Uterine Involution in Nubian Goats Monitored by Ultrasonography

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Abstract

Twelve postpartum Nubian goats were used to monitor the uterine involution using ultrasonography on days 3, 7, 10, 14, 21, 24, 27 and 31 postpartum (pp). The maximum and minimum means of uterine diameter (UD) and uterine lumen (UL) were recorded on day 3 and day 31 pp, respectively. More than 50% of uterine involution occurred between day 3 and day 14 pp. The end of uterine involution was characterized by small UD and absence of lochia in the UL. The uterine involution was completed at 22 days pp.

It could be concluded that Ultrasonographic imaging proved to be a valuable tool for monitoring uterine involution in Nubian goats. There is a positive correlation between UD and UL.

Keywords: Postpartum, Uterine involution, Ultrasonography, Nubian goats.

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Introduction

Nubian goats are among the best dairy breeds in Africa and are reputed as good milk producers in Sudan (Hassan and El-Derani, 1990). The majority of Nubian goats are reared in the northern part of the country north of latitude 12°N. This breed plays an important role in the livelihood of many Sudanese families as a favourite household animal kept for milk. It is raised under the traditional system, usually roaming freely during the day, scavenging in towns then confined and fed household wastes and concentrates atnight (Ahmed *et al.*, 2000).

Postpartum uterine involution is of great reproductive and economic importance as it is decisive in achieving an optimal interval between parturition andthesubsequent gestation (Sanchez *et al.*, 2002).Previous studies indicated that uterine involution in oats is completed on day 16 postpartum (Sanchez *et al.*, 2002), day 19 postpartum (Baru *et al.*, 1983; Degefa *et al.*, 2006) or day 28 postpartum (Greyling and van Niekerk, 1991). However, these studies examined uterine involution in a static state at necropsy. Other techniques such as hormonesand theirmetabolite measurements (Ishwar, 1995), radiography (Kene, 1991; Tian and Noakes, 1991; Goddard, 1995), and laparotomy (Ishwar, 1995) were also used to study the dynamics of uterine involution in small ruminants. However, these techniques are not practical under field conditions (Goddard, 1995).

The ultrasonographic technique has been proven to be a suitable method for monitoring uterine involution in sheep (Godfrey *et al.*, 1998; Hauser and Bostedt, 2002; Zdunczyk *et al*., 2004). The close relationship between ultrasound findings and macroscopic involution measurements hasindicated that ultrasonography can reliably be used to monitor uterine involution under field conditions and can be a suitable alternative to the slaughtering of the animal to study the uterine involution in Balady goats (Ababneh and Degefa, 2005). Hayder and Ali (2008) observed that uterine diameter decreased rapidly between day 7 and day 14 postpartum (>50%), but more steadily from day 14 to day 32 pp in Farafra sheep. The end of uterine involution is characterized by a small cross-sectional diameter of uterine horns and absence of lochia in the uterus (Zdunczyk *et al.*, 2004). Using ultrasonography, the uterine involution is found to be completed at day 19 pp in Balady (Ababneh and Degefa, 2005) and Shiba goats (Takayama *et al.*, 2010).while it is completed at day 31 and 35 pp in Farafra sheep (Hayder and Ali, 2008) and Polish Long-wool sheep (Zdunczyk *et al.*, 2004), respectively.

In Sudan ultrasound is only used for pregnancy diagnosis in the clinic. Few studies have been done on detection of pregnancy and foetal number in Saanen goats (Abdelghafar *et al.*, 2007, 2010, 2011, 2012).The aim of this study was to monitor the postpartum uterine involution in Nubian goats using the transrectal ultrasonography.

Material and Methods

This study was carried out at the farm of Sudan University of Science and Technology (SUST) at Hilat Kuku - Khartoum North ((N 15° 37` 11.30", E 32º 33`51.35").Twelve postpartum Nubian goats at the age of 5-8 years and body weight of 40-60 kgs were used. Animals were fed on concentrates (44% sorghum, 36% wheat bran, 10% ground nut cake and 10% ground nut hulls) and alfalfa hay once a day *ad libitum.* Water troughs were filled with fresh water twice daily in the morning and afternoon. Mineral salt licks were offered for choice. The animals were allowed to exercise and to graze once a week in an adjacent field

Songraphic examination was done on days 3, 7, 10, 14, 21, 24, 27 and 31 postpartum by using a real-time B-mode ultrasound scanner (Pie Medical, Easote, Holland) with a linear-array transducer of 6.0/8.0 MHz. Sonographic pictures were documented by a video graphic printer (Sony Corporation 6-7-35, Kitashinagawa Shinagawa, Tokyo, Japan).

The animals were fasted for 12 hours prior to scanning to avoid accumulation of gases into the gastrointestinal tract. They were restrained in standing position; the rectum was evacuated from faecal material with a gloved finger. The rectal probe made rigid by an extension plastic rod and covered with some ultrasonic jelly (Aquasonic, Parker Laboratories, INC. Fairfield, New Jersey, USA) was gently inserted into the rectum with reference to the cranial border of the urinary bladder as a position landmark (Ababneh and Degefa, 2005; Hayder and Ali, 2008). For scanning of the uterus, the probe was moved approximately 60º to each side (medially and laterally) around its longitudinal

axis. Then, the maximum transversal cross-sectional diameter and the lumen diameters of the previous gravid horn was recorded and fixed on the screen of the ultrasound (Godfrey *et al*., 1998; Hauser and Bostedt, 2002; Zdunczyk *et al.*, 2004). Uterine involution was considered to be complete when no further reduction in the uterine diameter for three successive examinations was recorded in addition to absence of lochia in the uterus.

Statistical analysis was performed using the computer programmer statistical package for social science (SPSS) version 18. Correlation and regression analysis was done to determine the relationship between UD and UL according to Petrie and Watson (2006).

Results

Mean diameters of the uterus (UD) and uterine lumen (UL) measured by ultrasound from day 3 to day 31 postpartum (pp) are shown in table 1 and fig.1. The maximum mean of UD (32.8 ± 3.6 mm) and UL (3.70 ± 0.4 mm) were recorded on day

3 pp (fig.2). While the minimum mean of UD (22.9 ± 3.0 mm) and UL (2.5 ± 0.2) were observed on day 31 pp (fig.3). The UD decreased rapidly between day 3 and day 14 pp (> 50 %), but more steadily from day 17 to day 27 pp and slowed down thereafter until day 31 pp.

The greater value of UL observed on day 31 pp was almost equal to the minimum value recorded on day 3 pp (2.7 mm). Consequently the UL decreased slowly from day 3 until day 31 pp. Accumulation of fluid in the UL was observed during the first 7 days pp.

The end of the uterine involution was characterized by small UD (no further reduction of UD for three consecutive examinations was recorded) and absence of fluid (lochia) in the UL (fig.4). There were positive correlations between UD on days 10, 14, 17, 21, 24 pp and UL on day 17 pp, and these correlations were highly significant ($P \leq 0.01$).According to these measurements, uterine involution is completed by 17-27 days pp (averaged 22 ± 3.3 days).

Table1. Diameters (mm) of the uterus (UD) and uterine lumen (UL) measured by ultrasound from day 3 to day 31 postpartum (pp) in Nubian goats (n=12). (Mean ± SD)

Days pp		UD				UL		
		Min	*Max*	*Mean ± SD*		*Min*	*Max*	*Mean ± SD*
3		27.0	39.0	32.8 ± 3.6		2.7	4.3	3.7 ± 0.4
7		25.0	35.0	30.2 ± 3.0		2.7	4.2	3.5 ± 0.4
10		21.0	33.6	27.9 ± 3.8		2.7	4.1	3.4 ± 0.4
14		20.6	31.7	26.1 ± 3.3		2.3	3.5	3.1 ± 0.4
17		17.4	30.0	25.0 ± 3.9		2.0	3.7	3.0 ± 0.4
21		17.7	28.0	23.9 ± 3.2		2.2	3.4	2.8 ± 0.4
24		17.3	28.0	23.6 ± 3.2		2.2	3.3	2.7 ± 0.3
27		18.5	28.0	24.0 ± 2.8		2.5	3.0	2.7 ±0.2
31		18.2	26.1	22.9 ± 3.0		2.2	2.7	2.5 ± 0.2
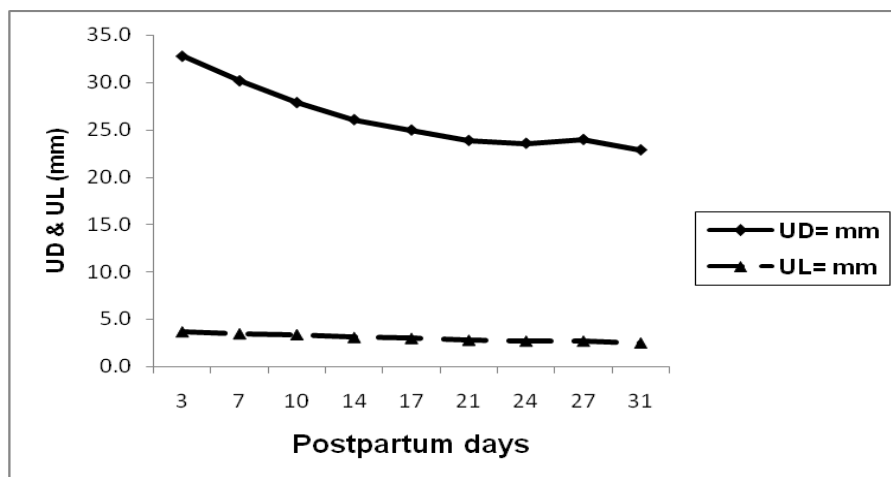
Fig.1. Uterine diameters (UD) and uterine lumen (UL) from day 3 to day 31 pp.
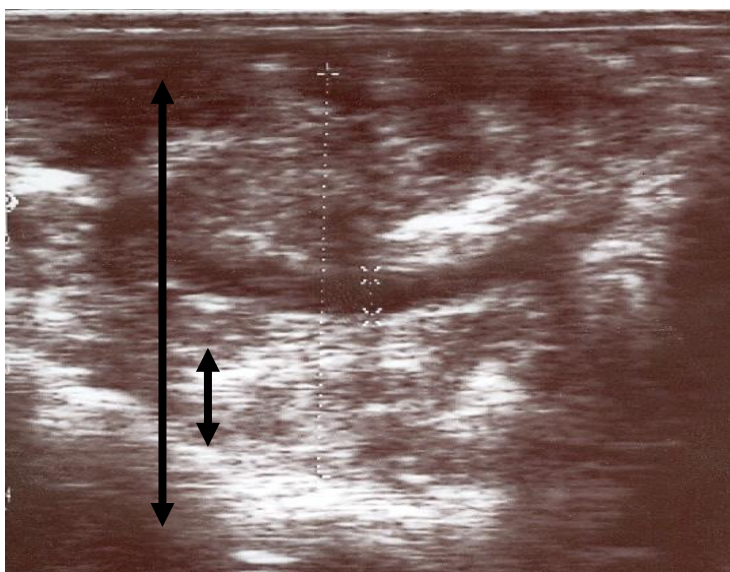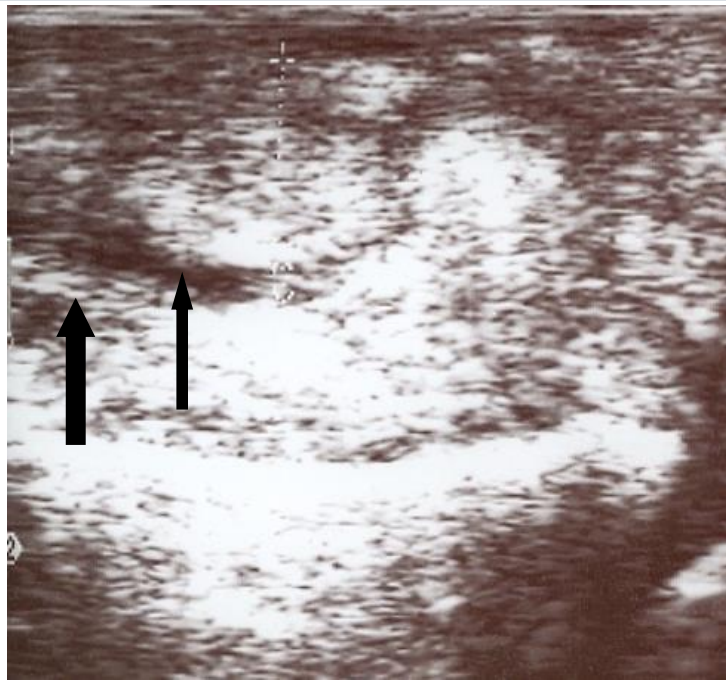

Fig. 2. Uterine diameter (32 mm) and uterine lumen (3.7 mm) on day 3 pp (arrows).
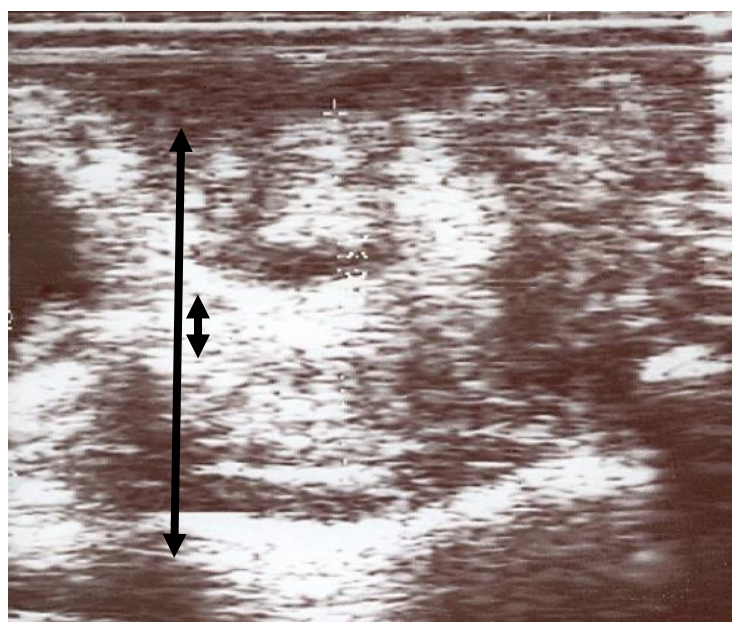
Fig. 3. Uterine diameter (22 mm) and uterine lumen on day 31 pp (arrows).

Fig. 4. Uterine lumen without lochia on day 31 pp (arrow).

Discussion

Study of the available literature and databases revealed limited information on using ultrasonography for measurement of uterine involution in goats. In Sudan ultrasound is adapted as diagnostic tool for pregnancy diagnosis in small ruminants in the clinic and few studies have been conducted in Saanen goats (Abdelgahfar *et al.*, 2007, 2010, 2011, 2012).

In the present study, the ultrasonographical appearance of the uterus was in accordance with previous reports in sheep (Hauser and Bostedt, 2002; Zdunczyk *et al.*, 2004) and goats (Ababneh and Degefa, 2005). The uterine wall and uterine lumen were rapidly identified by different echo-textures. Accumulation of fluid and debris (lochia) in uterine cavity were eliminated as early as 4-7 days post partum.

The maximum uterine diameter, in this study, was noted on day 3 and the minimum on day 31 postpartum. This was similar to that reported by Hauser and Bostedt (2002) in normally delivered ewes.

In previous studies in Balady goats (Ababneh and Degefa, 2005) and Farafra sheep (Hayder and Ali, 2008) more than 50% of the total reduction in uterine diameter was recorded between day 7 and day 14 postpartum. The same finding was found in the present study when uterine diameter decreased rapidly during the first two weeks (>50%), then slowed down from day 17 to day 27 postpartum.

The end of the uterine involution in the present finding was characterized by small diameter of the uterus and absence of lochia in the uterine lumen. This was similar to that ultrasonographic observed in sheep (Zdunczyk *et al.*, 2004; Hayder and Ali, 2008) and goats (Ababneh and Degefa, 2005; Takayama *et al.*, 2010), using ultrasonographic imaging.

Based on the present results, the period required for complete uterine involution in Nubian goats ranged between 17 and 27 days (22 ± 3.3 days) and this was in agreement with that revealed in German sheep (Hauser and Bostedt, 2002), Balady goats (Ababneh and Degefa, 2005) and Shiba goats (Takayama *et al.*, 2010). On the other hand, this result was different from those reported in Polish Long-wool sheep (Zdunczyk et al. 2004) and Farafra sheep (Hayder and Ali, 2008).

In conclusion, B-mode real-time ultrasonography is a useful and reliable method to monitor uterine involution in goat. Reduction in uterine lumen was gradual during postpartum period and accumulation of fluid (lochia) in the lumen disappeared during the first week.

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