

5 **Biometrical Changes in Reproductive Tract of Arbia Goats According to Age,
Body Condition and Pregnancy**

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Abstract

Background: Improved reproduction requires an understanding of the biometry of goats' female reproductive system.

20 **Objectives:** The present study was conducted to record the biometry of the female genital organs of the Arbia goats in Algeria, according to age, body condition score, and pregnancy.

Methods: A total of 149 reproductive tracts (80.54% non -pregnant and 19.46% pregnant) from three slaughterhouses were collected and measured. The length, width, thickness, and weight of each organ were measured using slide calipers, and an electric weighing balance. Ages of the
25 fetuses in pregnant goats were determined using measurements of their crown-rump length. Analysis was carried out using SPSS, version 21.

Results: The reproductive tract measurements increased with age, body condition score, and stages of pregnancy. The weight, length, and width of the left ovary showed very highly significant ($P<0.001$) increases across age. The measurements of the uterine horn (except
30 thickness) increased significantly ($P<0.001$) with ages. The fallopian tube, the uterine body and the cervix measurements showed significant increases ($P<0.001$) between the first and third groups of age.

The dimensions of the ovary and the uterine body showed very highly significant ($P<0.001$) increases across body condition score.

35 Pregnancy had no significant effect on the ovary's and cervix' dimensions. The uterine horn measurements showed significant increases ($P<0.05$) throughout gestation, and those of the uterine body showed extremely significant increases ($P<0.001$) along the stages of pregnancy.

Conclusions: This study will provide baseline information on the morphology of the female Arbia breed reproductive system.

40 **Keywords:** Age, Arbia, goat, morphometry, pregnancy.

1. Introduction

45 According to FAO statistics, in 2017, Algeria had about five million head of goats (FAOSTAT, 2018). Small ruminants play an important role in food security for livestock keeping households (Wodajoet *al.*, 2020). Goats provide milk, meat, fiber, and skin. It provides rural residents with both animal protein and a source of income, especially in developing countries (Escarnoet *al.*,

2013). Additionally, goat milk is considered to be a potential source of various macro- and micro-
50 nutrients which help in promoting nutritional and desirable health benefits (Nayik et al., 2021).

In order to meet the growing demand for meat and milk, goat breeds that are adapted to specific regions should be examined for their reproductive performances and maturity level.

Currently in Algeria, four local breeds have been identified phenotypically and genetically: Arbia, Mekatia, Naine of Kabyle, and M'zabite (Tefiel *et al.*, 2018).

55 The Arbia goat is the dominant breed, located especially in the steppe regions and high plateau (Ouchene-Khelif *et al.*, 2021), subjected to extensive breeding conditions, Arbia breed is characterized phenotypically by a multicolored coat, long hair and a low waist of 50-70 cm, a head devoid of horns with pendulous ears (Laouadi *et al.*, 2020). It is raised for its meat, for the quality and quantity of its hair (Ouchene-Khelif *et al.*, 2021), and it has an acceptable milk
60 production capacity (Djouza and Chehma, 2018). Additionally, this native goat is very good at adapting to environmental changes.

To maintain a good reproductive performance and serve as an economic resource, it is important to have a firm understanding of the breed's reproductive anatomy. The female animals' genitalia anatomy provides information about their general health, for pregnancy diagnosis, treatment, and
65 dealing with issues related to infertility, knowledge of the biometrical status of the female genital tract is necessary (Bhat *et al.*, 2011). Also, modern methods of population growth like artificial

insemination (AI) and in-vitro fertilization (IVF) require a thorough understanding of female reproductive biometry. Compared to cattle, buffaloes, ewes, and pigs, the reproductive architecture of these animals is poorly known, description of goat is usually made as if it is
70 identical to sheep (Smith and Saunders, 1986).

Animal morphology shows considerable variation with respect to breed, age, sex, nutritional condition, pregnancy, and environmental factors among others (Alpak et al., 2009). Thus, measurements are important tools for comparison. In order to achieve a more objective assessment, numerous metrical measurements need to be carried out (Brombinet et al., 2009).

75 To our knowledge, biometric parameters of different segments of the reproductive tract of the Arbia goat have never been reported. Therefore, this is the first study undertaken with the aim of determining the biometry of the female genital organs of the Arbia goat kept in Algeria according to age, body condition score, and pregnancy. The reproductive biology and biotechnology of small ruminants will greatly benefit from the insights gained from the current
80 study.

2. Material and methods

85 **2.1.Ethical approval**

The European Communities Council Directive (2010/63/EU) for animal experiments was followed in this study. The genitals that were the subject of our study came from animals slaughtered at the slaughterhouse, and the latter were destined for incinerating.

2.2. Study area and sample collection:

90 This investigation was carried out at the laboratory of veterinary sciences, University of Tiaret, from June,2021 to November, 2022.

One hundred forty-eight genital tracts (80.54% non -pregnant and 19.46% pregnant) of the Arbia goat were collected from three slaughterhouses located in the Tiaret region of Algeria. Tiaret is a major agricultural center on the Sersou Plateau, dealing in wheat and livestock. According to the
95 Köppen classification, the climate in the Tiaret region is CWa, characterized as a hot, summer Mediterranean climate. The average rainfall is 472 mm per year, and the mean temperature is 15.5 °C.

2.3. Animals

Non-pregnant goats were grouped according to age (based on the dental pattern): 6-12 months,
100 12-36 months, and >36 months, and to the body condition score (emaciated, thin, average), as reported by Ghosh *et al.* (2019).

Crown-rump length measurements of the fetus were used to estimate the fetus' age in pregnant goats, which were grouped according to stage of gestation (first trimester: 21-49 days: 18, second trimester: 42-77days: 10), as described by Sivachelvan *et al.* (1996) and Martinez *et al.* (1998).

105 **2.4. Sample collection**

After slaughter, the genital tract was removed from the pelvic viscera and transferred immediately in a plastic bag to the laboratory of the Institute of Veterinary Sciences of Tiaret.

2.5. Measurements

110 In order to better examine the organs, extra fat was carefully removed through dissection, and then the organs were washed and positioned normally on a table.

Length, width, and thickness of different segments were measured by a measuring scale and recorded in millimeters (mm) (Figure 1).

The weight of each organ was determined using an electric balance (Ohaus[®]; USA), recorded in grams (g) (Figure 2).

115 **2.6. Statistical analysis**

The data obtained was recorded in Microsoft Excel 2016. The descriptive analysis was performed with IBM SPSS, version 21, and the results were expressed as mean \pm standard error.

Before analyzing the data on age, BCS, and pregnancy groups, the normality of the data was tested using the Kolmogorov-Smirnova test. The Kruskal-Wallis test and one-way analysis of variance test were used. In order to determine the significance between groups, the Mann-Whitney and Tukey tests were used. The data from the pregnancy samples were subjected to t-test and Mann-Whitney test. The level of significance was recorded at 5%.

3. Results

The genital tract of the Arbia goat is composed of a pair of ovaries, a pair of fallopian tubes, a pair uterine horns, the body of the uterus, the cervix, the vagina, and the vulva (Figure3 & 4).

A comparison of the size of the Arbia goat's reproductive tract based on its age is presented in the Table 1.

In comparison to the left ovary, the right ovary was heavier and longer. In contrast, the left side of the fallopian tube and the uterine horn were heavier and longer than the right ones.

There was no significant difference ($P>0.05$) in dimensions between the left and right ovaries in the first and second groups, but there was a very highly significant difference ($P<0.001$) in weight and length of the ovary across ages.

The length and weight between left and right fallopian tubes in each age group show no significant difference ($P>0.05$), while there was a very highly significant difference ($P<0.001$) in weight across ages.

In terms of uterine horns, the length, width, and thickness of the right and left horns differ significantly in the first and second groups, while the measurements (weight, length, and width) of the uterine horns differ highly significantly across ages ($P<0.001$).

The uterine body weight, width, and thickness revealed highly significant differences ($P<0.001$) between age groups.

There were no significant differences ($P>0.05$) between the second and third groups in the cervical weight, length, and thickness.

The dimensions of the ovary, uterine body, and cervix showed a statistically significant difference ($P<0.001$) between the first and third groups.

Biometry of the reproductive tract according to body condition score is indicated in the Table 2.

For the body condition score, all ovarian measurements showed highly significant differences ($P<0.001$) between groups. With the exception of weight, there were differences between the left and right ovary in terms of their length, width, and thickness.

Between the left and the right fallopian tubes in the second and third groups, there were no appreciable changes in length or weight ($P > 0.05$). However, the length of the fallopian tube varied significantly ($P < 0.001$) between the first and third groups across the BCS.

Right and left uterine horns in the first and second groups differed significantly ($P < 0.05$) in length, width, and thickness, while there were highly significant differences ($P < 0.001$) in weight, length, and width of uterine horns across the BCS.

There were very highly significant differences ($P < 0.001$) in the measurements and weight of the uterine body between all BCS groups.

Cervical measures and weight varied very significantly ($P < 0.001$) between the first and second groups as well as between the first and third groups.

Biometry of the reproductive tract according to stages of gestation is presented in the Table 3.

There was no significant difference ($P > 0.05$) in measurements between the left and right of the ovaries, oviducts, and uterine horns in both the first and second trimesters of pregnancy.

The length of the fallopian tube showed no significant increases throughout pregnancy, while the weight showed extremely significant increases ($P < 0.001$) along the stages of gestation.

There were very highly significant differences ($P<0.001$) in all measurements and weights of the
165 uterine horn and the uterine body along the stages of pregnancy.

A total of 33 fetal losses occurred as a result of the 18.9% (28/148) slaughter of pregnant goats.
The first trimester of pregnancy showed the highest prevalence (64.3%), followed by the second
trimester (35.7%) (Table 4).

4. Discussion

170 The biometrical measurements were carried out on a total of 149 reproductive tracts (80.54%
non-pregnant and 19.46% pregnant). The mean (\pm S.E) of length, width, thickness, and weight of
different segments are presented according to age in the Table 1 and according to body condition
score in the Table 2.

In the present study, the mean weight, length, and width of the right ovary in Arbia goat at 6-12
175 months were 0.79 ± 0.05 g, 15.50 ± 0.47 mm; 10.98 ± 0.29 mm, respectively, and those of the left
were 0.75 ± 0.03 , 15.35 ± 0.33 mm; 10.73 ± 0.28 mm, respectively. The mean values for weight of
the right and left ovaries were lower than those given by Uddin *et al.* (2021) at 7-12 m, but the
mean length and width of the right and left ovaries were higher than those reported by Uddin *et*
al. (2021) at 7-12 m in Black Bangle goats.

180 The average measures (weight, length, width, and thickness) of the right and left ovary at 12-36
m in this study were higher than the results of Kirbas Dogan *et al.* (2019) in the Anatolian Wild
goat, and those of Haque *et al.* (2016) in the Black Bengal goat. However, these results were
lower than the results in Iranian native goats (Mohammadpour 2007).

The weight and width between left and right ovaries in this study did not reveal a significant
185 difference, these findings were similar to those reported by Aliyu *et al.* (2016) in the Sahel breed
of Nigeria.

There was a very highly significant difference ($P < 0.001$) in the weight of the ovary across ages,
however, Aliy *et al.* (2016) reported that there was no significant difference. The weight of the
ovary is influenced by the number and size of follicles and corpus luteum that it contains.
190 Kouamo *et al.* (2015) stated that a good nutritional status had a positive influence on the
follicular population. Moreover, the animal's age has an impact on the ovary's weight, which
increases during the pubertal stage and more so during the post-pubertal stage than during the
pre-pubertal stage, according to Sahu *et al.* (2017).

Based on our results, the right ovary was heavier than the left one according to age, body
195 condition score, and pregnancy, indicating that the right ovary is more active than the left, as
supported by previous studies (Gupta *et al.*, 2011; Reasul *et al.*, 2018; Kirbas Dogan *et al.*,
2019).

In this study, the lengths of the right and left fallopian tubes at 6-12 months were 165.55 ± 4.35 mm and 176.88 ± 4.35 mm, respectively. These findings were significantly higher than the results of Uddin *et al.* (2021), which were 93 ± 0.57 mm and 90 ± 0.54 mm, respectively, at 7-12 m in Black Bengal goats.

The mean lengths of the right and left fallopian tubes in Arbia goat at 12-36 months were 170.80 ± 4.38 mm and 178.70 ± 4.18 mm, respectively, which were longer compared to the salpinx's length in Red Sokoto goat, Black Bengal goat, and Anatolian goat, reported by Adigwe and Fayemi (2005), Gupta *et al.* (2011), and Kirbas Dogan *et al.* (2019).

The mean weights of the right and left fallopian tubes at 12-36 m were 0.45 ± 0.02 and 0.46 ± 0.02 g, respectively; these results were higher than those recorded in Anatolian goat by Kirbas Dogan *et al.* (2019). The salpinx of the Arbia goat is longer than that of other breeds, this may be related to the breed of goat studied.

At 6–12 months, the length and the width of the right uterine horn were 62.05 ± 1.88 mm and 9.63 ± 0.41 mm, respectively. The length and the width of the left uterine horn were 66.80 ± 2.00 mm and 9.25 ± 0.39 mm, respectively. However, Uddin *et al.* (2021) reported greater length and width for both the right and left uterine horns of Black Bengal goats at 7-12 m.

The right and left uterine horns measured 79.70 ± 2.85 and 84.83 ± 2.76 mm in length, respectively, at 12-36 m. Comparatively, Adigwe and Fayemi (2005) and Gupta *et al.* (2011) reported relatively longer lengths for Red Sokoto goats and Black Bengal goat, although, Kirbas Dogan *et al.* (2019) found a shorter length for Anatolian goats.

The width of the right and left uterine horns at 12-36 m in this study was less than that measured in Red Sokoto, Black Bengal and Anatolian goats by Adigwe and Fayemi (2005), Gupta *et al.* (2011), and Kirbas Dogan *et al.* (2020), respectively.

In this study, the average measures (weight, thickness) for the uterine horn at 12-36 m were higher than those mentioned by Kirbas Dogan *et al.* (2020).

There was a significant difference in weight and length of the uterine horn across ages, which is in agreement with the results of Abiaezute *et al.* (2017) in the West African Dwarf goat of Nigeria.

The mean length of the body of the uterus was 32.83 ± 1.53 mm at 6–12 m; comparatively, a lower length was obtained in Black Bengal goats at 7–12 m (22.7 ± 0.16 mm) (Uddin *et al.*, 2021). The increase in length of the body of the uterus may be due to repeated cycles (Shalini *et al.*, 2013). On the other hand, a higher width was recorded in the Black Bengal goat (Uddin *et al.*, 2021). (29.5 ± 0.31 mm) at 7–12 m of age in comparison to the current study.

The mean values for weight, length, width, and thickness of the body of the uterus at 12-36 m were higher than those given by Kirbas Dogan *et al.* (2020) in the Anatolian Wild goat, however, Adigwe and Fayemi, (2005) reported a higher length of the body of the uterus in the Red Sokoto goat.

235 There was a significant difference in the weight of the uterine body across ages, which is in accordance with the report of Abiaezute *et al.* (2017).

The length of the cervix at 6-12 months in this study was 25.50 ± 1.80 mm, whereas it was 27.8 ± 0.31 mm in Black Bengal goats reported by Uddin *et al.* (2021) at 7-12 months. The length of the cervix is influenced by factors including age, species, physiological conditions, and the number
240 of births (Abiaezute *et al.*, 2017).

The width of the cervix in Arbia goats at 6–12 months (13.63 ± 0.59 mm) was slightly higher than that obtained by Uddin *et al.* (2021) in Black Bengal goats at 7-12 months.

The average size (weight, length, width, and thickness) of the cervix at 12-36 m were higher than those reported by Adigwe and Fayemi (2005) and Kirbas Dogan *et al.* (2020).

245 The reproductive tract measurements of the Arbia goat increased with age; this is consistent with the findings of Shah *et al.* (2015), Fernandez *et al.* (2020), and Uddin *et al.* (2021). According to

Holm *et al.* (2016), both age and live weight have an impact on the reproductive system's development.

In the current study, the biometry of all reproductive tract organs increased with BCS, and the
250 third group (2.5–3) had the highest values. Therefore, breeders and producers must take these
results into account and take care to feed their herds well for better productivity because good
body condition score has direct effects on hypothalamic activity and GnRH secretion (Rhind *et al.*, 1989).

The difference between the results of the current study and those of other researchers may be
255 explained by differences in breed, age, height, and weight of the animals in the study. These
differences may also be due to climatic effects, as young goats in the tropics have to contend
with the effects of the first dry season, when growth may be seriously retarded.

In the present study, the prevalence of slaughtered pregnant goats was 18.9%. This finding was
higher than the result of Anup Kumar *et al.* (2015), and Pagamici and Stephan (2022), which was
260 15.3% in goats, 7.6% in sheep, respectively. However, higher incidences of 25.82%, and 29.1%
were reported in the Sahel goats of Nigeria (Bokko, 2011), in cows of Tanzania (Swai *et al.*,
2015), respectively.

The highest rate of pregnancy loss was in the first trimester; this is in agreement with those reported by Anup Kumar *et al.* (2015) and Bokko, (2011) in goats. On the contrary, Swai *et al.* (2015) found that the highest number of wasted fetuses occurred in the second trimester of pregnancy in cows. Less practiced pregnancy diagnosis could be the cause of this high percentage.

In this study, on the measurements and weight of both the left and right ovaries, pregnancy did not have a significant impact, too (Jaji *et al.*, 2012).

The dimensions of the uterine horns and body of the uterus increase significantly during pregnancy, which is consistent with the findings of Jaji *et al.* (2012) in goats and as reported in sheep (Jaji *et al.*, 2013), and cows (Jaji *et al.*, 2012). These increases may be linked to fetal growth and the accompanying fluids and membranes during pregnancy (Jaji *et al.*, 2012).

In conclusion, according to the results of the current study, measurements of the different parts of female genitalia in Algerian Arbia goats are either distinct from or less comparable to those in earlier reports for goats of other breeds.

These findings have established the baseline measurements of the female reproductive tract in Arbia goats according to age, body condition score, and stages of gestation, all of which have an impact on the biometry of the female genital organ. This knowledge will facilitate the

280 identification of a variety of organ anomalies and serve as a manual for artificial insemination
procedures and pregnancy detection in this species of animal.

Conflict of interest

The authors declared that there is no conflict of interest.

Acknowledgements

285 The authors are thankful to Dr. Hamri M. and the employees at the slaughterhouses for their
assistance. This research is a contribution to the project PRFU D01N01UN140120220003,
founded by the DGRSDT-MERRS-Algeria.

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Table 1. Arbia goat's reproductive tract measurements according to age.

Organ	Side	Measurements (Mean±SE)	6-12 months n=40	12-36 months n=40	> 36 months n=40
Ovary	Right	Weight(g)	0.79±0.05 ^a	1.03±0.07 ^b	1.68±0.12 ^c
		Length(mm)	15.50±0.47 ^a	17.20±0.41 ^b	20.08±0.49 ^c
		Width(mm)	10.98±0.29 ^a	11.83±0.40 ^{bc}	13.65±0.52 ^{ac}
		Thickness(mm)	6.78±0.24 ^a	8.18±0.31 ^{ab}	8.98±0.38 ^{ac}
	Left	Weight(g)	0.75±0.03 ^a	1.06±0.11 ^b	1.60±0.10 ^c
		Length(mm)	15.35±0.33 ^a	16.40±0.38 ^b	19.08±0.39 ^c
		Width(mm)	10.73±0.28 ^a	12.18±0.47 ^b	13.88±0.36 ^c
		Thickness(mm)	7.10±0.23 ^a	8.10±0.31 ^{ab}	8.80±0.35 ^{ac}
	Right	Weight(g)	0.36±0.01 ^a	0.45±0.02 ^b	0.56±0.03 ^c

Oviduct		Length(mm)	165.55±4.35 ^a	170.80±4.38 ^a	175.85±4.51 ^a
	Left	Weight(g)	0.40±0.02 ^a	0.46±0.02 ^b	0.60±0.03 ^c
		Length(mm)	176.88±4.35 ^a	178.70±4.18 ^b	190.65±4.02 ^c
Uterine Horn	Right	Weight(g)	2.38±0.21 ^a	4.41±0.35 ^b	6.52±0.51 ^c
		Length(mm)	62.05±1.88 ^a	79.70±2.85 ^b	93.28±4.43 ^c
		Width(mm)	9.63±0.41 ^a	11.35±0.38 ^b	13.58±0.53 ^c
		Thickness(mm)	7.13±0.29 ^a	8.80±0.35 ^{ab}	9.73±0.40 ^{ac}
	Left	Weight(g)	2.44±0.17 ^a	4.67±0.34 ^b	6.82±0.53 ^c
		Length(mm)	66.80±2.00 ^a	84.83±2.76 ^b	101.70±4.45 ^c
		Width(mm)	9.25±0.39 ^a	11.30±0.43 ^b	12.68±0.48 ^c
		Thickness(mm)	6.80±0.31 ^a	8.25±0.32 ^{ab}	9.13±0.33 ^{ac}
Body of uterus		Weight(g)	5.51±0.65 ^a	8.84±0.95 ^b	14.41±1.11 ^c
		Length(mm)	32.83±1.53 ^a	39.35±1.51 ^{ab}	43.25±1.68 ^{ac}
		Width(mm)	19.30±0.70 ^a	22.30±0.89 ^b	27.88±1.02 ^c
		Thickness(mm)	7.55±0.32 ^a	10.03±0.43 ^b	11.73±0.41 ^c
Cervix		Weight(g)	2.99±0.30 ^a	5.76±0.46 ^{ab}	5.76±0.46 ^{ab}
		Length(mm)	25.50±1.90 ^a	35.30±1.53 ^{ab}	35.30±1.53 ^{ab}
		Width(mm)	13.63±0.59 ^a	16.85±0.61 ^b	16.85±0.61 ^b

	Thickness(mm)	8.20±0.49 ^a	11.03±0.42 ^{ab}	11.03±0.42 ^{ab}
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395 Values with different superscripts (^{abc}) in a row indicate significant difference ($P < 0.001$).

Table 2. Arbia goat's reproductive tract measurements according to body condition score

Organ	Side	Measurements (Mean±SE)	Emaciated n=50	Thin n=47	Average n=23
Ovary	Right	Weight(g)	0.76±0.03 ^a	1.25±0.08 ^b	1.90±0.17 ^c
		Length(mm)	15.72±0.40 ^a	18.23±0.42 ^b	20.74±0.65 ^c
		Width(mm)	10.62±0.24 ^a	12.60±0.35 ^b	14.65±0.74 ^c
		Thickness(mm)	6.70±0.21 ^a	8.38±0.26 ^b	9.96±0.50 ^c
	Left	Weight(g)	0.78±0.03 ^a	1.26±0.10 ^b	1.66±0.16 ^c
		Length(mm)	15.62±0.30 ^a	17.34±0.40 ^b	19.09±0.56 ^c
		Width(mm)	10.80±0.23 ^a	13.04±0.42 ^b	13.87±0.56 ^c
		Thickness(mm)	7.08±0.21 ^a	8.19±0.27 ^b	9.57±0.49 ^c
Oviduct	Right	Weight(g)	0.37±0.01 ^a	0.46±0.01 ^{ab}	0.64±0.05 ^{ac}
		Length(mm)	162.96±3.76 ^a	170.64±3.92 ^b	188.00±5.46 ^{ac, bc}
	Left	Weight(g)	0.40±0.02 ^a	0.51±0.02 ^{ab}	0.62±0.05 ^{ac}

		Length(mm)	174.84±3.67 ^a	181.87±3.73	196.57±5.87 ^{ac}
Uterine Horn	Right	Weight(g)	2.40±0.19 ^a	5.19±0.41 ^b	7.34±0.50 ^c
		Length(mm)	63.94±1.77 ^a	85.21±3.89 ^b	95.61±4.11 ^c
		Width(mm)	9.46±0.32 ^a	12.17±0.37 ^b	14.74±0.63 ^c
		Thickness(mm)	7.08±0.28 ^a	9.28±0.29 ^{ab}	10.26±0.51 ^{ac}
	Left	Weight(g)	2.51±0.17 ^a	5.34±0.38 ^b	7.86±0.60 ^c
		Length(mm)	69.26±1.87 ^a	90.94±3.90 ^b	104.17±4.31 ^c
		Width(mm)	9.18±0.35 ^a	11.98±0.39 ^{ab}	13.35±0.58 ^{ac}
		Thickness(mm)	6.84±0.30 ^a	8.66±0.25 ^{ab}	9.52±0.41 ^{ac}
Body of uterus	Weight(g)	5.33±0.56 ^a	10.27±0.85 ^b	17.44±1.37 ^c	
	Length(mm)	31.66±1.21 ^a	41.13±1.26 ^b	47.43±2.17 ^c	
	Width(mm)	19.32±0.67 ^a	23.87±0.69 ^b	30.52±1.30 ^c	
	Thickness(mm)	7.66±0.31 ^a	10.87±0.43 ^b	12.04±0.48 ^c	
Cervix	Weight(g)	2.93±0.29 ^a	6.51±0.39 ^{ab}	9.21±0.99 ^{ac}	
	Length(mm)	24.38±1.61 ^a	37.66±1.20 ^{ab}	38.87±2.54 ^{ac}	
	Width(mm)	14.06±0.62 ^a	17.81±0.51 ^c	20.48±0.75 ^b	
	Thickness(mm)	8.18±0.40 ^a	11.38±0.28 ^{ab}	11.48±0.45 ^{ac}	

Values with different superscripts (^{abc}) in a row indicate significant difference ($P < 0.001$).

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Table 3. Arbia goat reproductive tract measurements according to stages of gestation.

Organ	Side	Measurements (Mean±SE)	21-29 days n=18	42-77 days n=10
Ovary	Right	Weight(g)	1.44±0.11 ^a	1.57±0.15 ^a
		Length(mm)	17.83±0.50 ^a	19.80±1.17 ^a
		Width(mm)	13.56±0.58 ^a	15.50±0.98 ^a
		Thickness(mm)	10.00±0.55 ^a	9.90±0.45 ^a
	Left	Weight(g)	1.31±0.11 ^a	1.54±0.42 ^a
		Length(mm)	17.00±0.65 ^a	19.50±1.63 ^a
		Width(mm)	14.11±0.67 ^a	13.30±1.28 ^a
		Thickness(mm)	9.17±0.32 ^a	8.80±0.77 ^a
Oviduct	Right	Weight(g)	0.39±0.03 ^a	0.53±0.03 ^b
		Length(mm)	162.17±4.93 ^a	178.80±10.22 ^a
	Left	Weight(g)	0.41±0.03 ^a	0.54±0.03 ^b
		Length(mm)	167.83±5.30 ^a	190.70±12.99 ^a
	Right	Length(mm)	109.44±7.20 ^a	163.50±16.19 ^b

Uterine		Width(mm)	21.83±2.29 ^a	39.40±6.24 ^b
		Thickness(mm)	16.44±1.47 ^a	22.70±1.82 ^b
Horn	Left	Length(mm)	110.44±7.72 ^a	173.50±9.57 ^b
		Width(mm)	20.11±1.90 ^a	41.00±3.22 ^b
		Thickness(mm)	15.33±1.22 ^a	23.50±1.67 ^b
Body of uterus		Length(mm)	77.56±4.81 ^a	155.00±8.94 ^b
		Width(mm)	48.39±4.17 ^a	121.00±7.70 ^b
		Thickness(mm)	22.83±1.11 ^a	34.40±2.29 ^b
Cervix		Weight(g)	5.71±0.60 ^a	8.37±1.21 ^b
		Length(mm)	32.22±2.16 ^a	40.40±5.66 ^a
		Width(mm)	16.72±0.74 ^a	17.40±1.16 ^a
		Thickness(mm)	12.39±0.70 ^a	13.90±1.14 ^a

405 Values with different superscripts (^{ab}) in a row indicate significant difference ($P < 0.05$).

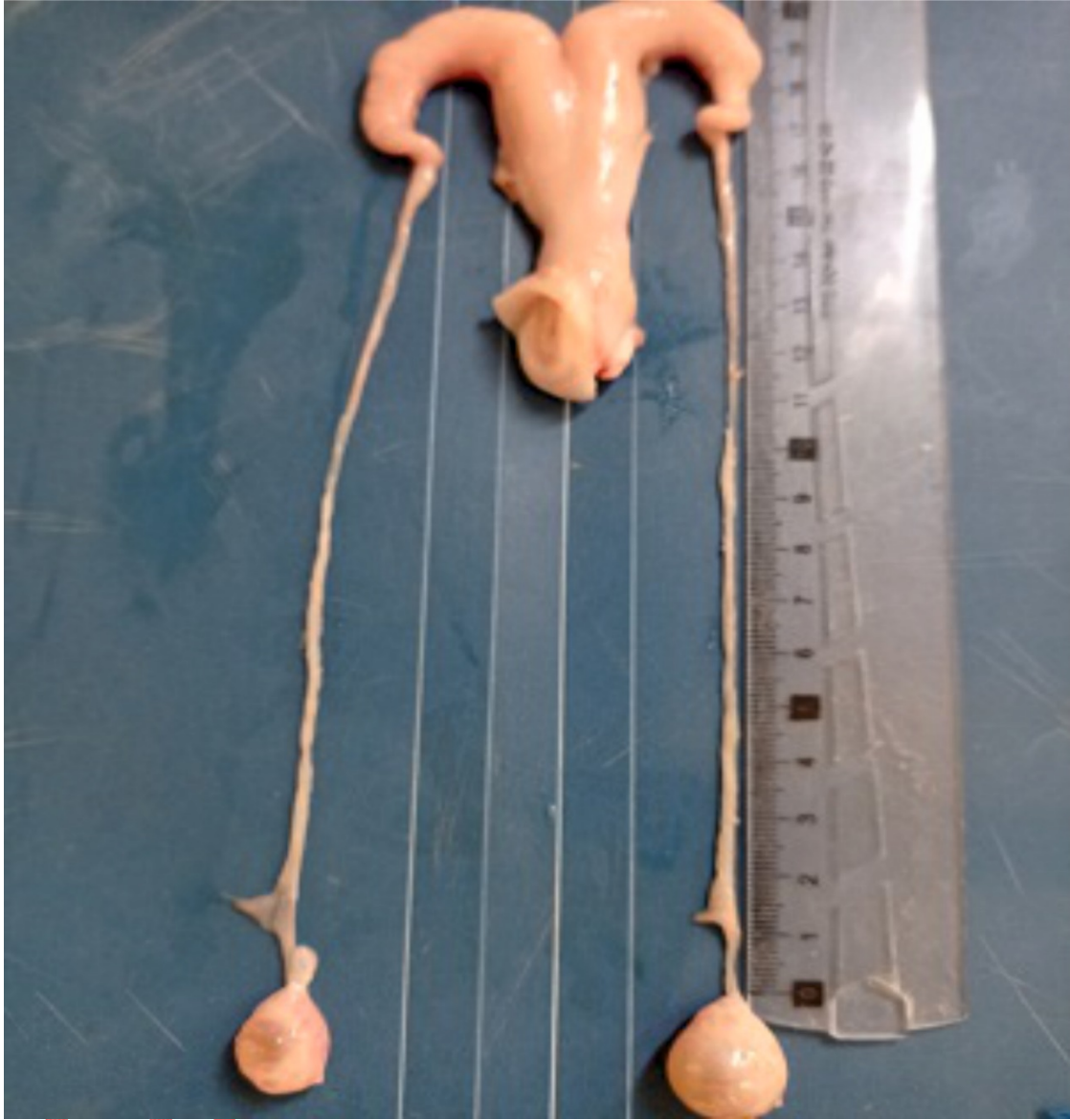
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Table 4. Number and age fetal wastage of the slaughtered Arbia goat.

Number of pregnant slaughtered goats	Number of fetal loss	Crown-rump length (mm)	Estimated age (Days)
6	8	7-11	21-28
8	10	15-20	29-33
4	4	24-52	33-49
8	9	65-135	42-56
2	2	131-320	63-77

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Figure 1. Measuring the length of right salpinx



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Figure 1. Measuring the length of right salpinx

Uncorrected Proof



Figure 2. Measuring the weight of ovary

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Figure 3. The reproductive system of the female Arbia goat

1: ovary, 2: oviduct, 3: uterine horn, 4: the body of the uterus, 5: cervix.

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