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Effect of supplementation of safflower oil in Ovsynch on conception rate of postpartum Bidri goats

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Abstract

The study was conducted to find out the effect of safflower oil supplementation combined with Ovsynch estrus synchronization protocol in postpartum Bidri goats. Twenty-four full term pregnant goats were selected and divided into 3 groups (n=8). From day of kidding, all the 3 groups were fed with concentrate feed (250 gm/day/doe) for 30 days. Group one (T₀) was kept control and maintained on concentrate feed without additional supplementation. Treatment groups – Group 2 (T₁) and Group 3 (T₂) received safflower oil supplementation at the rate of 30 gm and 50 gm/day/doe respectively, for 30 days. Ovsynch (G-P-G) estrous synchronization protocol was carried in all 3 groups from day 16 postpartum. All animals received a I/M inj of GnRH @ 4 mcg on day 16 post kidding and I/M inj of PGF2 α @ 250 mcg on day 23; Upon observing of estrus signs, does were allowed for natural mating. All the animals received second, I/M inj of GnRH @ 4 mcg on day 25 (48 hours after PGF2 α injection). Estrus induction rates for all the 3 groups were 100 %. Conception rates for T₀, T₁ and T₂ were 50%, 75% and 100% respectively. Based on conception rate, it was noticed that safflower oil supplementation augmented conception rates in both Group 2 (T₁) and Group 3 (T₂). It was concluded that Group 3, which received 50-gram safflower oil + Ovsynch had better efficiency in increasing conception rate of postpartum Bidri does.

Keywords: Bidri Goats, Ovsynch, Safflower oil, Estrus synchronization

Introduction

Goats are commonly considered as poor man's ATM, where M can be attributed to money, meat, milk, manure etc. Good quality hide can also be profitably extracted from goats after the slaughter. They are also regarded as "poor man's cow" because of their milk that is sufficient for a small family. Goat farming contributes about 8.5% to livestock GDP and plays an important role in Indian economy. It ensures self-employment and acts as a cushion in distress situations like drought and famine.

The necessity of good nutrition for better reproductive function is a universal fact. Harsh environmental conditions, lack of pasture land for grazing, nutritional deficiencies (Kennedy *et al.* 1994) [15] and prolonged postpartum anestrus period (Wagenmaker *et al.* 2009) [26] are the major hurdles for poor economic returns experienced by the rural goat farmers. Controlled reproduction is a valuable tool in goat farming. The actual profitability of goat rearing depends on the exploitation of fertility potential. Positive effects of oil supplementations on animal reproduction are well documented. Safflower (*Carthamus tinctorius*) (also called Kusum, Kusumbha, Kardi etc.,) is one such oil seed plant with rich source of one of two essential fatty acids – "Omega – 6 PUFA", the Linoleic Acid (LA) up to about 70 to 80 % (GRDC, 2010). The current study is aimed to increase kid crop of goats by reducing the postpartum period of Bidri goats by supplementation of safflower oil and Ovsynch protocol.

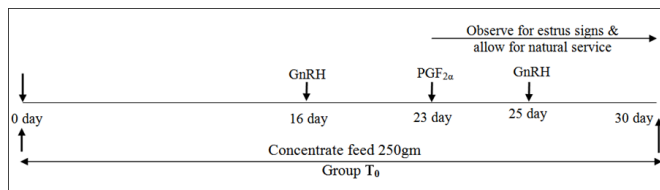
Material and Method

Twenty-four healthy full term pregnant does of age about 3 – 4 years old were selected for this study. They were allowed for grazing during day time from morning 10.30 AM to evening 5.30 PM. All the does were dewormed Fenbendazole (PANACUR®, MSD) @7.5mg/Kg body weight. These animals were randomly divided into three groups. Number of animals in each group was eight. All animals were stall fed during night time and were housed in sheds. Ad libitum clean drinking water was made available.

Treatment Regimen

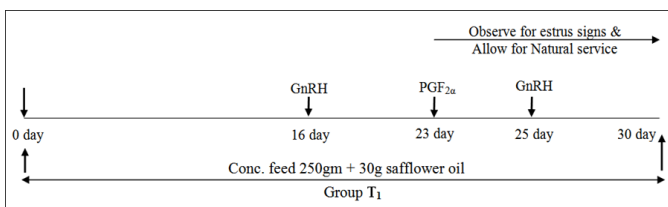
Group 1 – T₀ (n=8)

Each animal received 250 g of concentrated pellet. Ovsynch (GnRH-PGF_{2α}-GnRH) estrous synchronization protocol was carried from day 16. Animals were observed for estrus signs daily morning and evening. Estrus detected animals were left with bucks for natural mating.



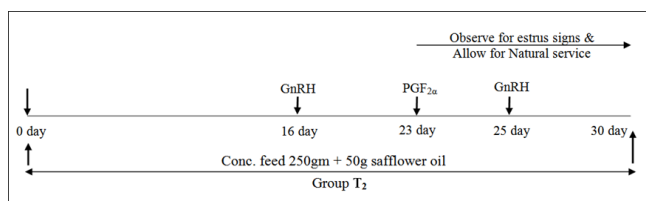
Group 2 – T₁ (n=8)

Each animal received 250g of concentrated pellet feed hand mixed with additional 30g of safflower oil, for 30 days. Ovsynch (GnRH-PGF_{2α}-GnRH) estrous synchronization protocol was carried from day 16. Later animals were observed for estrus signs daily morning and evening. Estrus detected animals were left with bucks for natural mating.



Group 3 – T₂ (n=8)

Each animal received 250g of concentrated pellet feed hand mixed with additional 50g of safflower oil, for 30 days. Ovsynch (GnRH-PGF_{2α}-GnRH) estrous synchronization protocol was carried from day 16. Animals were observed for estrus signs daily morning and evening. Estrus detected animals were left with bucks for natural mating.



Results and Discussion

Concentrates + Ovsynch – Group 1 (T₀)

In this group, total 8 does were allowed to feed 250 gm of concentrate feed /day/doe up to 30 days post kidding. Ovsynch (GnRH-PGF_{2α}-GnRH) estrous synchronization protocol was carried from day 16 post-partum. All the animals were responded to Ovsynch and exhibited estrus. Hence, the estrus induction rate was 100%. Estrus signs were observed after 62.25 ± 1.66 hr, approximately 3 days after administration of PGF_{2α} on 23rd day with the range of 60-72 hr. Duration of estrus in these animals was found to be 38.25 ± 1.21 hr with the range of 36 – 42 hr. Here, 4 animals were pregnant, diagnosed by ultrasonography scanning after 45 days. Thus conception rate was 50.00 %.

Present findings regarding estrus induction were found to be similar to findings of Holtz *et al.* (2008) [14] and Cinar *et al.* (2017) [7], both of them found 100% estrus induction rate by Ovsynch protocol in Boer goats of Germany and Hair goats of

Turkey respectively. Walkden-Brown and Bocquier, (2000) [27] suggested that availability of energy has a key influence on reproductive performance due to sensitivity of the reproductive axis to adequacy of nutrition and metabolic reserves.

Present findings for onset of estrus (62.25 ± 1.66 hr) were delayed than Holtz *et al.* (2008) [14], Nur *et al.* (2013) [20] and Alemat (2017) [2] who recorded the onset of estrus in ovsynch was 40.4 hr, 30.9 hr and 34.97 ± 3.74 hr respectively. Further, the delayed onset of estrus may be due to lower body condition as said by (Freitas *et al.* 2004) [9], who noticed that lower body condition of postpartum animals lead to prolonged onset of estrus, delayed post-partum anoestrus period, that reflects compromised response to estrus synchronization and the low level fertility.

Duration of estrus in present study (38.25 ± 1.21 hr) was found to be in accordance with findings of Pujar *et al.* (2016) [22] who observed mean duration of estrus in Osmanabadi goats as 38.00 ± 5.0 hr in ovsynch. Similarly, Holtz *et al.* (2008) [14] reported duration of estrus in lactating Boer does treated with ovsynch was 40.4 hr.

Conception rate in present study (50%) was closer to the results of Holtz *et al.* (2008) [14] and Panicker *et al.* (2015) [21] where, both of them recorded 58 % conception rate under ovsynch in Boer goats and Malabari goats respectively.

Estrus induction and conception rates in the present study were observed to be favorable as this study was conducted in postpartum period of the goats. Nascimento *et al.* (2014) [18] demonstrated supplementation of energy rich diet promoted reduced number of days for uterine involution, return to postpartum ovarian activity and estrus onset in goats of Brazil.

Concentrates + 30 g Safflower Oil + Ovsynch – Group 2 (T₁)

In this group, numbers of animals were 8 and these animals were allowed to feed uniformly mixed 250 g of concentrate feed and 30 g Safflower oil/day/doe daily for 30 days post kidding. Ovsynch (GnRH-PGF_{2α}-GnRH) estrous synchronization protocol was carried from day 16 post-partum.

In this group, all animals responded to ovsynch and exhibited estrus. Hence, the estrus induction rate was 100 percent. Estrus signs were observed after 49.62 ± 1.48 hr, approximately 2 days after administration of PGF_{2α} on 23rd day with the range of 42-54 hr.

Duration of estrus in these animals was 46.125 ± 0.89 hr with the range of 42 – 48 hr. 6 animals were found to be pregnant out of 8, diagnosed by ultrasound scanning after 45 days post mating and thus conception rate was 75.00 %.

Estrus induction rate in present study (100%) was found to be similar to the findings of Deshmukh *et al.* (2017) [8] under ovsynch on postpartum day 60 in crossbred cows fed with n-6 PUFA rich Soyabean oil. However, Grant *et al.* (2003) [11] reported 50% estrus induction by single GnRH – PGF_{2α} synchronization on day 40 postpartum in cows supplemented with safflower seeds. The elevated serum cholesterol due to n-6 PUFA supplementation results in higher steroidogenesis (Needleman *et al.* 1986) [19] that produces increased estrogen (Staples *et al.* 1998) [24] and subsequently higher estrus induction rates are achieved. Walkden-Brown and Bocquier, (2000) [27] suggested that availability of energy has a key influence on reproductive performance due to sensitivity of the reproductive axis to adequacy of nutrition and metabolic

reserves.

Present findings for onset of estrus (49.62 ± 1.48 hr) are closer to Holtz *et al.* (2008) [14] who recorded the onset of estrus in ovsynch as 44.8 hr. Burke *et al.* (1996) [5], noticed onset of estrus was one day shorter when intravenously infused with n-6 PUFA rich olive oil, than n-3 PUFA rich soybean oil in ewes.

Duration of estrus in present study was found to be 46.12 ± 0.89 hr with the range of about 36-42 hr. Present findings are closer to findings of Holtz *et al.* (2008) [14] and Riaz (2012) who reported duration of estrus under ovsynch was 40.4 hr in lactating Boer does and 44.7 ± 4.9 in Beetal and Dwarf does respectively. Present findings were found to be higher than Nur *et al.* (2013) [20] and Alemat (2017) [2] who found lower duration of estrus about 29.4 hr in Saanen goats and 27.35 ± 5.14 hr in local goats of Ethiopia respectively. Whereas, Kusina *et al.* (2000) [16] witnessed that African goats maintained on pasture with low body score, found no differences in reproductive response. The supplementation of n-6 PUFA delays the pre-ovulatory estradiol release needed for ovulation, which may increase the duration of estrus (Zachut *et al.* 2010) [28]. The probable delayed ovulation might be countered by GnRH given on day of mating, which ensures ovulation of dominant follicle via LH surge (Beck *et al.* 1996) [3]. Conception rate in present group (75%) was found to be higher than Holtz *et al.* (2008) [14] and Panicker *et al.* (2015) [21] where, both of them recorded 58% conception rates under ovsynch in Boer goats and Malabari goats respectively. Similarly, Pujar *et al.* (2016) [22] documented 66.66% pregnancy rate in Osmanabadi goats. However, our findings were found to be lower than Cinar *et al.* (2017) [7] who reported higher pregnancy rate about 85% by ovsynch in Hair goats during breeding season. Higher conception rates were recorded in goats with longer duration of estrus (Panicker *et al.* 2015) [21], which might have lead to increased exposure of estrus goats to natural mating by Bucks. Higher pregnancy rate in present group might be due to supplementation of n-6 PUFAs through safflower oil. Staples *et al.* (1998) [24], Funston (2004) [10] and Hess *et al.* (2008) [13] observed the improvement in pregnancy rates of cows supplemented with fat. Further, Improvement in pregnancy rates was noticed by Lopes *et al.* (2009) [17] in n-6 PUFA supplemented *Bos indicus* cows of Nellore. However, the specific effects of n-6 PUFAs on pregnancy rates in ruminants are variable (Gulliver *et al.* 2012) [12].

Estrus induction rate and conception rates in the present study were observed to be desirable as this study was conducted in postpartum period of the goats, with safflower oil supplementation as a source of n-6 PUFAs. These n-6 PUFAs are associated with higher Prostaglandins - PGF_{2α} (Thatcher and Staples, 2000) [25], which cause early onset of estrus by luteolysis of mature corpus luteum (Burke *et al.* 1996) [5]. Buendia *et al.* (2015) concluded that addition of safflower seeds in diets of finishing cattle improved feed intake and dry matter digestibility with positive effects on ruminal fermentation, which positively reflected on conception rates. Further, Nascimento *et al.* (2014) [18] demonstrated supplementation of energy rich diet promoted reduced number of days for uterine involution, return to postpartum ovarian activity and early estrus onset in goats of Brazil.

Concentrates + 50 g Safflower Oil + Ovsynch – Group 3 (T₂)

In this group, numbers of animals were 8 and these animals

were allowed to feed on uniformly mixed 250 gm of concentrate feed and 50 g Safflower oil /day/doe daily for 30 days post kidding. Ovsynch (GnRH-PGF_{2α}-GnRH) estrous synchronization protocol was carried from day 16 post partum.

In this group, all animals responded to ovsynch and exhibited estrus. Hence, the estrus induction rate was 100%. Estrus signs were observed after 41.25 ± 1.71 hr, approximately 2 days after administration of PGF_{2α} on 23rd day, with the range of 36 - 48 hr. Duration of estrus in these animals was found to be 42.75 ± 3.50 hr with the range of 36 - 48 hr. All the 8 animals which were expressed heat found pregnant, diagnosed by ultrasonography scanning after 45th day post natural mating. Thus, conception rate was 100.00 %.

Present findings regarding estrus induction rate were found to be similar to findings of Deshmukh *et al.* (2017) [8] who reported under ovsynch in n-6 PUFA rich Soyabean oil fed cross bred cows. While, Grant *et al.* (2003) [11] reported 50% estrus induction by single GnRH – PGF_{2α} synchronization on day 40 postpartum in cows supplemented with safflower seeds. The elevated serum cholesterol due to n-6 PUFA supplementation results in higher steroidogenesis (Needleman *et al.* 1986) [19] that produces increased estrogen (Staples *et al.* 1998) [24] and subsequently higher estrus induction rates are achieved. Walkden-Brown and Bocquier, (2000) [27] suggested that availability of energy has a key influence on reproductive performance due to sensitivity of the reproductive axis to adequacy of nutrition and metabolic reserves.

Present findings for onset of estrus (41.25 ± 1.71 hr) in present group were found to be closer to findings of Burke *et al.* (1996) [5], who noticed onset of estrus was one day shorter when intravenously infused with n-6 PUFA rich olive oil, than n-3 rich soybean oil in ewes.

Duration of estrus in present study (42.75 ± 3.50 hr) was found to be with the range of about 36 - 48 hr. Present findings were found to be closer with findings of Holtz *et al.* (2008) [14], who reported duration of estrus in lactating does treated with ovsynch was 40.4 hr and Akusu *et al.* (1986) [1], who observed duration of estrus ranging from 10 to 48 hours in West African dwarf goats. Duration of estrus in present findings were longer than Nur *et al.* (2013) [20] and Alemat (2017) [2] who found lower duration of estrus about 29.4 hour in Saanen goats and 27.35 ± 5.14 hr in local goats of Ethiopia respectively. The supplementation of n-6 PUFA delays the pre-ovulatory estradiol release needed for ovulation, which may increase the duration of estrus (Zachut *et al.* 2010) [28].

Conception rate in present group (100%) was higher than that of Cinar *et al.* (2017) [7], who reported 85% pregnancy rate by ovsynch in Hair goats. Similarly, present findings were higher than Holtz *et al.* (2008) [14] and Panicker *et al.* (2015) [21] where, both recorded 58 % conception rates under ovsynch in Boer goats and Malabari goats respectively. Further, Pujar *et al.* (2016) [22] documented 66.66% pregnancy rate in Osmanabadi goats. Staples *et al.* (1998) [24], Funston (2004) and Hess *et al.* (2008) [13] witnessed the improvement in pregnancy rates of cows supplemented with fat. Higher pregnancy rate in the present group might be due to supplementation of n-6 PUFAs through safflower oil. Lopes *et al.* (2009) [17], noticed improvement in pregnancy rates when *Bos indicus* cows of Nellore received n-6 PUFAs. In contrast (Hess *et al.* 2008) [13] observed supplementation of n-6 PUFAs lead to lower pregnancy rates in beef cows, which was due to higher luteolytic PGF_{2α} produced from n-6 PUFA diets. The GnRH given on day of mating in ovsynch ensures

ovulation of dominant follicle via LH surge, efficient luteinization and improved luteal function, which leads to formation of good sized CL (Beck *et al.* 1996) [3]. This increases progesterone production and compensates for possible luteal insufficiency during early pregnancy and stimulates embryonic development (Cam *et al.* 2002) [6]. Hence, no embryonic loss might have resulted in higher pregnancy rate in present group.

Estrus induction rate and conception rates in the present group

were observed to be outstanding as this study was conducted in postpartum period of the goats, with safflower oil supplementation as a source of n-6 PUFAs. The n-6 PUFAs are associated with higher Prostaglandins (PGF_{2α}) production (Thatcher and Staples, 2000) [25], which cause early onset of estrus by luteolysis of the mature Corpus Luteum (Burke *et al.* 1996) [5]. But, the GnRH given by ovsynch on mating day prevents possible luteal insufficiency and stimulates embryonic development during early pregnancy.

Table 1: Estrus induction rate (%), Onset of estrus (hr), Duration of estrus (hr) and Conception rates (%) in different groups

Sl. No.	Groups	No. of animals	No. of animals induced to estrus	Estrus Induction rate (%)	Onset of Estrus (hr)	Duration of Estrus (hr)	No. of animals conceived	Pregnancy rate at induced estrus (%)
1	Group 1 (T ₀)	8	8	100 %	62.25 ± 1.66	38.25 ± 1.21	4	50 %
2	Group 2 (T ₁)	8	8	100 %	49.625 ± 1.48	46.125 ± 0.89	6	75 %
3	Group 3 (T ₂)	8	8	100 %	41.25 ± 1.71	42.75 ± 3.50	8	100 %

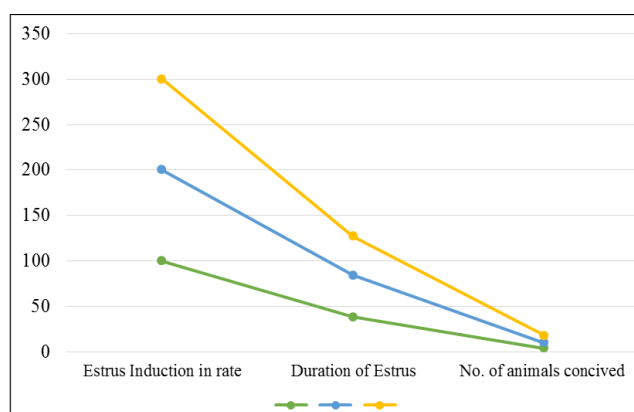


Fig 1: Estrus induction rate (%), Duration of estrus (hr) and Conception rates (%) in different groups

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