than the prostaglandin-PMSG group. According to Aurstad and Gysler (1979) and Borghese *et al.* (1987) this might be due to the high incidence of single birth and increased birth weight in does treated with prostaglandin alone.

Oestrus synchronization and controlled breeding appear to have a negative effect on the preweaning survivability of kids as evidence by the results of this study. Control.. : group with prostaglandin alone had a lower mortality compared to prostaglandin-PMSG combination possibly owing to the increased litter size among primiparous goats. The litter size among Malabari goats in the first kidding is one in 80 per cent cases (Sudarsanan and Raja, 1973), where as in the present study it ranged from between 1.2 to 1.6. Ordinarily in untreated animals the preweaning mortality was 8 to 10 per cent. The increased mortality in the study possibly reflex on the increased litter size among primiparous goats and hormonal effects on kids.

Summary

SUMMARY

The objective of the present investigation was to evaluate the efficacy of administration of Prostaglandin-PMSG combination at different dose level on fertility and prolificacy of cyclic nulliparous Malabari goats.

Materials for the present study consisted of forty eight Malabari nulliparous does of eight to ten months and body weight of 18 to 20 kg belonging to Kerala Agricultural University Goat farm, Mannuthy. All the experimental does were administered intramuscularly two doses of cloprostenol, prostaglandin analogue (SYNCHROMATE) at the rate of 0.5ml (263micrograms/ml) 11 days apart. One day before the second dose of prostaglandin administration the does were randomly divided into four groups viz. Group I, II, III and IV each group consisting of 12 animals and group I, II and III were administered PMSG (FOLLIGON) intramuscularly at the rate of 200 IU, 400 IU and 600 IU respectively. Group IV was maintained as control with the prostaglandin treatment alone. All the does were closely observed in morning and evening after second prostaglandin administration for the incidence, onset, duration and intensity of oestrus. An apronised buck was also used in detecting oestrus. All the oestrus exhibited does were inseminated with fresh liquid semen by vaginal speculum method.

After second prostaglandin administration all the 12 does in group I, II and III (100%) and 11 does in group IV (91.67%) showed oestrous signs. Time

taken for onset of oestrus after second dose of prostaglandin in all prostaglandin-PMSG groups ranged from 24 to 72 h whereas in control group it ranged from 48 to 60 h. The mean time taken for onset of oestrus in group I, II, III and IV were 28.00±2.70, 30.00±4.31, 24.00, 43.64±4.36 h respectively. Overall onset of oestrus in the prostaglandin-PMSG group and control group was 27.33±2.34 and 43.64±4.36 h respectively. Time taken for onset of oestrus in all prostaglandin-PMSG groups varied significantly ($P < 0.01$) from that of control group; there was no significant difference between prostaglandin-PMSG group I, II and III. Duration of oestrus in all prostaglandin-PMSG group ranged from 48 to 120 h whereas that in control group ranged from 24 to 48 h. The mean duration of oestrus in group I, II, III and IV was 84.00±6.94, 64.00±7.44, 86.00±7.52 and 34.91±4.97 h respectively. Overall mean duration of oestrus in prostaglandin-PMSG group and control group was 78.00±7.30 and 34.91±4.97 h respectively. In all prostaglandin-PMSG group mean duration of oestrus was significantly higher ($P < 0.01$) than that of control group.

Intensity of oestrus scores in group I, II, III and IV ranged from 7 to 13, 10 to 14, 11 to 17 and 2 to 17 respectively. The mean intensity score in groups were 11.50±0.49, 12.25±0.33, 14.25±0.72 and 8.82±1.59 respectively. Overall mean score of prostaglandin-PMSG group and control group was 12.67±0.51 and 8.82±1.59 respectively. In all prostaglandin-PMSG groups intensity of oestrus score was significantly higher than that of control group and between prostaglandin-PMSG group I and III were highly significant ($P<0.01$). The does which were treated with prostaglandin-PMSG groups had more pronounced heat signs than the control

group. The common behavioural signs and physiological changes noted in prostaglandin-PMSG groups were wagging of tail, standing to be mounted, vulval redness, vulval oedema and vulval discharge. In control group wagging of tail, vulval redness and vulval oedema were noticed.

Conception rate in group I, II, III and IV was 41.67, 50.00, 33.33 and 45.45 per cent respectively. Group II recorded a better conception rate than the other groups. The mean litter size in group I, II, III and IV was 1.60±0.25, 1.50±0.43, 1.50±0.65 and 1.20±0.20 respectively. Out of 32 kids born, two cases of mummified and one case of stillborn foetus were noticed. The incidence of single, twins and triplets was 40, 60 and 0; 40, 40 and 20; 50, 25 and 25 and 80, 20 and 0 per cent respectively. Litter size was not significantly different between treatment groups. However, group I recorded the highest mean litter size of 1.60±0.25. The mean birth weight of kids in group I, II, III and IV was 1.45±0.14, 1.24±0.13, 1.27±0.18 and 1.62±0.24 kg respectively. Mean birth weight of kids in prostaglandin-PMSG group and control group was not significantly different. However the control group recorded the highest mean birth weight of kids. The preweaning mortality of kids in group I, II, III and IV were 50.00, 44.44, 50.00 and 33.33 per cent respectively. Analysis of the results revealed that preweaning mortality percentage in group I, II and III was higher than that of control group. The common causes of kid mortality from birth to weaning age of 60 days were pneumonia, enteritis and sudden death of weak born kids.

To sum up it may be stated that prostaglandin-PMSG treatment of low dose of 200 IU protocol could be successfully used for induction of oestrus in nulliparous goats with satisfactory fertility and litter size.

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EFFECT OF PROSTAGLANDIN - PREGNANT MARE SERUM GONADOTROPIN (PMSG) COMBINATION FOR ENHANCING PROLIFICACY IN MALABARI GOATS

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ABSTRACT OF A THESIS

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ABSTRACT

The object of present investigation was to evaluate the efficacy of prostaglandin–PMSG combination treatment at different dose levels in order to enhance the fertility and prolificacy of Malabari does. The material used for the study consisted of 48 cycling nulliparous Malabari does of eight to ten months age and body weight 18 to 20 kg, belonging to Kerala Agricultural University Goat farm, Mannuthy. All the experimental does were administered with two doses of cloprostenol (SYNCHROMATE) at the rate of 0.5ml intramuscularly 11 days apart. One day prior to the second prostaglandin administration the does were randomly divided into four groups viz. Group I, II, III and IV with 12 in each group. On the same day group I, II and III were administered PMSG (FOLLIGON) intramuscularly at the rate of 200, 400 and 600 IU respectively. Group IV was maintained as control with the prostaglandin treatment alone.

After the second dose of prostaglandin all does in group I, II and III (100%) showed oestrus and in group IV only 11 does (91.67%) exhibited oestrus. The mean time taken for onset of oestrus in group I, II, III and IV was 28.00±2.70, 30.00±4.31, 24.00, 43.64±4.36 h respectively. Group IV was significantly different from prostaglandin-PMSG group I, II and III ($P < 0.01$). The mean duration of oestrus in group I, II, III and IV was 84.00±6.94, 64.00±7.44, 86.00±7.52 and 34.91±4.97 h respectively. Group IV was significantly different from group I, II and III ($P < 0.01$).

Mean intensity oestrus score was 11.50±0.49, 12.25±0.33, 14.25±0.72 and 8.82±1.59 respectively in group I, II, III and IV. Group IV was statistically significant from group I, II and III ($P < 0.01$). All prostaglandin-PMSG treated does exhibited common oestrus signs like wagging of tail, standing to be mounted, vulval redness, vulval oedema and vulval discharge whereas in control group only wagging of tail, vulval redness and vulval oedema noticed. The percentage of conception rate in group I, II, III and IV was 41.67, 50.00, 33.33 and 45.45 respectively. In prostaglandin-PMSG groups I, II and III mean litter size was 1.60±0.25, 1.50±0.43 and 1.50±0.65 respectively but in group IV the same was 1.20±0.20. There was no significant difference between the groups in litter size. However, more litter size with twins and triplets was noticed in prostaglandin-PMSG groups than the control group.

In group I, II and III mean birth weight was 1.45±0.14, 1.24±0.13 and 1.27±0.18 kg respectively whereas in group IV it was 1.62±0.24 kg. There was no significant difference among the groups with respect to the birth weight of kids. The percentage of preweaning mortality of kids in group I, II, III and IV was 50.00, 44.44, 50.00 and 33.33 respectively. The causes of preweaning mortality were pneumonia, enteritis and other etiological factors such as sudden death of weak born kids.

Analysis of the results of present investigation indicated that prostaglandin double dose combined with PMSG at low dose regimen of 200 IU treatment can be used for enhancing the litter size without affecting the

reproductive efficiency of nulliparous young does. For enhancing the litter size of goat, though requires further detailed investigation, it appears to offer a clear indication on the possibility of hormonally modulated for enhancement of litter size among goats. This might find in potential commercial application in intensive goat production system.