American Journal of Biological and Environmental Statistics
2023; 9(1): 1-8
http://www.sciencepublishinggroup.com/j/ajbes
doi: 10.11648/j.ajbes.20230901.11
ISSN: 2471-9765 (Print); ISSN: 2471-979X (Online)

Biometrical Studies on the Oviduct and uterus of Slaughtered Balady Does During Estrous Cycle and Seasons in Sub Tropic

Mervat Sayed Hassan[1, *], Ahmed Mamdouh Osman[2], Hassan Abd El-Sabour Hussein[2]

[1]Department of Theriogenology, Faculty of Veterinary Medicine, New Valley University, New Valley, Egypt

[2]Department of Theriogenology, Faculty of Veterinary Medicine, Assiut University, Assiut, Egypt

Email address:

mervathassan1981@gmail.com (Mervat Sayed Hassan)

[*]Corresponding author

To cite this article:

Mervat Sayed Hassan, Ahmed Mamdouh Osman, Hassan Abd El-Sabour Hussein. Biometrical Studies on the Oviduct and uterus of Slaughtered Balady Does During Estrous Cycle and Seasons in Sub Tropic. *American Journal of Biological and Environmental Statistics*. Vol. 9, No. 1, 2023, pp. 1-8. doi: 10.11648/j.ajbes.20230901.11

Received: February 20, 2023; **Accepted**: March 14, 2023; **Published**: March 24, 2023

Abstract: The present work was aimed to study the biometrical measurements of the reproductive tract of slaughtered Balady does in relation to various reproductive conditions and seasons to establish the baseline for the size of each segments. *Methods:* 127 normal pair ovaries were taken for this purpose in Assiut province and classified according to phases of estrus cycle (Proestrous 39, Estrus 12, Metestrus 23 and Diestrus 53) and as well according to seasons (Autumn 36, Winter 40, Spring 26 and Summer 25). The oviduct total length was measured from the top of the fimbria to the tubal uterine horn junction. The lengths if its ampulla and isthmus were measured. Each oviduct weighed separately. The lengths and diameters of greater and lesser curvature of each uterine horn were then taken. The length and diameter of the attached portion of both horns was taken and the number of the protruded caruncles counted. The length of the uterine body as well as the length and diameter of the cervix were recorded. All these measurements were taken with a flexible metric tape. *Results:* Among different phases of estrous cycle, the estrus have the highest value for oviduct parameters and the lowest values were presented in metestrus ($p<0.05$). The autumn has the largest values for all of the measurements, with a significant difference between summer. The uterine horns showed highest values were recorded during diestrus. Significant differences were found in the diameters of uterine horn between seasons and the highest values were in winter followed by autumn then spring and summer ($P<0.05$-0.01). Moreover, the diameter of uterine body was highly significant during autumn. For all measured criteria, the summer has the lowest values. Significant correlation ($P<0.05$) was present between uterine weight and oviduct weight. The highest values recorded for length, diameter and weight were significantly noticed during estrus and diestrus ($P<0.05$-0.01). The lowest values were found during metestrus. Among seasons, significant differences in cervical diameters and weight at levels of $P<0.05$-0.001 were found. The autumn has the maximum values in comparison to other seasons. The summer has the lowest values. *Conclusion:* The genitalia of slaughtered Balady goats that the typical breeding seasons are absent in Balady goat, but during autumn there is marked tendency for better improvement in the biometry of the reproductive genitalia with an expected higher fertility.

Keywords: Balady, Does, Estrous, Oviduct, Breeding Season

1. Introduction

Goat is the most popular small ruminants in the world among farm animals (FAO; 2014) [10]. In Egypt, Balady goat is distributed all over the country as the animal of poor people due to its socioeconomic value. As far as the changes occurring in the ovarian biometry in Balady goat are concerned, Osman et al (2015) cited that the right ovaries are significantly larger, heavier and active than the left [20]. Moreover, during diestrus the ovaries are larger in weight and size than other phases of estrous cycle.

Goyal (2014) cited that the oviducts are divided into three distinct segments that transport the ova and spermatozoa in

opposite directions where further capacitation of the spermatozoa occurs [11]. The oviduct opens like a funnel (the infundibulum) near the ovary. The infundibulum receives ova released from the ovary and transports them to the site of fertilization in the oviduct.

Gupta et al (2011) found during their studies on the Biometry of Female Genital Organs of Black Bengal Goat that the mean length of the oviduct was 10.15 ± 0.228 cm [12]. El Agawany (1987) reported that the oviduct length and weight reached their maximum values at 7th month of age in Balady goat [9].

Robert (2004) and Maria, (2009) cited that doe's uterus is Bicornuate and has 15-20 cm long horn (in the non-pregnant state), meaning that it has two long corns or horns which connect the uterine body to the oviducts [21], [17]. Does are known to have a small uterine body, generally 3 cm in length and 2 cm wide. The uterus is a smooth muscular organ that stretches during the pregnancy along with the growth of a fetus or fetuses. The uterus protects and provides nourishment to the embryo and fetus during pregnancy. The uterus is also the site where the sperm cells reach maturation or capacitation, and where the embryo migrates and develops throughout pregnancy until parturition. Gupta et al (2011) reported from his studies on genital organs of Black Bengal Goat that the mean lengths of the uterine body and uterine horns were 2.50±0.112 and 12.287±0.270 cm, respectively, and the width of the uterine body and uterine horn were 2.739±0.079 and 2.805±0.069 cm, respectively [12].

Adigwe and Fayemi (2005) reported that the mean lengths of the uterine body, left and right horns were 5.83 ±1.69, 14.43 ±0.94 and 14.17 ±1.33 cm, respectively [3]. Goyal (2014) cited that the goat uterus is Bicornuate and each horn can contain one or more fetuses. The uterus is a smooth, muscular organ that stretches during the pregnancy along with the growth of a fetus or fetuses [11].

Basha and Abdul Ghani (2013) cited that most of the Bovidae have very similar placentas. And the average number of Caruncles ranged from 40 – 65 [6]. Al-Baggal et al (2003) reported that the caruncles of does are oval or round thickenings in the uterine mucosa resulting from proliferation of sub epithelial connective tissue. Caruncles are readily visible in the non-pregnant uterus of does [4].

Gupta et al (2011) recorded that the average number of Caruncles in uterus was 54.714±1.70 in Black Bengal Goat [12]. Out of the above information the goat has a wide range in the number of uterine caruncles.

As far s the cervix is concerned, Abebe (2004) described the cervix in goat to be the gateway to the uterus and it is a muscular canal consisting of several folds of tissue referred to as rings [1]. It has little smooth musculature.

Robert (2004) stated that the cervix (4-7 cm long), has an anterior and a posterior opening or os. It remains closed; however, it opens during heat under the influence of the hormone estrogen to facilitate the penetration of the sperm cells [21]. The cervix is also opened during parturition for the passage of the fetus. During pregnancy, the cervix enlarges like the uterus. The inner layer of the cervix has secretary cells that produce a thick mucus, or "plug," which accumulates during pregnancy to protect the uterine environment against pathogens or infectious agents and foreign bodies. Fayemi (2005) record that the mean lengths of the cervix was 2.59 ±0.61 cm [3], where (Smith, 1986) published shorter value of 5.5 cm for the same organ in goats [22].

Gupta et al (2011) decided with his studies on the Biometry of Female Genital Organs of Black Bengal Goat that the mean length and width of the Cervix were 3.348 ± 0.113cm, 1.7551 ± 0.042 cm, respectively [12]. Dayan (2010) reported that the cervical canal of Angora goat in Turkey is a potential area for problems related to uterine infection because it links septic vagina to the normally sterile uterus because it is an area through which sperm and neonates must pass [8].

It is evident from the literature at our disposal, that cattle and buffalo received great attention, during the last few decades, on the pattern of follicular dynamics. On the other hand, sheep and especially goat require much work on this aspect of reproductive physiology for better improvement.

2. Material and Methods

Animals and Experimental design

A total number of 127 intact genital organs were selected freshly from slaughtered, healthy; adult does more than one year of age. These animals were of unknown breeding history and slaughtered in four local abattoirs near Assiut City. Their meat was suitable for consumption. The genital tract excised from each animal and transported in a plastic bag to the lab. The present materials were collected during all seasons of the year (from April 2012 to September 2014). The obtained materials were classified according to the different phases of estrus cycle (Proestrous 39, Estrus 12, Metestrus 23 and Diestrus 53) and as well according to seasons (Autumn 36, Winter 40, Spring 26 and Summer 25).

2.1. The Oviduct

The oviduct was separated and its intact length (in situe position) taken. Its total length after removal of the surrounding tissue and stretching was measured from the top of the fimbria to the tubal uterine horn junction. The lengths if its ampulla (from the fimbria to the narrowest part of the tube) and isthmus (from the narrowest part of the tube to the uterotubal junction) were measured. The diameters of both ampulla and isthmus after dissection were taken. Each oviduct weighed separately.

2.2. The Uterus

The uterus after being dissected free from its surrounding attachments, examined morphologically in situe for the presence of any abnormalities and the symmetrical appearance of its uterine horns. The lengths of greater and lesser curvature of each uterine horn were then taken from the dorsal and ventral surface respectively using the flexible metric tape. This measurement was taken from the tip of each uterine horn anterior to the point of its attachment with the cervix posterior. The diameters of each horn were measured

by the caliber at its tip near the oviduct and at the point of attachment between the horns. The length and diameter of the attached portion of both horns was taken.

Each horn was then incised along its whole length (from its tip till the external os of the cervix) to expose the interior surface of the uterus. The appearance of the endometrium was described and the number of the protruded caruncles counted.

The length of the uterine body was taken from the site of horns bifurcation to the internal os of the cervix. After dissection, each uterine horn weighed separately as usual.

2.3. The Cervix

The length and diameter of the cervix were recorded. Its consistency was evaluated. The cervical length was measured as the distance between the external os and internal os while the diameter measured by the caliber at the middle portion. The cervix incised longitudinally to expose fully its cervical canal. The annular eccentric folds within each canal were counted in many cases. The cervix was weighed separately to the nearest 0.01 gm as usual.

2.4. The Vagina and Vulva

Some genital tracts were obtained including the intact vagina and vulva. Under these circumstances, the length of the vagina was taken as the distance from the external os of the cervix to the ventral commissars of the vulva. The longitudinal eccentric vaginal folds were counted and recorded. The length of the Vulva was taken as the distance between the upper and lower commissars. All these measurements were taken with a flexible metric tape.

Data obtained expressed as Mean ± MSD and subjected for statistical analysis using the student t-test and correlation between two factors according to Snedecor and Cochran (1980) and The Costat Computer Program (1986). [23, 7].

3. Results

3.1. The Oviduct

The oviduct is a tortuous tube extended from the ovary to the uterine horn. It lodges the border of the mesosalpinx (Figure 1). The bursa ovarica, which is a pocket formed between the mesoovarian and uteroovarian ligaments, is not well developed in doe as in cow. The oviduct has a fan like infundibulum close to the ovary, followed by the thickened ampulla then the narrowest isthmus, which gradually attached to the tip of uterine horn. The oviduct is very firm in texture and of pale pink coloration. Doe ampulla is highly tortuous in situe than the isthmus.

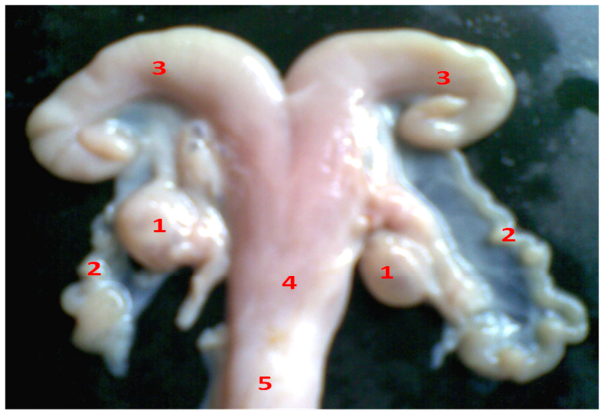

Figure 1. *1=Ovaries; 2=Oviducts; (Isthmus and Ampulla); 3=Uterine horns; 4=Uterine body; 5= Cervix.*

Among different phases of estrous cycle, table 1 showed that the estrus have the highest value for fallopian tubes parameters and the lowest values were presented in metestrus with a variable significant differences ($p<0.05$).

Out of table 2 it is evident that autumn has the largest values for all of the measurements taken than the other seasons, with a significant difference between autumn and summer. This was the case between ampulla and isthmus intact length ($p<0.01$) and isthmus straight length ($p<0.05$).

With regard to the ampulla, the straight length was nearly double fold larger than that taken in situe. Meaning that this part of the oviduct is highly tortuous than the other (isthmus).

Table 1. *Biometrical changes of oviducts parameters in slaughtered does as related to various reproductive conditions (MSD).*

Parameters (cm)	Oviduct	Proestrus (n=39)	Estrus (n=12)	Metestrus (n=23)	Diestrus (n=53)
Intact length (cm)	Ampulla	3.38±0.17*	3.87±0.13*	3.25±0.18*	3.56±0.18
	Ismuth	2.80±0.11	2.83±0.13	2.65±0.10	2.66±0.11
Straight length (cm)	Ampulla	5.96±1.53	6.80±1.30	6.33±1.32	6.51±1.20
	Ismuth	4.13±0.19*	4.80±0.13*	4.50±0.13	4.52±0.15
Diameter (cm)	Ampulla	0.32±0.08	0.33±0.07	0.30±0.09	0.31±0.04
	Ismuth	0.18±0.04	0.19±0.02	0.17±0.03	0.17±0.04
Total weight (g)		0.36±0.06	0.41±0.01*	0.30±0.03*	0.31±0.07

* = P<0.05

Table 2. *Biometrical changes of oviduct parameters in does as related to seasons (MSD).*

Parameters (cm)	Oviduct	Autumn (n=36)	Winter (n=40)	Spring (n=26)	Summer (n=25)
Intact length	Ampulla	3.90±0.13**	3.43±0.18	3.40±0.15*	3.33±0.11**
	Ismuth	3.09±0.18**	2.92±0.10	2.75±0.13	2.18±0.17**
Straight length	Ampulla	7.25±1.91	5.99±1.22	6.43±1.18	5.93±1.31
	Ismuth	4.76±0.10*	4.35±0.18	4.56±0.18	4.28±0.12*

Parameters (cm)	Oviduct	Autumn (n=36)	Winter (n=40)	Spring (n=26)	Summer (n=25)
Diameter	Ampulla	0.36±0.08	0.31±0.07	0.33±0.07	0.26±0.06
	Ismuth	0.21±0.03	0.17±0.03	0.18±0.04	0.15±0.02
Total weight (g)		0.39±0.04*	0.33±0.04	0.37±0.08	0.29±0.01*

* = P<0.05 ** = P<0.01

3.2. Uterus

The uterus has short body and two long tortuous uterine horns (Corunna). Both horns are attached together, at their origin from the uterine body and for a little distance, 4.5-6cm before being separated.

After their bifurcation, the uterine horns initially curved downwards and forward forming the great curvature externally. They pass backwards and upwards in a coiled shape that taper gradually to join the oviduct. Generally, both horns are symmetrical, in most cases, with invaluable differences in shape and size between them. Therefore, the data for only one side were considered. The inner border of such coiled horn is the lesser curvature. The intercornual ligament which joins both horns posterior at their base before being free appeared very small in comparison to cow or buffalo.

The inner lining of the uterine endometrium has 4 longitudinal rows of markedly distinguished protruded caruncles. Each raw has about 20-22 caruncles, per single horn, with a total number of 80 to 88. The gross shape of caruncles are nearly quadrilateral and of variable size. Each caruncle has 2 different dimensions (large at base and small at tip). The outer surface of the caruncles is usually smooth, round, faintly concave and more brownish in color than the endometrium (figures 2 & 3). The diameter of the caruncles decreased towards the uterine tip (0.57cm at base versus 0.37cm at tip). Caruncles near the body and even within it have larger size with faint depression. Close to horn tip, no Caruncles could be seen.

Out of table 3, it is evident that the diameters of uterine horns showed significant differences (P<0.05-0.001) between the different phases of estrous cycle and the highest values were recorded during diestrus. The other parameters of the uterine horns which include the length of great and lesser curvatures, uterine body length and diameter and uterine horn weight are nearly similar among phases of estrus cycle.

The results present in table 4, showed significant differences in the diameters of uterine horn between seasons and the highest values were in winter followed by autumn then spring and summer at levels of P<0.05-0.01. Moreover, the diameter of uterine body was highly significant during autumn. For all measured criteria, the summer has the lowest values.

It is of interest to mention that significant correlation (r=0.4206, P<0.05) was present between uterine weight and oviduct weight.

Figure 2. *Incised uterine horn showing the caruncles.*

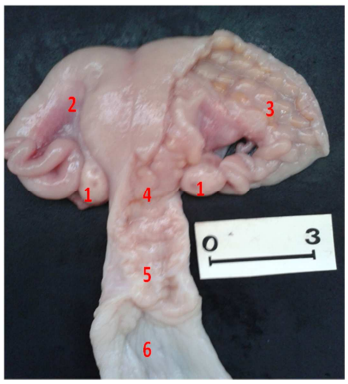

Figure 3. *Uterine caruncles and cervical annulai rings.*

1=Ovaries 2=intact uterine horn 3= Incised uterine horn showing caruncles 4=Uterine body 5= Incised cervix 6= Incised vagina

Table 3. *Biometrical changes of uterine parameters in does as related to various reproductive conditions (MSD).*

Uterine parameters	Proestrus (n=39)	Estrus (n=12)	Metestrus (n=23)	Diestrus (n=53)
Length (cm)				
Great curvature	12.80±3.69	13.00±3.82	12.30±2.50	12.33±2.87
Lesser curvature	7.12±1.44	8.00±1.95	5.94±1.20	6.86±1.76
Diameter:				
Anterior	0.45±0.02***	0.52±0.01	0.54±0.08	0.56±0.01***
Base	0.87±0.04**	0.89±0.06	0.99±0.03**	0.99±0.02**
Fused	1.18±0.11*	1.59±0.13	1.66±0.15	1.68±0.14*
Body				
Length	2.08±0.33	2.10±0.31	1.61±0.26	1.91±0.25
Diameter	1.20±0.17	1.23±0.17	1.36±0.16	1.42±0.14
Weight (g)	13.09±3.45	13.55±3.33	11.41±2.61	12.47±2.57

* = P<0.05 ** = P<0.01 *** = P<0.001

Table 4. *Biometrical changes of uterine parameters in slaughtered does as related to seasons (MSD).*

Uterine parameters	Autumn (n=36)	Winter (n=40)	Spring (n=26)	Summer (n=25)
Length (cm)				
Great curvature	12.40±2.97	13.87±3.83	12.11±2.72	12.05±3.14
Lesser curvature	7.11±1.29	7.48±1.20	6.62±1.12	6.71±1.57
Diameter:				
Anterior	0.55±0.02*	0.58±0.04*	0.48±0.07	0.46±0.02*
Base	1.00±0.02	1.07±0.08**	0.90±0.01*	0.77±0.01**
Fused	1.65±0.17	1.78±0.18*	1.47±0.10	1.21±0.18*
Body				
Length	2.16±0.35	1.98±0.21	1.86±0.35	1.70±0.26
Diameter	1.48±0.10*	1.33±0.17	1.28±0.18	1.12±0.12*
Weight (g)	13.61±6.13	13.68±6.06	12.30±5.12	10.86±4.43

* = P<0.05 ** = P<0.01

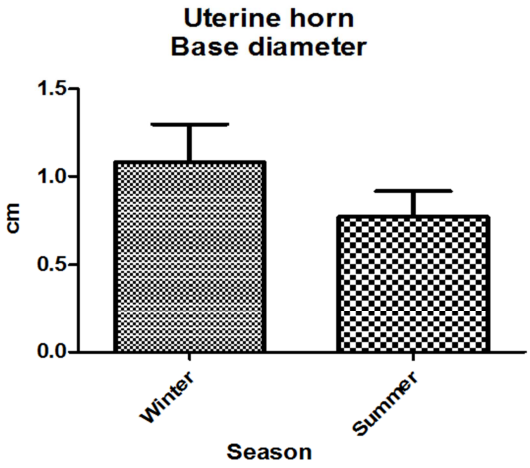

Figure 4. *Showing difference in uterine base diameter between winter and summer (p<0.01).*

3.3. Cervix

The cervix is a tubular rigid sphincter muscle join the anterior vagina to the uteArine body. It is firm and cartilaginous in texture when rolled between fingers. Its line of demarcation can be achieved by palpation. The external os or portio of the cervix is circular with two rings and faintly protruded into the anterior vagina (Figure 4). Blunt small tube can pass easily through the cervical canal especially during estrus. In longitudinal incision, its inner lining has 4-6 annular folds.

As far as the uterine cervix parameters are concerned, table 5 showed that the highest values recorded for length, diameter and weight were noticed during estrus and diestrus at significant levels of P<0.05-0.01. However, the lowest values were found during metestrus. Among seasons, table 6 showed significant differences in cervical diameters and weight at levels of P<0.05-0.001. The autumn has the maximum values in comparison to other seasons. The summer has the lowest values.

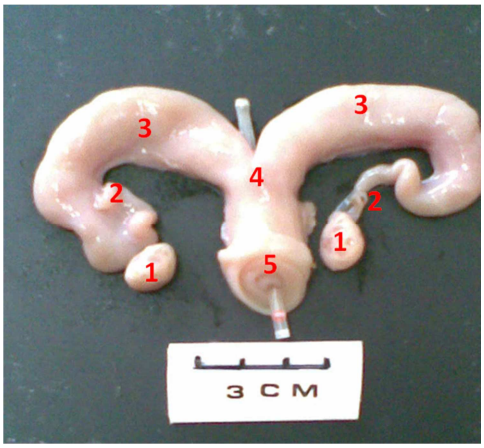

Figure 5. *Showing the cervix and its annular portio with a blunt tube passed through its canal.*

1=Ovaries 2=Oviducts 3=Uterine horns 4=Uterine body 5=Cervix with introduced mini-tube

Table 5. *Biometrical changes of cervix parameters in slaughtered does as related to various reproductive conditions (MSD).*

Parameters	Proestrus (n=39)	Estrus (n=12)	Metestrus (n=23)	Diestrus (n=53)
Length	3.32±0.10	3.70±0.13*	3.18±0.19*	3.63±0.16
Diameter	1.29±0.04*	1.50±0.05**	1.13±0.07**	1.33±0.04
Weight (g)	5.60±0.22	5.73±0.20*	4.70±0.22*	5.61±0.23

* = P<0.05 ** = P<0.01

Table 6. *Biometrical changes of cervix parameters in slaughtered does as related to seasons (MSD).*

Parameters	Autumn (n=36)	Winter (n=40)	Spring (n=26)	Summer (n=25)
Length	3.69±0.10	3.60±0.11	3.42±0.12	3.13±0.18
Diameter	1.55±0.09***	1.19±0.04**	1.26±0.07	1.04±0.01***
Weight (g)	5.92±0.22*	5.14±0.28	5.53±0.29	4.95±0.24*

* = P<0.05 *** = P<0.001

3.4. Vagina and Vulva

The vagina is the copulatory organ of the female. It extends from the cervix to the vestibulum and vulva exteriorly. Its inner lining exhibited many longitudinal folds. In the present slaughtered does it varies in length between 8.5 and 11 cm.

The terminal portion of the vagina is known as the vestibule through which the urethral opening is located ventrally.

The vulva is the end point of the reproductive tract. It has two labia which meet dorsally and ventrally in two commissures. The ventral commissure encloses the clitoris which is very small in size. Soft fine hair can be seen in the outer surface of the labia. The distance between the two commissures varied between 3 and 3.5 cm.

Statistics

The overall weights of the reproductive tract in slaughtered non pregnant does which includes both oviducts, uterus and cervix after removal of the extraneous tissues are revealed that autumn has the maximum value among other seasons of the year (47.96±5.33, 43.59±4.61, 40.27±5.27 and 38.74±4.41g for autumn, winter, spring and summer respectively).

Correlations between ovarian weight and each of oviduct, uterus and cervix were found to be not significant.

4. Discussion

4.1. Oviducts

As far as the oviduct is concerned, Woodruff and Pauerstein (1969) pointed out that Gabriel Fallopius, the human anatomist, is the first who discover the oviduct in 1561 [24]. The term oviduct is applied to animal while the term Fallopian tube is applied to human.

The anatomical features of the oviduct in slaughtered Balady does are in harmony with other work in goats that it is tortuous in situe with higher thickness of the ampulla than the isthmus (Gonzalez-Stagnaro (1983) and El Agawany, 1987) [13, 9]. The underdeveloped pouch of the bursa ovarica noticed in the present work on doe coincides with that reported by Abd-Elnaiem (2007) [2]. The intact length of the oviduct is shorter than the straight length, slightly less than its half total length. El Agawany (1987) reported an average total length of 8.6 cm for the oviduct in slaughtered goat at 21 month of age [9]. This value is less than the obtained value (average 10.06 cm) and the difference in age might be responsible for such difference. Hafez (1987) reported higher average value of 13.9 and 13.7 cm for the right and left oviducts in Maradi goats [4]. This insignificant difference between right and left side was noticed also in Balady goat in the current investigation.

The obtained data showed significant higher values during estrus especially with regard to the oviduct weight. It seems possible that under estrogenic phase of the cycle the oviduct activity became high to receive to ova and be ready for the act of fertilization. Among different seasons, the autumn appeared to have the maximum values for the different parameter of the oviduct. This is in general trend with other results recoded for the ovary in Balady goat. This means that the autumn has a tendency for favorable reproduction in goat in Upper Egypt. Ali et al (2009) reported that seasons did not affect reproduction in Farafra ewes [5].

The average length of oviduct in Awassi doe in Syria has a range of 15.9-22.4 cm without any significant differences between the left and right side (Koujan 1974) [16]. The same authors reported that months of autumn have the highest values for the oviduct length and diameters.

4.2. The Uterus

The descriptive morphology of the uterus in the present study referred to the bipartite type of uterus, two long horns with short body, and these results are similar to that reported by Abd-Elnaeim et al (2007) and Maria (2009). The intercornual ligament is not well developed as in cow [2, 17].

The obtained measurements of uterine horn diameters have significant differences between seasons and the highest values were recorded during diestrus (0.56 ± 0.01, 0.99± 0.02 and 1.68± 0.14 cm at anterior tip, base and fused portions respectively). The high levels of progesterone during this phase of the cycle have great effects on the functional activities of the endometrial glands. As early as (1951) Hamilton and Harrison cited that the uterine glands in goats showed more advanced changes with evidence of impending secretary activity under the influence of functioning C. L. [15].

The diameters, of uterine horn at 21 months of age in Balady goat were 0.6, 0.4 and 0.2 cm for the base, middle and apex of uterine horn respectively as reported by El Agawany (1987). The same author found highly significant correlations between uterine horn diameter and each of live body weight and combined weight of both ovaries in postnatal growing Balady goats [9].

In the present work significant correlation was present between uterine weight and oviduct weight. This may indicate that the hormonal effects of the ovarian hormones on both organs might be of great similarity in adult cycling non pregnant Balady goats and both organs behaved as one unite.

In slaughtered Awassi doe in Syria, Koujan (1974) reported that the weight of uterus averaged 40.1 g as a maximum value in October [16]. The lowest value was recorded in April (25.5 g). The inner lining of the uterine endometrium of Balady goat has 4 regular longitudinal rows of markedly distinguished protruded caruncles. Each raw has about 20-22 caruncles, per single horn, with a total number of 80 to 88. These numbers was higher than those reported in ewe (50-60 per single horn) as recorded by Smith (1986) and Wooding et al (1993), Basha and Abdul Ghani (2013). [22, 24, 6].

The shape of the uterine caruncles in the present study are nearly quadrilateral and of variable size. Each caruncle has 2 different dimensions (large at base and small at tip). The

outer surface of the caruncles is usually smooth, round, faintly concave and more brownish in color than the endometrium and these are similar to that reported by Abd-Elnaeim *et al,* (2007) [2].

Hamilton and Harrison (1951) mentioned that in mixed breeds of goat, the lumen of the uterine horn is stellate in shape and the caruncles were with fairly defined contour and irregularly placed in the mucosa [15].

Seasons have no significant effect on uterine parameters except with diameters of uterine body and horn when significant differences were noticed in autumn and winter.

4.3. Cervix

Concerning the biometrical investigations of the cervix, the obtained results have nearly the same trend of variations with regard to phases of estrus cycle or seasons. It is evident here that the functional activities of this organ were higher during estrus and during autumn. At 7 month of age At 7 month of age El Agawany (1987) reported smaller values (2.3 and 1.05 cm for the length and diameter of the cervix) than our results (3.69 and 1.55 cm for both measurements respectively [9].

The cervical canal in Balady goat has 4-6 annular folds which are nearly similar to the average value of 4.3 as reported in Angora goat by Mustapha et al (2010). [19]. The same authors added that theses circular folds were of high volumes in the caudal part of the cervical canal. The blind sacs between them are deeper than the cranial half. A finding which should be considered during artificial insemination technique in goat. Hamilton and Harrison (1951) cited that the cervix has no glands in goat but has many secretary goblet cells which are highly active during estrus. At diestrus, the cervical folds elongated and thickened to close the lumen under the influence of progesterone from the C. L. [15].

4.4. Vagina and Vulva

The obtained measurements of the vagina and vulva in slaughtered cycling non pregnant does are higher than those reported by El Agawany (1987) in growing goat at 7 month of age (4.75 ± 0.25 and 3.05 ± 0.3 versus 8.5-11 and 3-3.5 cm for the length of the vagina and vulva respectively [9]. Mc Entee (1990) described the vagina in goat to be retroperitoneal with layers of smooth muscles fibers and loose connective tissue [18]. The observed longitudinal folds in the vagina of studied goats are in agreement with Hamilton and Harrison (1951). They cited that the vagina of goat is thrown into a number of small well-marked longitudinal folds which is most pronounced at estrus [15].

However, the overall weight of the genital tract from slaughtered non pregnant Balady goat is found much higher than that of 23.2 ± 2.23 g as reported by El Agawany (1987) at 7 month of age. The overall weight reported in the present investigation were 47.96±5.33, 43.59±4.61, 40.27±5.27 and 38.74±4.41g for autumn, winter, spring and summer respectively [9]. The pondreal increase in the total weight of the genitalia during autumn than any other seasons may reflect high reproductive activity in this season but not at significant levels.

5. Conclusion

The cyclical changes occurring in the reproductive genitalia of slaughtered Balady goats are closely associated with the changes that occurred in the ovary. Moreover, autumn has a marked tendency for better improvement in the biometry of the reproductive genitalia with an expected higher fertility.

References

[1] Abebe, G. (2004): Sheep and Goat Production, Handbook for Ethiopia. Ethiopia Sheep and Goat Productivity Improvement Program., http://www.agric.nsw.gov.au.

[2] Abd-Elnaeim, M. M. M. (2007): Scanning Electron Microscopic Study on the Cyclic Goat Uterus with Special Reference to the Microvascular Architecture of the Uterine Caruncles. *J. Agri. & Vet. Sci. Qassim Uni.* Vol. 1. No. 1, pp. 21-32.

[3] Adigwe, P. I. and Fayemi, O. (2005): A biometrical study of the reproductive tract of the Red Sokoto (Maradi) goats of Nigeria. Pakistan Vet. J. 25, 3.

[4] Al-Baggal, H. A. R., Al-Dahash, S. Y. A., and Alwan, A. F. (2003): Macroscopic study of the female genital system in Iraqi goats. Depart. of Surg. & Obs., College of Vet. Med., Univ. of Mosul, Mosul, Iraq.

[5] Ali, A., Hayder, M. and Derar, R. (2009): Reproductive performance of Farafre ewes in the subtropics. Anim. Reprod. Sci. 114: 356-361.

[6] Basha, S., Abdul Ghani, M. (2013): Some anatomical and histological studies on the placenta of goats in Dhamar, Yemen. Depart. Vet. Med. Fac. of Agri. & Vet. Med., Uni. of Thamar, Yemen. Yemeni Journal of Agri. & Vet. Sci., 1 (1): 26-32.

[7] Costat Computer Program (1986): Version 3.03, Copyright C. C. P Software.

[8] Dayan, M. O., Eken, K., B., E. and Oskadif, S. (2010): Anatomy of cervical canal in the Angora goat (Capra Hircus). Kafkas Univ. Vet. Fak. Derg, 16, 5, 847-850.

[9] El-Agawany, A. A. A. (1987): Pubertal development and estrous activity in Baladi Goats. Ph.D. Thesis., Theriogenology; Cairo University.

[10] FAO and IAEA (2014): Animal production and Health Newsletter, ISSN 1011-2529, 57, January.

[11] Goyal, A. K. (2014): Phytochemistry and in vitro studies on anti-fertility effect of Ficus Religiosa Fruits extract on uterine morphology of goat (Capra hircus). Int. J. Drug Dev. & Res. 6, 2, 141-158.

[12] Gupta, M. D., Akter M. M., Gupta A. D., Das A. (2011): Biometry of Female Genital Organs of Black Bengal Goat. International (Journal of Natural Sciences) Vol 1, No 1: 12-16.

[13] González-Stagnaro, C. (1983): Comportamiento reproductive de las razas locales de ruminates en el Tropico Americano. In: Chemineau, P., Gauthier, D., Thimonier, J. (Eds), Reproduction des Ruminants en Zone Tropicale (pp. 180). France: Institut National de la Recherche Agronomique.

[14] Hafez, E. S. E. (1987): Reproduction in Farm Animals. 5th edition. K. M. Varghese Company Post Box 7119, Bombay, India.

[15] Hamilton, W. J. and Harrison, R. J. (1951): Cyclical changes in the uterine mucosa and vagina of goat. J. Anat. 85, 4.

[16] Koujan Abdel-Hamed S. (1974): Morphogyn-Ecological studies of the genitalia of Syrian Awassi ewes. M. V. Sc. Obst. Gynaec. & A. I. Cairo Univ.

[17] Maria L. B. (2009): Biology of Reproduction of Goats Pages: 8, Balance: 0, PubID: UNP-0107.

[18] McEntee, K., (1990): Reproductive pathology of Domestic Mammals. Ch 3: The ovary, PP31-51, Academic Press, Inc. NY, Tokyo.

[19] Mustapha, O. D., Kamil, B. E. E. and Sema, O. (2010): Anatomy of cervical canal in the Angora goat (Capra hircus). Kafkas University. Fak. Derg, 16, 5, 847-850.

[20] Osman, A. M., Shehata, S. H., et al., (2015): Effect of seasons on ovarian morphology and oocytes quality in slaughtered buffaloes. Assuit Vet. Med. J., 51, 105, 314-330.

[21] Robert (2004): North Former Veterinary Officer, NSW Agriculture (Reviewed JT Seaman Program Leader Flock Health), Anatomy and physiology of the goat Agfact A7.0.3, second edition.

[22] Smith, M. C. (1986): Caprine reproduction. In: Current Therapy in Theriogenology, Marrow, D. A. (ed.) 2nd Ed. W. B. Saunders, Philadelphia, USA, pp: 577-579.

[23] Snedecor, B. W. and Cochran, W. G. (1980): Satistical methods, 7th Ed. Iowa state Univ. Press, Ames, Iowa, USA.

[24] Wooding, F. B. P., Hobbs, T., Morgan, G., et al (1993): Cellular dynamics of growth in sheep and goat synepitheliochorial placentomes: an autoradiographic study. *J. Reprod. Fertil.*; 98: 275–283.

[25] Woodruff, J. D. and Pauserstein (1969): The fallopian tube. Williams and Wilkins, Baltimore, USA.