



## Short communication

## Dalagh: An Iranian half-tailed sheep breed with continuous annual ovarian activity at a mid-latitude temperate region

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## ABSTRACT

At mid and high latitudes, seasonal breeding is prevalent in sheep production which makes ewes to reproduce for a restricted window of time. Unconfirmed local reports have declared a continuous reproductive activity in a half-tailed sheep breed, Dalagh, at a mid-latitude region (37°N) in Golestan province, northern Iran. The present study aimed to evaluate the ovarian and thyroidal activity in Dalagh ewes during a one-year-long trial. Fifty-five fertile healthy ewes were isolated from rams and bled weekly to quantify the serum levels of progesterone (P<sub>4</sub>), tri-iodothyronine (T<sub>3</sub>), and tetra-iodothyronine (T<sub>4</sub>), using radioimmunoassay. The day-length and ambient temperature were recorded daily. The lowest overall mean of P<sub>4</sub> level was recorded in winter; whereas, no differences were found among those of other seasons. The overall mean values of serum T<sub>3</sub> level were comparable in spring, autumn, and winter, being higher than that recorded in summer. The highest mean value of T<sub>4</sub> level was found in winter and the lowest ones were observed in spring and summer with that of autumn lying between these extremes. The weekly variation of P<sub>4</sub> level showed a decreasing trend towards the end of the trial, where the highest P<sub>4</sub> levels were found in late May and September and the lowest one was noted in mid March. Interestingly, individual weekly records of P<sub>4</sub> for each ewe revealed that none of the animals studied showed an 8-week or longer period wherein P<sub>4</sub> level fell below 1 ng/mL, the threshold reported for anestrus status. Although T<sub>3</sub> levels had a steady trend, serum T<sub>4</sub> showed an increasing trend as the trial proceeded, with the highest and lowest records found in January and July, respectively. Correlation coefficients between serum P<sub>4</sub>, T<sub>3</sub>, and T<sub>4</sub> levels with day-length were +0.21, -0.25, and -0.42, respectively. The corresponding values with ambient temperature were +0.30, -0.57, and -0.84 for P<sub>4</sub>, T<sub>3</sub>, and T<sub>4</sub>, respectively. Data suggested that despite reproducing in a mid-latitude temperate region, Dalagh ewes showed a continuous cyclicity in ovarian activity throughout the year that would be beneficial to exploit it in breeding schemes to decrease seasonality at mid or possibly high latitudes. Future studies may be interested in searching for the underlying mechanism(s) involved.

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## 1. Introduction

Seasonality is a common feature in sheep reproduction at mid- and high-latitude temperate regions (Rosa and Bryant,

2003). Although the seasonal pattern of reproductive activity almost disappeared at tropical conditions, sheep breeds at temperate regions rely on environmental cues (mainly daily photoperiod) to synchronize their ovarian activity (Rosa and Bryant, 2003). The strategy makes the ewes sure that lambing time would correspond to adequate environmental conditions for their offspring. Meanwhile, the reproductive activity is restricted to a specific window of time in the year,

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differing in duration among breeds or individuals (Rosa and Bryant, 2003). Thus, the photo-dependence of temperate-region sheep may result in a lower lambing rate per annum versus the tropical ones, provided that other situations are comparable.

At higher latitudes, the duration of reproductive activity is more restricted so that the higher the latitude, the greater the photo-dependence (Poulton, 1987). Overall, the reproductive activity shows a seasonal pattern at latitude greater than 35°N. In other words, a long seasonal acyclicity (anestrous) without spontaneously-ovulating ewes is found at higher latitudes (Dyrmundsson, 1978). Hence, searching for approaches to establish a longer period of ovarian activity or decreasing the duration of anestrous would be of great interest to improve reproductive performance at higher latitudes. Major breed and individual differences in sexual activity and duration of breeding season (Rosa and Bryant, 2003) may provide a clue to find breeds or individuals displaying a lower level of photo-dependence in their reproductive activity at temperate regions. These breeds or individuals might be selected and produced to meet a higher annual reproductive performance.

Dalagh is a meat-type half-tailed sheep breed produced by cross-breeding between Zel (a thin-tailed Iranian breed) and Kordi (a fat-tailed Iranian breed) sheep. Dalagh is broadly produced in Golestan province, northern Iran, at a temperate mid-latitude condition (37°15'N and 55°10'E) with a 14.39- and 9.55-h day-length at summer and winter solstices, respectively. Although other sheep breeds prevalent in the same region (e.g. Zel breed) shows seasonality in their reproductive activity (Jafari Ahangari, 2006), unofficial reports by the local producers as well as preliminary observations made by the authors indicated that Dalagh sheep are reproductively active throughout the year. To provide more documented evidence on these preliminary findings, a 1-year-long study was undertaken to evaluate the ovarian activity in Dalagh ewes where the blood progesterone ( $P_4$ ) levels (as an appropriate index for ovarian activity; Arroyo et al., 2007) were recorded on a weekly basis. Being involved in seasonal reproduction especially at transition from breeding season to anestrous (Dahl et al., 1995), thyroid hormones [tri-iodothyronine ( $T_3$ ) and tetra-iodothyronine ( $T_4$ )] were also quantified to provide more details on plausible mechanisms involved. If a prolonged or sustained ovarian activity is approved, then Dalagh would be a sheep breed suggesting a considerable degree of refractoriness to or independence of the circ-annual variations in environmental factors at a temperate climate, a finding that is not conventional in mid- and high-latitude regions (Rosa and Bryant, 2003).

## 2. Materials and methods

Fifty-five 3-year old cyclic ewes, weighing  $61.2 \pm 7.7$  kg, were selected from a fertile flock at Shirang Sheep Research Station, Gorgan, Iran (37°15'N and 55°10'E). One month prior to the study, the ewes were isolated from rams, kept on natural photoperiod, and fed a conventional diet, including corn silage, cotton seed meal, wheat bran, cracked barley, and corn grains with free access to water and mineral licks. The trial was initiated in April 2009 and

extended through March 2010, during which the day-length and ambient temperature were recorded daily.

Blood samples were obtained weekly from jugular vein, centrifuged (3000 rpm, 10 min), and the sera were stored at  $-20^\circ\text{C}$  until analyzed for  $P_4$ ,  $T_3$ , and  $T_4$  levels, using commercially available radioimmunoassay kits (Immuno-technique, Marseille, France), according to Whitley et al. (1994). The lowest detectable levels of  $P_4$ ,  $T_3$ , and  $T_4$  were 0.02 ng/mL, 0.20 nmol/L, and 0.50 nmol/L. The intra- and inter-assay coefficients of variation were 5.8% and 9% for  $P_4$ , 6.2% and 7.7% for  $T_3$ , and 6.3% and 8.6% for  $T_4$ . Ewes recording  $P_4$  levels lower than 1 ng/mL in eight or more consecutive serum samples were considered as anestrous and the remaining animals as to have ovarian activity, according to Arroyo et al. (2007). Accordingly, the duration of anestrous season was calculated for each individual ewe and the percentage of total ewes in anestrous was then determined for a particular time of sampling.

The data were subjected to the Proc Mixed of SAS (2002) and body weight was included as a covariate in the analysis of variance. Overall means of the circulatory levels of hormones for each season were compared by the Duncan multiple range tests and the level of significance was set at  $P \leq 0.05$ . The correlation coefficients of blood hormones levels with ambient temperature and with day-length were also calculated (SAS, 2002).

## 3. Results

Individual weekly records of  $P_4$  for each ewe revealed that none of the animals studied showed an 8-week or longer period wherein  $P_4$  level fell below 1 ng/mL. Hence, all the ewes could be considered to have a sustained ovarian activity throughout the year. In other words, the animals did not experience a “real” anestrous period. Among the animals, only one ewe was found to record  $P_4$  levels lower than 1 ng/mL for 5 successive weeks which was also considered as a cyclic animal.

The lowest overall mean of  $P_4$  level was recorded in winter ( $2.1 \pm 0.64$  ng/mL); whereas, no differences were found among those of other seasons [6.2, 6.7, and 5.6 ( $\pm 0.64$ ) ng/mL for spring, summer, and autumn, respectively]. Interestingly, the overall mean values of serum  $T_3$  level were similar in spring, autumn, and winter ( $2.1 \pm 0.06$  nmol/L), being higher than that in summer ( $1.8 \pm 0.06$  nmol/L). For serum  $T_4$  levels, the highest mean value was found in winter ( $141.3 \pm 5.25$  nmol/L) and the lowest ones were observed in spring ( $73.1 \pm 5.25$  nmol/L) and summer ( $72.9 \pm 5.25$  nmol/L) with that of autumn ( $102.0 \pm 5.25$  nmol/L) lying between these extremes.

The overall mean values of weekly variation in serum  $P_4$ ,  $T_3$ , and  $T_4$  levels over the year is presented in Fig. 1. Overall, the serum  $P_4$  level showed a decreasing trend from April to March. The highest  $P_4$  levels were found late in May and September (9.83 and 9.76 ng/mL, respectively) and the lowest one was noted in mid March (0.51 ng/mL). A steady trend was noticed for serum  $T_3$  level throughout the experiment. Excluding early in the trial, no considerable variation in  $T_3$  level was found thereafter. The highest and lowest  $T_3$  levels were recorded in late April (3.35 nmol/L) and mid July (1.37 nmol/L), respectively.

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