



Penile and Preputial Pathological Problems and Their Impact on Reproductive Organ Biometry and Epididymal Sperm Quality in Dromedary Camels



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Abstract

THIS study aimed to investigate the penile and preputial problems and its impact on reproductive organ biometry and epididymal sperm quality in dromedary camels. Among total of 6300 male dromedary camels investigated, there were 2.86% phimosis, 3.00% paraphimosis, 4.14 penile trauma, 2.98% preputial prolapse, 1.47% balanoposthitis, and 2.85% penile tumors. Results revealed that there were no significant differences ($P > 0.05$) in measurements of the testes, epididymal tail, and accessory genital gland in males with penile and preputial problems compared to those with normal penis and prepuce. There were significant decreases in all sperm parameters evaluated (total motility, total sperm cell count $\times 10^6$ /total collected volume, sperm concentration $\times 10^6$ /ml and percentage of sperm vitality and sperm abnormality) in the pathological issues connected to the prepuce and penis compared to males with normal penis and prepuce. The correlation (r) between right testicular length and epididymal sperm cell count was positive ($P < 0.040$, $r = 0.853$). The epididymal sperm cell count correlated with both the length of right ($r = 0.805$; $P < 0.053$) and that of left bulbourethral glands ($r = 0.789$; $P < 0.058$). The vitality (%) correlated with both the right ($r = 0.889$; $P < 0.030$) and left ($r = 0.919$; $P < 0.022$) testicular length. It could be concluded that semen quality can be affected by the penile and preputial problems in male dromedary camels, while the testicular and epididymal biometry are not affected.

Keywords: Phimosis, paraphimosis; penile diseases; preputial prolapse; semen quality male dromedary.

Introduction

Worldwide, there are approximately 39,295,752 camels (Dromedary, *Camelus dromedaries*, and Bactrian camel, *C. bactrians*); of these, 95% are dromedaries, and the majority of them (87.2%) are found in African nations: 7,425,979 in Somalia, 9,401,892 in Chad, 4,940,961 in Sudan, and 99610 in Egypt [1, 2].

Camels behave differently when they are mating. Only camels copulate in a recumbent position; copulation lasts around 10–20 minutes, with three or

four ejaculations; mating frequently takes an hour; and ejaculation is frictional [3]. Dromedary bulls get more anxious during mating, which causes them to act aggressively against people and other males. As a result, camels are chained up and housed in individual boxes [4]. Researchers and veterinarians reported penile and preputial pathological affections in male dromedary camels. These affections can be characterized and explained as follows: The term phimosis refers to the shortening of the retractor penis muscle in males who suffer from a penile fracture or another condition that prevents them from

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(Received 19 December 2024, accepted 13 February 2025)

DOI: 10.21608/EJVS.2025.345863.2570

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protruding their penis [5,6]. Additionally, stenosis of the perpetual orifice, also called paraphimosis, is a condition in which the foreskin retracts behind the glans, narrowing the preputial opening and making it impossible to retract the free portion of the penis. This results in the strangulation of the penile tissues, edema, cyanosis, loss of blood supply, ischemia, and impaired lymphatic drainage. These findings were recorded in human [7], bulls [8], rams [9], dogs [10] and camels [5, 11, 12]. A male camel's libido may decline either temporarily or permanently or completely disappear because of injuries or inflammation to the scrotum, orchitis, balanoposthitis [13]. Additionally, penile trauma, also called penile fracture or penile hematoma, occurs when the fibrous covering of the two cylinders within the penis, known as the corpora cavernosa, experiences a traumatic rupture known as the tunica albuginea. This injury occurs when the tunica albuginea is torn [14,15].

Male dromedary camels' reproductive organs may be damaged because of the aggressiveness during its sexual drive, and they may have penile and preputial problems [7,8,16]. Additionally, prolapse of the prepuce (preputial prolapse) refers to the reversible eversion of the prepuce's parietal layer to the outside of the preputial orifice, indicating the appearance of one layer of internal skin covering the outer layer [17]. Balanoposthitis, a condition that affects the penis and prepuce, is referred to as penile and preputial inflammation [18]. Small growths or tumors on the genital area are called genital warts, penile tumors can impede the glans' ability to retract; they manifest as painless lumps on the penis [19].

As known, male camel fertility plays a vital role in herds; the insemination process is often carried out by a single fertile male [16,20], and its appraisal is critical [20]. One study reported male camels' preputial and penile pathologies and how they relate to gonad organs and future fertility [16]. Therefore, this study was designed to examine the penile and preputial pathological problems in male dromedary camels and their effect on reproductive organ biometry, and to assess the impact of these problems on semen quality.

Material and Methods

Animals and subgrouping

This study was conducted during the rutting season from December to April yearly between 2021 and 2023. The animals were deemed clinically healthy after a physical examination of their heart

rate, lungs, rumen, intestines, normal body temperature, respiration, feed intake, and regular mobility [21]. A total of 6300 male camels were checked in this study, aged 8–12 years, and were privately owned by individuals dwelling in Draw, Kom Ombo, Edfu, and Abu Sunbul belongs to Aswan governorate (Latitude: 23°- 58' N, 32°- 49' E and 194-meter Altitude/elevation), Egypt. The animals were examined based on pathological problems of the penis and prepuce in male dromedary camels (Table 1 and Figures 1 and 2). The animals (n=60 camels) were allocated into six groups according to penile and preputial problems (Phimosis, paraphimosis, penile trauma, balanoposthitis, preputial prolapse, penile tumors) and plus the seventh healthy group of camels with normal penis and prepuce (n=10) served as control. All examinations, including visual inspection of the genitalia with pathological penile and preputial pathological problems or normal, as well as palpation of the prepuce and penis and scrotum and its contents (Fig. 1), were performed in sternal recumbent position, with the camels restrained by ropes from the fore to hind limbs and a halter around the head.

Ultrasonography examination

After slaughtering and brining the male genitalia to the laboratory, all ultrasonographic measurements for male genitalia in water path were recorded. A portable ultrasound instrument (MyLab 30 Vet device, B mode; Esaote, Pie Medical, Firenze, Italy) with a 7-8 MHz convex probe was used to examine the testes and epididymis.

Testicular measurements include right testicular length (RTL), right testicular breadth (RTB), right testicular depth (RTD), left testicular length (LTL), left testicular breadth (LTB), and left testicular depth (LTD). The epididymal measurements include both the left and right epididymis tails (LET and RET). Each testicle is inspected by placing the probe in the water path vertically and sweeping it across the entire surface of the organ. The camels' accessory genital glands, comprising pars external thickness, breadth, and dissemination of the prostate gland, and the right and left bulbourethral glands, were assessed at their maximum by ultrasound.

Collection and evaluation of epididymal spermatozoa

A total of 140 testicles (7 groups × 10 animals × 2 testes (right and left), were collected in normal saline from males slaughtered at the local abattoir and transported to our laboratory for processing and examination within an hour. In the laboratory, the

two epididymis were dissected from the testes and their tails were cut lengthwise and rinsed three to four times with Brackett and Oliphant medium in 60-mm Petri plates (Liverpool, Australia, Bacto Lab.) that were placed on a warm stage (37°C) to collect a fluid rich in sperm cells [22]. The concentration ($\times 10^6/\text{ml}$), total sperm count (/total collected volume), vitality (%) and total motility (%) of spermatozoa were all evaluated on freshly collected epididymal sperm extender. Further, a fixed-smear stained with Eosin-Nigrosine was used to calculate the percentages of sperm vitality and abnormalities. The mixture was thin-smear-prepared and analyzed at 40x magnification using light microscopy. In the stained smear fields, 300 spermatozoa were examined to show colored dead sperm versus colorless live sperm cells.

Statistical Analysis

SPSS for Windows 25 was used to statistically analyze the obtained data (SPSS, Chicago). The data's normal distribution was confirmed by the Kolmogorov-Smirnov test. Based on the General Linear Model $Y_{ij} = \mu + T_i + A_j + E_{ij}$, a one-way ANOVA and Duncan's multiple range test were used to differentiate between significant means at ($P < 0.05$). where T_i = groups (i = pathological problems and normal), μ = general mean, Y_{ij} = experimental observation, and e_{ij} = experimental error. Pearson correlation coefficients were also performed between the testicular dimensions, accessory sex glands dimensions and the semen parameters

Results

The examinations for pathological problems in the prepuce and penis of male dromedary camels are provided in Table 2. Among the 6300 male dromedary camels examined, 2.86 (169/6300) of the animals had phimosis, and 3.01% (190/6300) had preputial orifice stenosis (paraphimosis). However, penile trauma was noted in 4.14% of cases (261/6300), 2.98% (188/6300) were prolapsed, 1.47% (93/6300) had prepuce and balanoposthitis, and 2.85% (180/6300) had penile tumors.

Ultrasonography of the testes and epididymal tail in dromedary camels with preputial and penile pathological problems are presented in Table (3) and Figures (2,3). It was found that, there were no significant differences ($P > 0.05$) in the measurements of the testes (right and left testicular length, breadth, and depth) and epididymal tail (right

and left) in male dromedary camels with pathological problems (Balanoposthitis, Penile trauma, preputial prolapse, Phimosis, Paraphimosis, and penile tumors) compared to those with normal penis and prepuce (Figs. 2,3).

Ultrasonography of the pars externa measuring the thickness, breadth, and pars disseminata, right and left bulbourethral gland in dromedary camels with preputial and penile pathological problems are presented in Table (4) and Fig. (4). In the present study, male dromedary camels with balanoposthitis, penile trauma, prolapsed prepuce, phimosis, and paraphimosis demonstrated that there were no significant differences ($P > 0.05$) in measurements of both pars externa and disseminata of the prostate gland, and both right and left bulbourethral glands compared to male group with normal penis and prepuce (Fig. 4).

The values of the semen parameters in dromedary camels with preputial and penile pathological problems are presented in Table 5. There were significant decreases in all the semen-evaluated parameters in camels with penile and preputial pathological issues compared to those with normal penis and prepuce. In camels suffering from penile and preputial problems, semen concentration ($\times 10^6/\text{ml}$; $P < 0.001$), total sperm count ($\times 10^6/\text{ml/ejaculate}$; $P < 0.001$), and vitality (%; $P < 0.002$) were considerably lower than that recorded in group with normal penis and prepuce. Additionally, total motility (%) was reduced ($P < 0.004$) in cases of phimosis and penile trauma in comparison to paraphimosis, normal penis, prolapsed prepuce, and penile trauma. However, camels with paraphimosis showed a significantly higher semen concentration, total sperm count, vitality, and live spermatozoa compared to those with other problems.

Furthermore, the percentage of alive spermatozoa (%) was significantly lower ($P < 0.001$) in camels with balanoposthitis, penile trauma, prolapsed prepuce, phimosis, and paraphimosis than that in males with normal penis and prepuce. On the other hand, the percentage of total sperm abnormalities (%) was significantly lower ($P < 0.001$) in normal comparison to those in camels with pathological problems of the penis and prepuce.

The results of correlation analysis among semen parameters and testicular measures, epididymal tail, and accessory genital gland in male dromedary with pathological problems in the prepuce and penis are

presented in Table 6. The correlation (r) between right testicular length and seminal concentration was significant ($P < 0.040$), with r values of 0.853. However, no correlation was found between seminal concentration and right testicular breadth, left testicular length and breadth, or right and left epididymis tails.

For the accessory genital gland, seminal concentration significantly correlated with both the right ($P < 0.053$) and left ($P < 0.058$) bulbourethral glands, with right bulbourethral gland, and left bulbourethral gland, with r values of 0.805 and 0.789, respectively. Furthermore, there was no significant correlation between total sperm count ($\times 10^6/\text{ml}/\text{ejaculate}$), testicular parameter measurements, epididymal tail, and accessory genital glands. Also, the vitality (%) significantly correlated with both the right ($P < 0.030$) and left ($P < 0.022$) testicular length with r values of 0.889 and 0.919, respectively.

Also, the total motility (%) significantly correlated with both the right ($P < 0.037$) and left ($P < 0.024$) testicular length with r values of 0.864 and 0.912, respectively, while there was no significant correlation between total sperm count ($\times 10^6/\text{ml}/\text{ejaculate}$), epididymal tail, and accessory genital glands.

Discussion

This study reported the epididymal spermatozoa characteristics and investigated the impact of preputial and penile pathological problems on it and genital organs biometry in dromedary camels. Male camels with preputial and penile pathologies were inspected, and the characteristics of the epididymal spermatozoa in both affected and healthy camels were noted, along with the biometry of the reproductive organs. These findings showed that 2.86% phimosis and 3.00% paraphimosis, 4.14% penile trauma, 2.98% prolapsed, 1.47% balanoposthitis, and 2.85% penile tumors were found among the 6300 male dromedary camels analyzed. This affects the success of mating and might keep these animals out of the breeding line, which would mean economic losses [23].

Measuring the testes and epididymis tails is important for understanding New World camel reproductive traits [24]. It was observed that among the many variables that can influence seminal features are differences in the morphometrics of the male animal sexual organs [25]. The measurements

of the testes and epididymis tails in male dromedary camels with preputial and penile pathological issues did not significantly differ, according to this study's findings, which did not agree with those reported by Waheed *et al.* [20]. It was reported that mild to severe testicular parenchymal degeneration was characterized by a loss of homogeneous appearance caused by localized lesions like cysts or fibrotic nests through ultrasonographic examination in such cases with penile and preputial problems [20]. The discrepancy between the current findings of the testicular tissues and the that reported before [20] could be attributed to authors who examined the testicular tissues of the sterile camels.

Another study found that the quality and properties of dromedary camel's semen are highly impacted by various kinds of preputial issues or penile insults [23,26]. According to this study, camels with prolapse, phimosis, paraphimosis, balanoposthitis, and penile trauma had significantly lower semen concentrations, total sperm counts, and vitalities than camels with normal penis and prepuce. Furthermore, compared to paraphimosis, normal penis, prepuce, and penile trauma, total motility was significantly lower in cases of phimosis and penile trauma. The study's findings are in line with those by Ali *et al.* [23], who stated that there were notable variations in sperm motility, viability, anomalies, and count between the camel groups that were fertile and impotent based on the semen analysis.

In the current study, a significant correlation was noticed between length of the right testicles and seminal concentration. Additionally, a significant correlation between vitality and the length of the left and right testicles in bucks was discovered. Moreover, there was a significant correlation found between the lengths of the right and left testicles and overall motility. The results of this study are consistent with those of Kumbhar *et al.* [27], who noticed a positive relationship between early motility, live sperm count, testicular length, and mass activity.

Total sperm count, testicular parameter measurements, epididymal tail, accessory genital glands, seminal concentration, right testicular breadth, left testicular length, and right and left epididymis tails did not significantly correlate, according to our study. Sperm motility and testicular morphology showed a non-significant correlation, according to Abu *et al.* [28]. While the production and sperm store of rams were positively connected with their testicular morphometric features [29-30].

Conclusions

This study concluded that male dromedary camels with pathological issues did not differ significantly in their measurements of the testes, epididymis tail, or accessories' glands compared to normal penis and prepuce. Additionally, all the semen parameters assessed in the pathological problems related to the prepuce and penis showed significant declines. Through the absence of a significant correlation between the testicular measures, epididymal tail, and seminal parameters, this study supports the idea that male dromedary camels with pathological problems may be used for insemination whenever possible.

Ethics approval and consent to participate:

In our study, informed consent was obtained from the owners of Dromedary camels to do regular reproductive examination, and the testes and epididymis were collected from some males after slaughtering. All Institutional and National Guidelines for the care and use of animals were followed according to the Egyptian Medical Research Ethics Committee (no. 14-126), and according to the ethical regulation of Faculty of Veterinary Medicine (Aswan University), Faculty of Agriculture Al-Azhar University and Faculty of Veterinary Medicine (Assiut University).

Consent for publication

Not Applicable.

Availability of data and materials

Upon reasonable request, the datasets of this study can be available from the corresponding author.

Competing interests

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Funding

This research received no external funding.

Authors' contributions

The authors RM, WE, AO, MH, MA and HH shared in conceptualization, experimental design, methodology. RM, WE and AO visualized and investigated the animals and collected the samples. MA and HH analyzed the samples and interpret the

obtained results after statistical analysis. RM, WE, AO, MKH, MA and HH shared in drafting the manuscript. All authors have read and approved the final manuscript.

Acknowledgements

The authors declare that this research did not receive any specific grant from funding agencies in the public, commercial, or non-profit sectors. The authors are thankful to all camel's owners in Draw, Kom Ombo, Edfu, and Abu Sunbul, in the Aswan for their kind help and participation in the study as well as for their kind assistance in the ultrasonographic examination of the animals and we thank all members in the Abattoirs.

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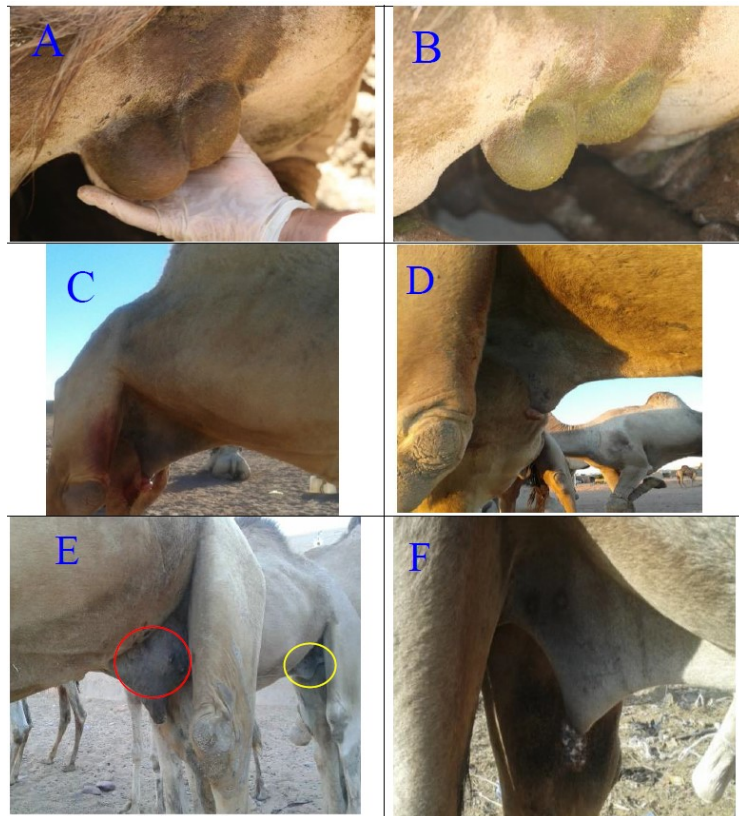


Fig. 1. Representative images of: (A) Scrotal pouches in normal male, (B) Scrotal pouches in dromedary camel with lacerated prepuce, (C) Penile and preputial laceration with inability to retract the penis in camel(paraphimosis), (D) Preputial prolapse, (E) Penile trauma (red circle, broken penis) and normal prepuce (yellow circle), (F) Penile tumor (wart).

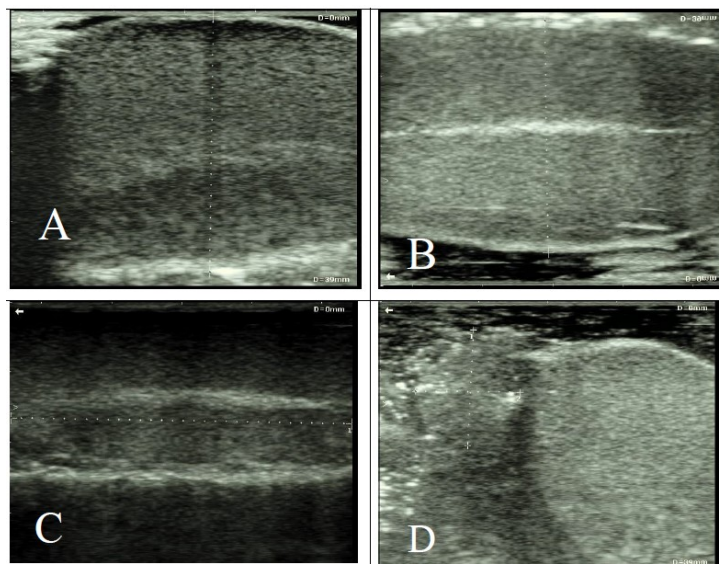


Fig. 2. Sonograms of the testes in dromedary camels (healthy, A) and with penile and preputial problems (B-D); the teste appeared homogenous in echogenicity and tunica albuginea appear hyperechoic and clear mediastinum testes, (A, B & C) sagittal sections, D) cross-section

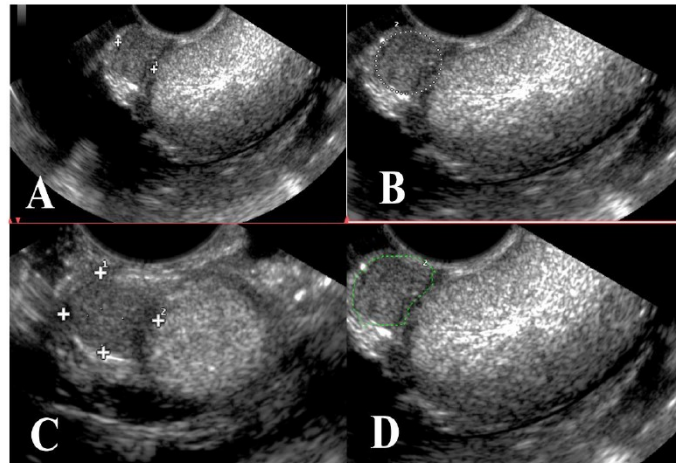


Fig. 3. Sonograms of the epididymis in normal camels (A) and in those with Penile and preputial pathological problems (B-D). The echogenicity in the epididymal tail appeared Homogenous in all images A , B, C and D.

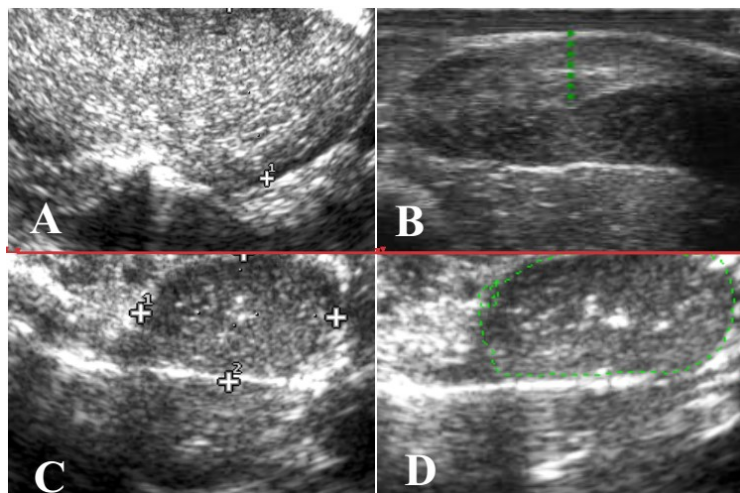


Fig. 4. Sonograms of the prostate; pars externa in normal camels (A) and pars desseminata in male camels with penile and preputial problems (B). Bulbourethral glands in normal camel (C) and in affected male (D). note the homogenous echogenicity, and similar measurements.

TABLE 1. Definitions of the pathological problems of the penis and prepuce in male dromedary camels.

Pathological problems (MP)	Identification	Reference
Balanoposthitis	Various conditions affecting the penis and prepuce, such as penile pain, pruritus, discharge, erythema, rash, or inconsolable sobbing, are referred to as inflammation.	[1]
penile trauma	A traumatic rupture of the tunica albuginea, the fibrous covering of the two cylinders, known as corpora cavernosa, which run along the penis,	[2]
Preputial prolapse	the reversible turning inside out of the foreskin is called prolapse of the prepuce, denoting the appearance of one layer of internal skin covering the outside layer	[3]
paraphimosis	a condition where the penis opening narrows due to the foreskin retracting behind the glans and the male unable to retract the penis.	[4]
Phimosis	as the inability to protrude the penis where the preputial skin covers the head (glans) of the penis.	[5]
Penile tumors	Genital warts are small growths, or tumors, on the genital area. Penile tumors present as painless lumps on the penis that can prevent from retracting their foreskin	[6]

TABLE 2. Incidence of the pathological problems of the prepuce and penis of male dromedary camels

Pathological problems	Frequency	Percentage (%)
Balanoposthitis	93	1.47
Penile trauma	261	4.14
Preputial Prolapse	188	2.98
Phimosis	169	2.68
Paraphimosis	190	3.0
Penile tumors	180	2.85
Total pathological problems	1081	17.15
Normal	5219	82.84
Total	6300	-

TABLE 3. Testicular and epididymal tail biometry in normal male camels and those suffered from pathological problems in the prepuce and penis (n=15 for each group, mean ± SEM).

Item	Normal	Balanoposthitis	Penile trauma	Preputial Prolapse	Phimosis	Paraphimosis	Penile tumors	SEM	P-Value
Right testicular length	7.21	7.61	7.50	7.34	7.17	7.21	7.11	0.18	0.206
Right testicular breadth	3.73	3.99	3.88	3.80	3.82	3.79	3.76	0.16	0.943
Right testicular depth	3.44	3.59	3.59	3.52	3.48	3.47	3.54	0.13	0.978
Left testicular length	7.18	7.56	7.51	7.27	7.09	7.11	7.03	0.16	0.482
Left testicular breadth	3.68	3.84	3.73	3.58	3.71	3.61	3.66	0.15	0.918
Left testicular depth	3.26	3.52	3.34	3.42	3.39	3.38	3.54	0.08	0.677
Left epididymal tail	2.24	2.27	2.26	2.23	2.27	2.39	2.36	0.26	0.875
Right epididymal tail	2.28	2.29	2.25	2.23	2.26	2.43	2.32	0.18	0.895

^{ab} Means within rows with different superscript are significantly differ (P 0.05).

TABLE 4. Measurements of the prostate (pars externa thickness, breadth), and pars disseminata & bulbourethral gland (right & left) in normal male camels and those with pathological problems in the prepuce and penis (n=15 for each group, mean ± SEM).

Item	Normal	Balanoposthitis	Penile trauma	Prep. prolapse	Phimosis	Paraphimosis	Penile tumor	SEM	P-Value
Prostate									
Pars Externa Thickness	3.73	3.94	3.82	3.79	3.84	3.78	3.76	0.16	0.986
Pars Externa Breadth	4.10	3.89	3.76	3.91	3.69	3.89	4.19	0.23	0.785
Pars Disseminata	2.21	2.01	2.13	2.19	2.14	2.20	2.06	0.14	0.956
Bulbourethral gland									
Right	1.44	1.48	1.43	1.43	1.44	1.46	1.41	0.04	0.867
Left	1.48	1.49	1.43	1.43	1.43	1.43	1.58	0.02	0.652

TABLE 5. Epididymal semen parameters in normal male camels and those suffered from pathological problems in the prepuce and penis (n=15 for each group, mean ± SEM).

Item	Normal	Balanoposthitis	Penile trauma	Prep. prolapse	Phimosis	Paraphimosis	Penile tumor	SEM	P-Value
Sperm Conc. ($\times 10^6/ml$)	18.54 ^a	3.65 ^c	3.13 ^c	4.66 ^c	2.32 ^c	3.77 ^c	13.39 ^b	1.17	0.001
Total sperm count (M)	45.31 ^a	9.89 ^b	6.78 ^b	12.23 ^b	5.79 ^b	9.01 ^b	42.12 ^a	2.16	0.001
Vitality (%)	40.9 ^a	16.11 ^{bc}	24 ^{bc}	9.18 ^c	18.17 ^{bc}	26.19 ^{bc}	30.04 ^a	5.91	0.002
Total motility (%)	22.97 ^a	13.64 ^{abc}	9.72 ^c	16.49 ^{abc}	6.33 ^c	15.94 ^{abc}	17.49 ^a	4.16	0.004
Live Spermatozoa (%)	87.00 ^a	65.67 ^b	47.33 ^c	54.33 ^{bc}	57.33 ^b	47.67 ^c	47.00 ^c	2.31	0.001
Sperm abnormality (%)	13.00 ^c	34.33 ^b	52.67 ^a	45.67 ^{ab}	42.67 ^b	52.33 ^a	53.00 ^a	2.31	0.001

^{ab} Means within rows with different superscripts (a,b,c) are significantly differ (P 0.05)

TABLE 6. Correlation analysis among semen parameters and testicular epididymal tail, and accessory genital gland measurements in male camels suffered from penile and preputial pathological problems.

		Sperm Conc. ($\times 10^6/\text{ml}$)	Total sperm count ($\times 10^6/\text{ml}$)	Vitality (%)	Total motility (%)
Testicular measurements	RTL	0.853*	0.770 [#]	0.889*	0.864*
	RTB	0.740 [#]	0.536	0.409	0.250
	LTL	0.665 [#]	0.549	0.919*	0.912*
	LTB	0.764 [#]	0.515	0.404	0.186
Epididymal tail	RET	0.533	0.403	0.158	0.364
	LET	0.265	0.189	0.351 [#]	0.410
Accessory genital gland	Prostate Pars externa (body)	0.708 [#]	0.572	0.101	0.147
	Bulbourethral Gland				
	Right	0.805*	0.562	0.912*	0.504
	left	0.789 [#]	0.523	0.490	0.480

Correlation is significant at $P > 0.05$ level; * Correlation is significant at $P < 0.05$ level.

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المشاكل المرضية في القضيب والقلفة وتأثيرها على قياسات الأعضاء التناسلية وجودة السائل المنوي في البربخ عند ذكور الإبل العربية

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الملخص

هدف هذه الدراسة هو فحص القضايا المرضية المتعلقة بقياسات الأعضاء التناسلية للجمل العربي ونوعية السائل المنوي للبربخ. من بين 6300 ذكر من الجمل العربي تم فحصها، كان هناك 2.86 حالة تضيق القلفة، و3.00% تضيق القلفة، و4.14% إصابة بالقضيب، و2.98% تدلي القلفة، و1.47% التهاب القلفة والحشفة، و2.85% أورام القضيب. ومع ذلك، أفادت هذه الدراسة بعدم وجود فروق كبيرة ($P > 0.05$) في قياسات الخصيتين وذيل البربخ والغدة التناسلية الإضافية لدى الذكور الذين يعانون من مشاكل في القضيب والقلفة مقارنة بالذكور الذين لديهم قضيب وقلفة طبيعيان. كان هناك انخفاض كبير في جميع معايير السائل المنوي التي تم تقييمها (الحركة الكلية/، إجمالي عدد خلايا الحيوانات المنوية م/إجمالي الحجم المجمع، تركيز الحيوانات المنوية م/مل، حيوية/، شذوذ الحيوانات المنوية/%) في القضايا المرضية المرتبطة بالقلفة والقضيب مقارنة بالذكور ذوي القضيب والقلفة الطبيعيين. كان الارتباط (r) بين طول الخصية اليمنى وعدد خلايا الحيوانات المنوية في البربخ إيجابيًا ومهمًا ($r = 0.853$, $p < 0.040$). بالنسبة للغدة التناسلية الإضافية، ارتبط عدد خلايا الحيوانات المنوية في البربخ بشكل كبير بالغدة البصلية الإحليلية اليمنى ($p < 0.053$) واليسرى ($p < 0.058$)، حيث كانت للغدة البصلية الإحليلية اليمنى والغدة البصلية الإحليلية اليسرى قيم r 0.805 و 0.789 على التوالي. كما ارتبطت الحيوية (%) بشكل كبير بكل من طول الخصية اليمنى ($P < 0.030$) واليسرى ($P < 0.022$)، مع قيم r 0.889 و 0.919 على التوالي. يمكن الاستنتاج أن جودة السائل المنوي يمكن أن تتأثر بمشاكل القضيب والقلفة في ذكور الإبل العربية، في حين لا تتأثر القياسات الحيوية للخصية والبربخ.

الكلمات الدالة: تضيق القلفة، تضيق القلفة، أمراض القضيب، تدلي القلفة، جودة السائل المنوي عند ذكر الجمل العربي..