



Original Research

Estrus Induction and Artificial Insemination in Acyclic Ewes under Field Conditions of Semi-Arid Region of Rajasthan

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Abstract

Reproductive efficiency of sheep inhabiting the semi-arid regions of India is relatively low due to inadequate feeding (fodder), lack of concentrate feeding practices and nearly free range management coupled with poor health coverage. Increasing the percentage of lamb crop and number of lambs marketed are the primary two goals of sheep producers. Therefore, this study was undertaken to increase the lambing percentage and produce heavier lambs in farmer's flock. Regular visits were made in the villages and screened 373 Malpura ewes and out of which 31 were identified as postpartum anestrus / acyclic. All the acyclic ewes were offered proper feeding, mineral supplementation, Vitadae injection and Janova capsule and treated with indigenously developed cost-effective progesterone impregnated intra-vaginal sponges and PMSG for induction of estrus. Estrus was detected by using aproned ram after 24 h of sponge removal till prior to artificial insemination. Out of 17 treated ewes, 15 (88.2%) exhibited estrus within 48 hrs of sponge withdrawal and covered by fixed time artificial insemination with chilled diluted semen of Patanwadi rams. conception rates based on 40, 60 and 90 days non-return and lambing rate were recorded as 33.33% (5/15). Artificial insemination resulted in the birth of five healthy Patanwadi x Malpura crossbred lambs with an average birth weight of 4.00 ± 0.09 kg. The average birth weight of these lambs was significantly ($P < 0.01$) higher than the contemporary Malpura lambs which had an average birth weight of 3.30 ± 0.06 kg in the same flock. The results indicate that estrus induction treatment in anestrus ewes with intra-vaginal sponges and PMSH can effectively be used in sheep under field conditions and A.I. with semen of Patanwadi rams produced heavier lambs from Malpura ewes.

Key words: Artificial Insemination, Estrus Response, Estrus Synchronization, Sheep, Rajasthan

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Introduction

Sheep play an important role in livelihoods of marginal and landless farmers in semi-arid and arid regions of Rajasthan as they serve as assets that can be easily liquidated to provide cash in times of need. Among the livestock herds, the sheep has proved to be of utmost importance in India particularly throughout Rajasthan because they are widely kept and maintained by the rural farmers similar to goat just like called as 'the poor person's bank or the poor families insurance policy' (Peacock, 1996). India possesses 61 million sheep (GOI, 2003) that accounts for nearly 6 % of the world sheep population and about 10 million sheep are being reared by resource poor farmers of arid and semi-arid regions of Rajasthan. Sheep are mainly grazers, they prefer 50% grasses, 30% forbes and 20% shrubs in Kadapa region of Andhra Pradesh. All the shepherds were allowing sheep for grazing early in the morning in summer and late in winters. It was observed that 86% of the shepherds were landless and were allowing them for grazing in the open lands, nearby forests and hilly areas for about 10 hrs in the winter and 6 hrs in summer, whereas remaining shepherds were using their own lands for grazing (Vani *et al.*, 2017; Yadav and Tailor, 2010; Rao *et al.*, 2013). Reproductive efficiency of different breeds of sheep inhabiting the semi-arid regions of India is relatively low (Arora and Garg, 1998). High ambient temperatures and scarcity in the availability of feed and fodder limit the reproduction performance of sheep (Sahni *et al.*, 1976). The average reproductive efficiency of sheep in farmers flock range from 75-80% with 5-8% twinning (Singh *et al.*, 2005). Inadequate nutrition may influence pituitary function i.e. pattern of synthesis and/or release of gonadotrophins and response of target organs to either gonadotrophins or gonadal hormones (Lamming, 1969). In Kadapa District of Andhra Pradesh the overall survey revealed that the diseases (28%), lamb mortality (25%), lack of feed resources (22%), fertility problems (12%), lack of veterinary aid (10%) and miscellaneous (3%) are the major constraints faced by shepherds in Nellore sheep (Vani *et al.*, 2017).

A large number of good sheep remain unsettled in the farmers' field due to acyclicity and slaughtered every year. Development of economical methods for induction of estrus can greatly benefit on reproductive management in sheep. Many different protocols has been evolved for the estrus induction / synchronization in sheep (Antoine *et al.*, 1994; Naqvi and Gulyani, 1994; Das *et al.*, 1999) but the research on cost effective, farmers oriented and field applicable estrus induction / synchronization protocol is very scanty. Artificial insemination in sheep plays a pivotal role for improving the sheep productivity in short period of time. But Indian condition the results of AI in sheep are not much encouraging as compared to Russia and in some European counties. The success percentage of AI in farmer's flocks was only 60% and somewhere it was reported 66%. In India through this technique being taken only on experimental basis for some years, still it has not been extended up to field level on large scale except Rajasthan and Andhra Pradesh (Meena *et al.*, 2018). Artificial insemination in sheep is also by no means a new technique but its success has been limited to liquid semen (Maxwell and Salamon, 1993). The main methods of short-term preservation of

ram semen in a liquid state are based on storage at reduced temperature (0-5 or 10-15°C) by reversible inactivation of spermatozoa. The spermatozoa deteriorate on storage irrespective of the diluents composition, dilution rate and temperature leading to reduced motility, a decline in viability and consequent decrease in fertility after 24 h of preservation (Maxwell and Salamon, 1993). For achieving good fertility with liquid semen, a diluent named as Egg yolk McIllvaine glucose (EYMG) has been developed at CSWRI (Srivastava *et al.*, 1987; Mathur *et al.*, 1993).

Induction of estrus in acyclic ewes and artificial insemination using semen of superior rams are two important reproductive technologies, which can be applied for improvement of reproductive efficiency in sheep under field conditions. Therefore, this study was undertaken in the Institute's adopted villages for transfer of technology to increase the lambing percentage and produce heavier lambs in farmer's flock through induction of estrus in anestrus ewes in a synchronize manner using progesterone impregnated intra-vaginal sponge and PMSG for fixed time artificial insemination with chilled diluted Patanwadi ram semen.

Materials and Methods

Location

The experiment was conducted during just before initiation of major breeding season (autumn) at farmers' flocks of institute's adopted villages for Transfer of Technology and located about 7 km away from the institute farm, which is situated in agro-climatically semi-arid part of India located at 75°28'E longitude, 26°26'N latitude and an altitude of 320 m from mean sea level. Annual erratic precipitation ranges from 250 – 400 mm and climatic extremity in terms of ambient temperature, relative humidity ranges from 02 to 46° C and 15 – 90%, respectively.

Animals and their Management

Regular visits were made in the Transfer of Technology adopted villages and screened 373 Malpura ewes out of which 31 (8.31%) identified as postpartum anestrus / acyclic. Out of 31 ewes, 17 non-responded to nutritional treatment ewes were selected for this study. All the animals were grazed 9-10 hours daily on natural vegetation interspersed with seasonal shrubs and herbs available as usual in semi-arid environments. Animals were range managed, exposed to wide seasonal variation in feed resources and environmental conditions.

Treatment for Induction of Estrus

In this study, ewes were treated with indigenously developed 350 mg progesterone impregnated intra-vaginal sponges, which were kept *In situ* vagina for 12 days followed by administration of 200 I.U. PMSG (Folligon, Intervet, Holland) intramuscularly per ewe immediately after sponge withdrawal. Estrus was

detected by using aproned ram 24 h after sponge removal till prior to artificial insemination with chilled Patanwadi ram semen.

Artificial Insemination

The Patanwadi rams were procured from Ahmedabad, Gujarat due to their higher body weight and preference of migratory sheep farmers. The semen from Patanwadi rams (n=2) was collected using artificial vagina and evaluated in semen lab of the institute. Semen samples having more than 80 % initial progressive motility were diluted @ 1000 million sperm per ml in Egg yolk McIlvaine glucose (EYMG) dilutor and preserved at 4°C. EYMG dilutor prepared with McIlvaine buffer - 100 ml (Disodium hydrogen orthophosphate 1.78 g ; Citric acid monohydrate-1.68 g, pH-7.0), glucose-0.8 g, Strepto-penicillin- 0.3 g and egg yolk- 20 ml. Same day of semen collection, the chilled diluted semen @ 0.1 ml per ewe was used for artificial insemination (AI). AI was performed twice per ewe i.e. after 36 hour and 48 hour of sponge removal. The data were analyzed using General Linear Model, Univariate, SPSS-13.

Result and Discussion

The data on estrus response, conception and lambing rate and birth weight is depicted in Table 1.

Table 1: Estrus response, conception and lambing rate and birth weight of lambs born through estrus induction and AI.

Parameters	Observations
No. of ewes screened	373
No. (%) of ewes as acyclic	31 (8.31)
No. (%) of ewes treated for induction of estrus	17
No. (%) of ewes responded after treatment	15 (88.2%)
No. of ewes attempted for AI	15 (88.2%)
No. (%) of ewes conceived	5 (33.33%)
No. (%) of ewes lambed	5 (33.33%)
Birth wt of Patanwadi x Malpura lambs (n=5)	4.00±0.09 ^a
Birth wt of Malpura lambs (n=10)	3.30±0.06 ^b

The values in the column having different superscripts differ significantly at $p < 0.01$.

In this study 31 (8.31%) ewes were recorded as anestrus / acyclic which were supposed to be sold / slaughtered ultimately as per routine practice of sheep rearing farmers of semi-arid regions of Rajasthan due to scarcity of fodder in the grazing field which reflecting the compulsions and hard livelihoods of mostly migratory type of farmers at these regions particularly. A total of 88.2% ewes exhibited estrus response within 2 days from the day of sponge removal and PMSG administration. As a direct consequence of feed inadequacy, sheep of most smallholder resource-poor farmers are often in poor body condition or emaciated. There are several reports available on the influence of body condition score on conception rate and the reason for the reduced conception rate in low body condition score ewes might be the reduced



gonadotrophin releasing hormone (GnRH) in undernourished ewes, which in turn affects the pre-ovulatory luteinizing hormone (LH) surge, fertilization and early embryonic development (Schneider, 2004; Wade and Jones, 2004). Inadequate nutrition may influence pituitary function i.e. pattern of synthesis and/or release of gonadotrophins and response of target organs to either gonadotrophins or gonadal hormones (Lamming, 1969). Present investigation attempts at unravelling the complex interactions of progesterone therapy through intra-vaginal sponges and PMSG were made to bring the anestrus ewes into estrus. After hormonal treatment 82.2% ewes were exhibited estrus within 48 hours from the withdrawal of sponge and PMSG injection which clearly revealed that above treatment having impact upon ovarian functions enhancement in anestrus ewes which were severely affected due to poor reproductive efficiency and inadequate level of reproductive hormones in the body. This synchronizing effects support the findings of well synchronized estrus using progesterone sponges and same (200 I.U.) or relatively higher (400 I.U.) dose of PMSG (Das *et al.*, 1999; Naqvi *et al.*, 1996). Regulation of ovarian activity is an integrated process encompassing both extra ovarian signals and intra-follicular factors (Webb *et al.*, 2004). Conception rate based on 40, 60 and 90 days non-return basis and lambing rate was recorded 33.33% particularly under hormonal therapeutic management technique. Various results obtained from AI using fresh semen in cyclic ewes showed that lambing rates varied from 47 to 60% in Awassi ewes (Epstein, 1985) whereas, cervical insemination resulted 54 to 82% conception rate (Fernandez Abella *et al.*, 1992). Studies using Jordanian ewes demonstrated that lambing rates from first mating ranged from 33 to 35% for either hormone treated or untreated ewes (Abdullah *et al.*, 2002; Alnimer *et al.*, 2005). Apparently, our results in acyclic ewes were in accordance with these studies which state that low pregnancy could be indicative of embryonic mortality. Early embryonic mortality during the first 3 week of gestation results in pregnancy rates ranging from 16 to 76% (Beck *et al.*, 1994; Nephw *et al.*, 1994). Although factors causing early embryonic mortality in sheep are not well established, there is some evidence suggesting the involvement of luteal inadequacy, resulting from environmental factors such as heat stress or nutrition, has been shown to be a major cause of embryonic loss in sheep (Binelli *et al.*, 2001).

Mean birth weight of Malpura x Patanwadi crossbred lambs was significantly ($P \leq 0.01$) higher than the contemporary Malpura lambs produced in the same flock. These results indicate that higher body weight of Patanwadi sheep originated from Kutchh and Khera districts of Gujarat can lead to produce crossbred lambs of higher birth weight in comparison to lambs of Malpura breed of semi-arid region of Rajasthan. Additional lambing from anestrus ewes through improvement of reproductive efficiency of sheep ultimately increasing the production potential of the flocks and fetching more economic returns.



Conclusion

Estrus induction treatment in anestrus ewes with progesterone impregnated intra-vaginal sponges and PMSG can effectively be used in sheep under field conditions for getting additional lambing and A. I. with chilled diluted semen of Patanwadi rams produced heavier lambs from Malpura ewes which reflect more economic return.

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