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Research Paper: Evaluating Gross Anatomy of Cervix in Zel Sheep

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ABSTRACT

Introduction: Many previous studies have proved that the anatomical features of cervix can affect the success of artificial insemination. These characteristics differ in sheep breeds. This study aimed to describe the anatomical features of cervix in Zell ewes; the only tailed sheep in Iran.

Methods: Eighty nonpregnant and clinically healthy reproductive tracts of adult Zel sheep were collected from a slaughter house. Based on the estrous cycle, the specimens were divided into follicular or luteal phase. Then, the morphology of the vaginal protrusion of cervix was classified as slit, papilla, duckbill, flap or rose. The cervices were sectioned longitudinally, and the length, number of cervical rings and the arrangement of the rings were recorded.

Results: The results showed the duckbill type was more common in vaginal protrusion of cervix. The mean length of cervix was 61.25±2.88 mm during follicular phase and 63.27±2.56 mm in luteal phase. The mean number of cervical ridges was 7.4 and cervices with a series of complete aligned cervical rings lying across the opened lumen were predominant. However, incomplete ridges and closed cervical canal were observed in some specimens. In 42.85% of cervices, the distance between first and second ridge were significantly more than the distance between other ridges.

Conclusion: The results showed that the anatomical characteristics of cervix in Zel sheep may lower the fertility chance through the Transcervical Artificial Insemination. However, the long distance between first and second cervical fold that has been observed in many cases may be suitable for intracervical insemination.

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1. Introduction

Artificial Insemination (AI) in sheep, is a common technique, used as a genetic improvement management at farm level, in recent decades [1]. Numerous intrinsic and extrinsic factors related to females, males, environment and technique itself impact insemination outcomes [2]. One of the most important reasons that refer to females is the anatomy of the cervix [3]. The cervix of the ewe is convoluted in structure and does not dilate during oestrus [4]. It is a long, fibrous tubular organ with an over convoluted lumen due to 4-7 cervical rings [5]. These rings narrow the cervix lumen and prevent the catheters from reaching the uterus during intracervical insemination [3].

Studies have indicated that breed played an important role in cervical morphology [5-9]. The Zel sheep is a small, thin-tailed, non-seasonal breed, raised for meat and milk production in north of Iran. Zel sheep is the only local breed suitable for crossbreeding [10-15]. Therefore, this study aimed to describe the anatomy of cervix in Zel sheep to improve AI in this native Iranian sheep.

2. Materials and Methods

Eighty nonpregnant and clinically healthy reproductive tracts of adult Zel sheep were collected from a slaughter house in Amol, Mazandaran Province, north of Iran. The specimens were transferred in cold temperature to anatomy laboratory. After being cleaned, the specimens were divided into 2 groups, based on the presence of follicle or corpus luteum on ovary. The specimens were examined and dissected for anatomical studies.

The following parameters were examined for this investigation:

Shape of vaginal protrusion of cervix: The vagina was sectioned longitudinally to observe the intra vaginal part of cervix. It was then classified as flap, duckbill, rose, slit or papilla using the classification introduced by Kershaw in 2005 [5].

Length of cervix: After longitudinal sectioning of the cervix, its length was measured from external uterine orifice to the uterine corpus with a caliper digital ruler (Digimatic Caliper, Japan).

Number and arrangement of cervical folds: After longitudinal sectioning of cervix, the folds were counted and recorded.

The degree of completeness and interdigitation of rings were recorded as per 3 grades of Kershaw 2005 definition: Grade 1 cervices had a series of complete aligned cervical rings lying across the opened lumen with no interdigitating cervical rings; Grade 2 cervices had both complete and incomplete cervical rings that lay partially across the opened lumen of cervix. They are interdigitated with one another that make the central lumen concealed; Grade 3 cervices had predominantly incomplete and interdigitating cervical rings that were not aligned.

Data were analyzed by SPSS using one-way analysis of variance (ANOVA) and Duncan's post-hoc test. The significance level was set at $P<0.05$. The data were presented as Mean±SEM.

3. Results

3.1. Shape of vaginal protrusion of cervix

Five types of vaginal protrusion of cervix; papilla, duckbill, flap, slit and rose were observed in Zel sheep. The duckbill was significantly more frequent than other types (Figures 1 and 2).

3.2. Length of cervix

In total, 57.14% of the specimens were at follicular phase and the length of cervix was 61.25±2.88 (mm); 42.85% of them s were at luteal phase with cervical length of 63.27±2.56 mm. There were no significant differences between the lengths of cervix during different phases of estrous cycle (Figure 3).

Number and arrangement of cervical folds: The mean number of cervical ridges was 7.4 with a range of 5 to 10 folds in each cervix. The size and distance between ridges reduced from vaginal protrusion of cervix to uterine corpus. In 42.85% of cervices, the distance between first and second ridge were significantly more than the distance between other ridges and the most prominent ridge were near vaginal protrusion of cervix.

The arrangement of cervical ridges based on grades 1, 2 and 3, were 42.85%, 38.09%, 19.04% respectively. There was no significant difference between the phase of estrous cycle and number and grade of ridges (Figure 4).

4. Discussion

Producing unique genotypes within selected sheep breeds made AI a growing practice [16]. However, the use of frozen/thawed semen in conventional insemina-

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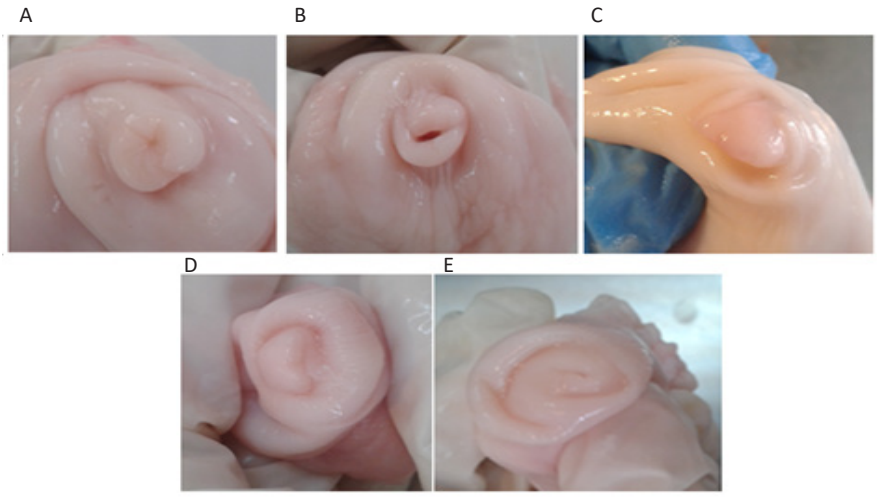

Figure 1. Classification of vaginal protrusion of cervix of Zel sheep
(A) Papilla; (B) Duckbill; (C) Flap; (D) Slit; (E) Rose

tion yields poor fertility in sheep. One of the most important restrictive reasons to this matter is the anatomical structure of the cervix [3]. Therefore, many studies explored the anatomical structure of cervix and revealed significant differences in the anatomy of cervix among different breeds [5-9]. The present study described the morphological aspect of cervix in Zel sheep. We provided information for increasing the fertility rate in this native Iranian ewe, using a more suitable AI technique..

Similar to Santa inês ewes in Brazil, duckbill was the most frequent shape of vaginal protrusion of cervix in Zel sheep, [17]. However, papilla is the most dominant shape in other native Iranian breeds such as, Makooee, Kordi and afshari. Also, flap shape vaginal protrusion of cervix was the most frequently observed shape in Sanjabi sheep. In addition, this finding was in contrast with other sheep breeds, with the most predominant vaginal protrusion of cervix shapes flap and rose [18-20, 5, 6] or spiral [9].

The mean length of cervix in Zel sheep was 61.25±2.88 mm during follicular phase and 63.27±2.56 mm in luteal phase. No significant changes were observed in length of cervix during different phases of estrous. This result indicated that the length of cervix in Zel sheep is significantly more than other native Iranian breeds such as Afshari, Makooee, kordi and Sanjabi [18, 19] with cervical lengths of 4.11±0.19, 4.02±0.23, 4.05±0.22 and 55.4±1.36 mm, respectively.

The cervical length of Zel sheep was significantly lower than the report of Kaabi about Churra, Assaf, Merino and Castellana breeds [3], with mean length of 68.6 mm and Canadian crossbreed ewe with cervical length of 67±1.1 mm [6]. The average cervical length of native Indian breeds (Malpura and Kheri) in ewe lambs and adult

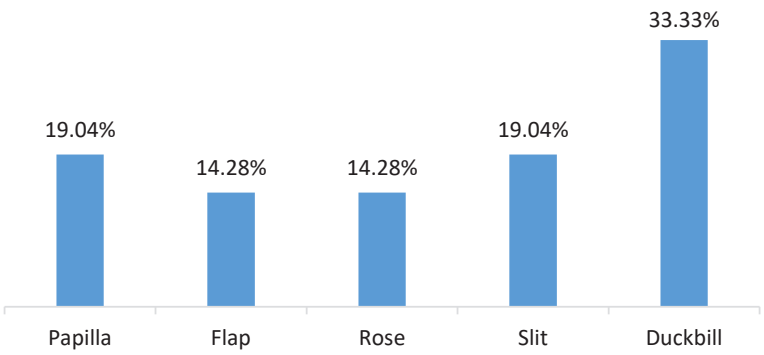

Figure 2. Distriubation of different shapes of vaginal protrusion of cervix in Zel sheep

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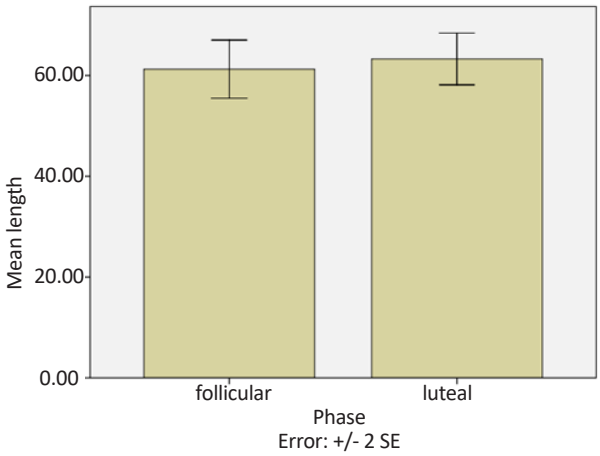

Figure 3. Length of cervix in follicular and luteal phase of genital tract in Zel sheep

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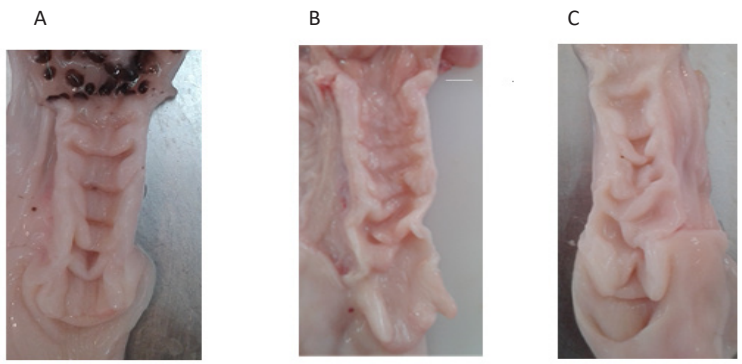

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Figure 4. Longitudinal section of cervical canal in Zel sheep and arrangement of cervical folds based on grades 1 to 3
A: grade 1; B: grade 2; and C: grade 3; Arrows show the direction and maximum penetration.

ewes were 38±0.12 mm and 53±0.15 mm, respectively [9] and 46.8 mm (range of 30 to 70 mm) in Santa inês hair ewe [17]. The mean length of cervix in Karayaka ewe was reported as 36.90±6.5 mm [21].

The mean number of cervical ridges in Zel sheep was 7.4 with a range of 5 to 10 folds in each cervix. The mean±SE number of cervical folds was 4.4±1.06 with a range of 3-7 folds per cervix in Sanjabi ewe [19] and 5.65±0.19, 5.62±0.23, 5.5±0.22 in Afshari, Makooee and Kordi breeds [18]. In the Canadian crossbreed ewe, 4.9±1.0 of funnel-shaped ring was reported [6], In Merino, Castellana, Assaf and Chura breed, an average of 4.16 cervical rings was observed [3]. In native Indian breeds (Malpura and Kheri), the average number of rings in the cervices of ewe lambs and adult ewes were 3.2±0.19 and 3.4±0.22, respectively [9]. Number of folds was 4.73±0.7 in karayaka adult ewe [21] and an average of 5.68 rings was seen in Santa inês hair ewe [17].

The anatomical features of the cervix of Zell ewes indicated predominance of duck-bill vaginal protrusion of cervix, long cervical length, higher number of cervical rings and larger rings near the vaginal protrusion of cervix. The anatomical characteristics of cervix in Zel sheep may lower the fertility chance through Transcervical Artificial Insemination (TCAI). However, the long distance between first and second cervical fold that has been observed in many cases may be suitable for intracervical insemination that is performed by insemination at the cervical opening or at the deepest possible intracervical site that is easily accessible without attempting to force the inseminating pipette into the cervical canal [22, 23].

Ethical Considerations

Compliance with ethical guidelines

All steps of this study were approved by the Animal Ethics Committee, based on the Research Council of Amol University of Special Modern Technologies, Amol, Iran.

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Authors contributions

All the authors have read and approved the manuscript.

Conflict of interest

The authors certify that they have no affiliation with or involvement in any organization or entity with any financial interest, or non-financial interest in the subject matter or materials dismissed in this manuscript.

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